Contract Routing Form

ROUTING: Routine printed on: 02/27/2014

Contract between: Scherrer Construction Co., Inc.
and Dept. or Division: Engineering Division
Name/Phone Number:

Project: Meadowridge Branch Library/Meadowood Neighborhood Center Remodeling

Contract No.: 7202 File No.: 32310
Enactment No.: ~~RES-14-00094~~ Enactment Date: 02/12/2014
Dollar Amount: 1,674,325.00

(Please DATE before routing)

Signatures Required	Date Received	Date Signed
City Clerk	2-27-14	2-27-14
Director of Civil Rights	2/28/14	3/18/14 MDC
Risk Manager Copy of Cert attached	3.19.14	3/19/14 RLV
Finance Director	3.19.14	3-19-14 pam
City Attorney 353	3-19-14	3-24-14 BAL
Mayor	3.24.14	3.24.14

Please return signed Contracts to the City Clerk's Office
Room 103, City-County Building for filing.

Original + 2 Copies PO 81537202

pam 3/19/14

02/27/2014 09:58:21 enjls - Jeanine Zwart, 267-8749

Dis Rights: OK / (N/A) / Problem - Hold
Prev Wage: AA / Agency / No
Contract Value: See above
AA Plan: ~~Pending Review~~ Approved
Amendment / Addendum # 4
Type: POS / Dvlp / Sbdv / Gov't / Grant / PW / Goal / Loan / Agrmt

Sign In

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Details Reports

File #:	32310 Version: 1	Name:	Awarding Public Works Contract No. 7202, Meadowridge Branch Library/Meadowood Neighborhood Center Remodeling.
Type:	Resolution	Status:	Passed
File created:	11/25/2013	In control:	BOARD OF PUBLIC WORKS
On agenda:	2/4/2014	Final action:	2/4/2014
Enactment date:	2/12/2014	Enactment #:	RES-14-00094
Title:	Awarding Public Works Contract No. 7202, Meadowridge Branch Library/Meadowood Neighborhood Center Remodeling.		
Sponsors:	BOARD OF PUBLIC WORKS		
Attachments:	1. Cont 7202.pdf		

History (4) Text

Fiscal Note
Budget authority is available in the Acct. Nos. listed on the attached.
Title
Awarding Public Works Contract No. 7202, Meadowridge Branch Library/Meadowood Neighborhood Center Remodeling.
Body
BE IT RESOLVED, that the following low bids for miscellaneous improvements be accepted and that the Mayor and City Clerk be and are hereby authorized and directed to enter into a contract with the low bidders contained herein, subject to the Contractor's compliance with Section 39.02 of the Madison General Ordinances concerning compliance with the Affirmative Action provisions **and subject to the Contractor's compliance with Section 33.07 of the Madison General Ordinances regarding Best Value Contracting:**

BE IT FURTHER RESOLVED, that the funds be encumbered to cover the cost of the projects contained herein.

See attached document (Contract No. 7202) for itemization of bids.

PROJECT	CONTRACTOR	AMOUNT OF BID

CONTRACT NO. 7202
MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
(TOTAL + ALTERNATE WITH ALLOWANCE)

SCHERRER CONSTRUCTION CO., INC. $1,674,325.00

Acct. No. CB18-58401-810758-00-53W1631	$887,878.00
Contingency 8%±	71,032.00
Sub-Total	$958,910.00
Acct. No. CD21-58401-810559-00-53W1631	$726,447.00
Contingency 8%±	58,113.00
Sub-Total	$784,560.00
Acct. No. CB18-58401-810758-00-53W1631	$33,000.00
Acct. No. CD21-58401-810559-00-53W1631	$27,000.00
GRAND TOTAL	$1,803,470.00

Wisconsin Office of the Commissioner of Insurance
Licensed Producer Search*

Wednesday, February 26, 2014

BARTON, DENNIS M
NEW BERLIN WI

Year of Birth: 1938
Status: Active
License Number: 125401
NPN**: 283633
Effective Date: 01-01-1982
Expiration Date: 12-31-2014
License Type: Resident Intermediary Indv
CE Compliance: 12-31-2014

Lines of Authority

Line of Authority	Residency	Effective Date	Status
Casualty	Resident	01-01-1982	Active
Fidelity	Resident	01-01-1982	Active
Property	Resident	01-01-1982	Active

Adjudicated Administrative Actions

Legal File: 72-C7044 **Adjudicated Date:** 06-14-1972

Actions: Forfeiture: $500

Allegations: payment as counselor and agent

Note: If this administrative action was settled with a stipulation, the Respondent denied the allegations but both parties agreed to the action taken except as noted in the stipulation. See the actual stipulation or order by viewing it at: https://ociaccess.oci.wi.gov/OrderInfo/OrdInfo.oci

Appointments and Terminations

Company Name	Qualification Type/Status	Effective Date	Termination Date	Termination Reason
ACUITY, A Mutual Insurance Company	CAS/Inactive	05-10-2005	10-14-2011	Canceled
	PROP/Inactive	05-10-2005	10-14-2011	Canceled
American Casualty Company of Reading, Pennsylvania	CAS/Inactive	08-27-1993	11-17-2004	Vol. Surrender per Agent Rqst
	PROP/Inactive	08-27-1993	11-17-2004	Vol. Surrender per Agent Rqst
American Insurance Company, The	CAS/Active	06-08-1987		
	PROP/Active	06-08-1987		
Amwest Surety Insurance Company	CAS/Inactive	10-11-1994	10-25-1996	Inadequate Production
Automobile Insurance Company	CAS/Inactive	06-15-1993	12-05-2009	Canceled
	PROP/Inactive	06-15-1993	12-05-2009	Canceled

of Hartford, Connecticut, The				
Berkley Insurance Company	CAS/Active	07-19-2013		
Berkley Regional Insurance Company	CAS/Active	03-05-2008		
	PROP/Active	03-05-2008		
Capitol Indemnity Corporation	CAS/Active	08-29-1994		
	PROP/Active	08-29-1994		
Carolina Casualty Insurance Company	CAS/Active	11-13-1996		
	PROP/Active	11-13-1996		
Charter Oak Fire Insurance Company, The	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
Continental Casualty Company	CAS/Active	08-27-1993		
	PROP/Active	08-27-1993		
Economy Fire & Casualty Company	CAS/Inactive	12-09-1998	11-03-2003	Inadequate Production
	PROP/Inactive	12-09-1998	11-03-2003	Inadequate Production
Farmington Casualty Company	CAS/Inactive	06-15-1993	11-20-2000	Vol. Surrender per Agent Rqst
	PROP/Inactive	06-15-1993	11-20-2000	Vol. Surrender per Agent Rqst
Fidelity and Deposit Company of Maryland	CAS/Active	09-01-2004		
	PROP/Active	09-01-2004		
Fidelity and Guaranty Insurance Company	CAS/Inactive	03-02-1992	12-05-2009	Canceled
	PROP/Inactive	03-02-1992	12-05-2009	Canceled
Guarantee Company of North America USA, The	CAS/Active	09-09-2010		
Gulf Insurance Company	CAS/Inactive	09-14-1993	06-30-2005	Inadequate Production
	PROP/Inactive	09-14-1993	06-30-2005	Inadequate Production
Hanover Insurance Company, The	CAS/Active	10-12-2004		
	PROP/Active	10-12-2004		
Liberty Mutual Fire Insurance Company	CAS/Active	05-20-2009		
Liberty Mutual Insurance Company	CAS/Active	05-20-2009		
LM Insurance Corporation	CAS/Active	05-20-2009		

Massachusetts Bay Insurance Company	CAS/Active	10-12-2004		
	PROP/Active	10-12-2004		
National Fire Insurance Company of Hartford	CAS/Inactive	08-27-1993	11-17-2004	Vol. Surrender per Agent Rqst
	PROP/Inactive	08-27-1993	11-17-2004	Vol. Surrender per Agent Rqst
Old Republic Insurance Company	CAS/Active	12-18-1990		
	PROP/Active	12-18-1990		
Old Republic Surety Company	CAS/Active	12-18-1990		
	PROP/Active	12-18-1990		
Phoenix Insurance Company, The	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
Seaboard Surety Company	CAS/Inactive	12-09-1998	02-17-2009	Canceled
	PROP/Inactive	12-09-1998	02-17-2009	Canceled
St. Paul Fire and Marine Insurance Company	CAS/Active	12-09-1998		
	PROP/Active	12-09-1998		
St. Paul Guardian Insurance Company	CAS/Inactive	12-09-1998	12-05-2009	Canceled
	PROP/Inactive	12-09-1998	12-05-2009	Canceled
St. Paul Mercury Insurance Company	CAS/Inactive	12-09-1998	12-05-2009	Canceled
	PROP/Inactive	12-09-1998	12-05-2009	Canceled
Standard Fire Insurance Company, The	CAS/Inactive	06-15-1993	12-05-2009	Canceled
	PROP/Inactive	06-15-1993	12-05-2009	Canceled
Transcontinental Insurance Company	CAS/Inactive	08-27-1993	12-11-2002	Inadequate Production
	PROP/Inactive	08-27-1993	12-11-2002	Inadequate Production
Transportation Insurance Company	CAS/Inactive	08-27-1993	12-06-2002	Inadequate Production
	PROP/Inactive	08-27-1993	12-06-2002	Inadequate Production
Travelers Casualty and Surety Company	CAS/Active	06-15-1993		
	PROP/Active	06-15-1993		
Travelers Casualty and Surety Company of America	CAS/Active	06-15-1993		
	PROP/Active	06-15-1993		
Travelers Casualty Company of Connecticut	CAS/Inactive	06-15-1993	11-20-2000	Vol. Surrender per Agent Rqst
	PROP/Inactive	06-15-1993	11-20-2000	Vol. Surrender per Agent Rqst
Travelers Casualty Insurance Company of America	CAS/Inactive	06-15-1993	11-22-2000	Vol. Surrender per Agent Rqst
	PROP/Inactive	06-15-1993	11-22-2000	Vol. Surrender per

				Agent Rqst
Travelers Commercial Insurance Company	CAS/Inactive	06-15-1993	11-22-2000	Vol. Surrender per Agent Rqst
	PROP/Inactive	06-15-1993	11-22-2000	Vol. Surrender per Agent Rqst
Travelers Home and Marine Insurance Company, The	CAS/Active	12-11-2007		
	PROP/Active	12-11-2007		
Travelers Indemnity Company of America, The	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
Travelers Indemnity Company of Connecticut, The	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
Travelers Indemnity Company, The	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
Travelers Property Casualty Company of America	CAS/Active	01-13-2006		
	PROP/Active	01-13-2006		
United Fire & Casualty Company	CAS/Active	11-01-1996		
	PROP/Active	11-01-1996		
United States Fidelity and Guaranty Company	CAS/Inactive	03-17-1986	12-05-2009	Canceled
	PROP/Inactive	03-17-1986	12-05-2009	Canceled
USF&G Insurance Company of Wisconsin	CAS/Inactive	05-24-1995	01-01-2001	Company Merger
	PROP/Inactive	05-24-1995	01-01-2001	Company Merger
Valley Forge Insurance Company	CAS/Inactive	08-27-1993	07-11-2003	Inadequate Production
	PROP/Inactive	08-27-1993	07-11-2003	Inadequate Production
West Bend Mutual Insurance Company	CAS/Inactive	01-12-2001	12-27-2011	Canceled
	PROP/Inactive	01-12-2001	12-27-2011	Canceled
Western Surety Company	CAS/Active	10-28-2010		
	CAS/Inactive	03-19-2002	09-21-2010	Vol. Surrender per Agent Rqst
XL Specialty Insurance Company	CAS/Inactive	01-05-1993	11-03-2006	Vol. Surrender per Agent Rqst
	PROP/Inactive	01-05-1993	11-03-2006	Vol. Surrender per Agent Rqst

* Photocopies of this report provided to an insurer should be confirmed on-line for accuracy.

** NPN = National Producer Number assigned by the National Insurance Producer Registry to assist with nonresident licensing in the future.

SCHER-1 OP ID: AB

ACORD

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 09/11/12

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Hausmann-Johnson Insurance Inc 700 Regent St., PO Box 259408 Madison, WI 53725-9408 Steve Squires	608-257-3795 608-257-4324
CONTACT NAME:	
PHONE (A/C, No, Ext):	FAX (A/C, No):
E-MAIL ADDRESS:	

INSURER(S) AFFORDING COVERAGE	NAIC #
INSURER A : Cincinnati Insurance Company	10677
INSURER B : Cincinnati Casualty Company	
INSURER C : Travelers Casualty & Surety	19038
INSURER D :	
INSURER E :	
INSURER F :	

INSURED: Scherrer Construction Company, Inc.
PO Box 740
Burlington, WI 53105

COVERAGES CERTIFICATE NUMBER: REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSR	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS		
A	GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS-MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT LOC			CPP0819635	10/01/11	10/01/14	EACH OCCURRENCE	$	1,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$	500,000
							MED EXP (Any one person)	$	10,000
							PERSONAL & ADV INJURY	$	1,000,000
							GENERAL AGGREGATE	$	2,000,000
							PRODUCTS - COMP/OP AGG	$	2,000,000
								$	
A	AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS / SCHEDULED AUTOS X HIRED AUTOS / X NON-OWNED AUTOS			CPA0819635	10/01/12	10/01/13	COMBINED SINGLE LIMIT (Ea accident)	$	1,000,000
							BODILY INJURY (Per person)	$	
							BODILY INJURY (Per accident)	$	
							PROPERTY DAMAGE (Per accident)	$	
								$	
A	X UMBRELLA LIAB X OCCUR EXCESS LIAB CLAIMS-MADE DED X RETENTION $ 0			CPP0819635	10/01/11	10/01/14	EACH OCCURRENCE	$	10,000,000
							AGGREGATE	$	10,000,000
								$	
B	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? Y/N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below	N/A		WC1924332-02	10/01/12	10/01/13	X WC STATU-TORY LIMITS / OTH-ER		
							E.L. EACH ACCIDENT	$	100,000
							E.L. DISEASE - EA EMPLOYEE	$	100,000
							E.L. DISEASE - POLICY LIMIT	$	500,000
C	Builders Risk			QT6609511L64ATIL12	04/15/12	04/15/13	Limit		1,743,000
A	Install Floater			CPP0819635	10/01/11	10/01/14	Limit		100,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (Attach ACORD 101, Additional Remarks Schedule, if more space is required)

The City of Madison is listed as additional insured with respect to Auto Liability and Commercial General Liability on a primary and non contributory basis, when specified in written contract (GA233 08/02).

CERTIFICATE HOLDER

MADENGR

City of Madison Engineering
RM 115, City County Bldg.
210 Martin Luther King Jr Blvd
Madison, WI 53710

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

Steve L. Squires

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$1,674,325.00
FILE

BID OF SCHERRER CONSTRUCTION COMPANY, INC.

2013

PROPOSAL, CONTRACT, BOND AND SPECIFICATIONS

FOR

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING

CONTRACT NO. 7202

IN

MADISON, DANE COUNTY, WISCONSIN

AWARDED BY THE COMMON COUNCIL
MADISON, WISCONSIN ON FEBRUARY 4, 2014

CITY ENGINEERING DIVISION
1600 EMIL STREET
MADISON, WISCONSIN 53713

https://bidexpress.com/login

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

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This Proposal, and Agreement have
been prepared by:

CITY ENGINEERING DIVISION
CITY OF MADISON
MADISON, DANE COUNTY, WISCONSIN

Robert F. Phillips, P.E., City Engineer

SECTION A: ADVERTISEMENT FOR BIDS AND INSTRUCTIONS TO BIDDERS

REQUEST FOR BID FOR PUBLIC WORKS CONSTRUCTION
CITY OF MADISON, WISCONSIN

A BEST VALUE CONTRACTING MUNICIPALITY

PROJECT NAME:	MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO.:	7202
SBE GOAL	17%
BID BOND	5%
PRE BID MEETING (1:00 P.M.)	JANUARY 3, 2014
PREQUALIFICATION APPLICATION DUE (1:00 P.M)	JANUARY 3,. 2014
BID SUBMISSION (1:00 P.M.)	JANUARY 10, 2014
BID OPEN (1:30 P.M.)	JANUARY 10, 2014
PUBLISHED IN WSJ	12/6/13, 12/13/13, 12/20/13, 12/27/13 & 1/3/14

PRE BID MEETING: Representatives of the Affirmative Action Department will be present to discuss the Small Business Enterprise requirements at 1600 Emil Street, Madison Wisconsin.

PREQUALIFICATION APPLICATION: Forms are available on our website, www.cityofmadison.com/business/pw/forms.cfm. If not currently prequalified in the categories listed in Section A, an amendment to your Prequalification will need to be submitted prior to the same due date. Postmark is not applicable.

BIDS TO BE SUBMITTED by hand to 1600 EMIL ST., MADISON, WI 53713 or online at www.bidexpress.com.

THE BID OPENING is at 1600 EMIL ST., MADISON, WI 53713.

STANDARD SPECIFICATIONS

The City of Madison's Standard Specifications for Public Works Construction - 2013 Edition, as supplemented and amended from time to time, forms a part of these contract documents as if attached hereto.

These standard specifications are available on the City of Madison Public Works website, www.cityofmadison.com/Business/PW/specs.cfm.

The Contractor shall review these Specifications prior to preparation of proposals for the work to be done under this contract, with specific attention to Article 102, "BIDDING REQUIREMENTS AND CONDITIONS" and Article 103, "AWARD AND EXECUTION OF THE CONTRACT." For the convenience of the bidder, below are highlights of three subsections of the specifications.

SECTION 102.1: PRE-QUALIFICATION OF BIDDERS

In accordance with Wisconsin State Statutes 66.0901 (2) and (3), all bidders must submit to the Board of Public Works proof of responsibility on forms furnished by the City. The City requires that all bidders be qualified on a biennial basis.

Bidders must present satisfactory evidence that they have been regularly engaged in the type of work specified herein and they are fully prepared with necessary capital, materials, machinery and supervisory

personnel to conduct the work to be contracted for to the satisfaction of the City. All bidders must be pre-qualified by the Board of Public Works for the type of construction on which they are bidding prior to the opening of the bid.

In accordance with Section 39.02(9)(a)I. of the General Ordinances, all bidders shall submit in writing to the Affirmative Action Division Manager of the City of Madison, a Certificate of Compliance or an Affirmative Action Plan at the same time or prior to the submission of the proof of responsibility forms.

The bidder shall be disqualified if the bidder fails to or refuses to, prior to opening of the bid, submit a Certificate of compliance, Affirmative Action Plan or Affirmative Action Data Update, as applicable, as defined by Section 39.02 of the General Ordinances (entitled Affirmative Action) and as required by Section 102.11 of the Standard Specifications.

SECTION 102.4 PROPOSAL

No bid will be accepted that does not contain an adequate or reasonable price for each and every item named in the Schedule of Unit Prices.

A lump sum bid for the work in accordance with the plans and specifications is required. The lump sum bid must be the same as the total amounts bid for the various items and it shall be inserted in the space provided.

All papers bound with or attached to the proposal form are considered a part thereof and must not be detached or altered when the proposal is submitted. The plans, specifications and other documents designated in the proposal form will be considered a part of the proposal whether attached or not.

A proposal submitted by an individual shall be signed by the bidder or by a duly authorized agent. A proposal submitted by a partnership shall be signed by a member/partner or by a duly authorized agent thereof. A proposal submitted by a corporation shall be signed by an authorized officer or duly authorized registered agent of such corporation, and the proposal shall show the name of the State under the laws of which such corporation was chartered. The required signatures shall in all cases appear in the space provided thereof on the proposal.

Each proposal shall be placed, together with the proposal guaranty, in a sealed envelope, so marked as to indicate name of project, the contract number or option to which it applies, and the name and address of the Contractor or submitted electronically through Bid Express (www.bidexpress.com). Proposals will be accepted at the location, the time and the date designated in the advertisement. Proposals received after the time and date designated will be returned to the bidder unopened.

The Bidder shall execute the Disclosure of Ownership form. REFER TO SECTION F.

SECTION 102.5: BID DEPOSIT (PROPOSAL GUARANTY)

All bids, sealed or electronic, must be accompanied with a Bid Bond equal to at least 5% of the bid or a Certificate of Annual/Biennial Bid Bond or certified check, payable to the City Treasurer. Bid deposit of the successful bidders shall be returned within forty-eight (48) hours following execution of the contract and bond as required.

PREVAILING WAGE RATES

Prevailing Wage Rates may be required and are attached in Section J of the contract. See Special Provisions to determine applicability.

Bidders for this Contract(s) must be Pre-Qualified for at least one of the following type(s) of construction denoted by an ☒

Building Demolition

101 ☐ Asbestos Removal
120 ☐ House Mover
110 ☐ Building Demolition

Street, Utility and Site Construction

201 ☐ Asphalt Paving
205 ☐ Blasting
210 ☐ Boring/Pipe Jacking
215 ☐ Concrete Paving
220 ☐ Con. Sidewalk/Curb & Gutter/Misc. Flat Work
221 ☐ Concrete Bases and Other Concrete Work
222 ☐ Concrete Removal
225 ☐ Dredging
230 ☐ Fencing
235 ☐ Fiber Optic Cable/Conduit Installation
240 ☐ Grading and Earthwork
241 ☐ Horizontal Saw Cutting of Sidewalk
242 ☐ Infrared Seamless Patching
245 ☐ Landscaping, Maintenance
250 ☐ Landscaping, Site and Street
251 ☐ Parking Ramp Maintenance
252 ☐ Pavement Marking
255 ☐ Pavement Sealcoating and Crack Sealing
260 ☐ Petroleum Above/Below Ground Storage Tank Removal/Install
265 ☐ Retaining Walls, Precast Modular Units
270 ☐ Retaining Walls, Reinforced Concrete
275 ☐ Sanitary, Storm Sewer and Water Main Construction
276 ☐ Sawcutting
280 ☐ Sewer Lateral Drain Cleaning/Internal TV Insp.
285 ☐ Sewer Lining
290 ☐ Sewer Pipe Bursting
295 ☐ Soil Borings
300 ☐ Soil Nailing
305 ☐ Storm & Sanitary Sewer Laterals & Water Svc.
310 ☐ Street Construction
315 ☐ Street Lighting
318 ☐ Tennis Court Resurfacing
320 ☐ Traffic Signals
325 ☐ Traffic Signing & Marking
332 ☐ Tree pruning/removal
333 ☐ Tree, pesticide treatment of
335 ☐ Trucking
340 ☐ Utility Transmission Lines including Natural Gas, Electrical & Communications
399 ☐ Other_____

Bridge Construction

501 ☐ Bridge Construction and/or Repair

Building Construction

401 ☐ Floor Covering (including carpet, ceramic tile installation, rubber, VCT
402 ☐ Building Automation Systems
403 ☐ Concrete
404 ☐ Doors and Windows
405 ☐ Electrical - Power, Lighting & Communications
410 ☐ Elevator - Lifts
412 ☐ Fire Suppression
413 ☐ Furnishings - Furniture and Window Treatments
415 ☐ General Building Construction, Equal or Less than $250,000
420 ☐ General Building Construction, $250,000 to $1,500,000
425 ☒ General Building Construction, Over $1,500,000
428 ☐ Glass and/or Glazing
429 ☐ Hazardous Material Removal
430 ☐ Heating, Ventilating and Air Conditioning (HVAC)
433 ☐ Insulation - Thermal
435 ☐ Masonry/Tuck pointing
437 ☐ Metals
440 ☐ Painting and Wallcovering
445 ☐ Plumbing
450 ☐ Pump Repair
455 ☐ Pump Systems
460 ☐ Roofing and Moisture Protection
464 ☐ Tower Crane Operator
461 ☐ Solar Photovoltaic/Hot Water Systems
465 ☐ Soil/Groundwater Remediation
466 ☐ Warning Sirens
470 ☐ Water Supply Elevated Tanks
475 ☐ Water Supply Wells
480 ☐ Wood, Plastics & Composites - Structural & Architectural
499 ☐ Other_____
_____

State of Wisconsin Certifications

1 ☐ Class 5 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for quarries, open pits and road cuts.
2 ☐ Class 6 Blaster - Blasting Operations and Activities 2500 feet and closer to inhabited buildings for trenches, site excavations, basements, underwater demolition, underground excavations, or structures 15 feet or less in height.
3 ☐ Class 7 Blaster - Blasting Operations and Activities for structures greater than 15 ' in height, bridges, towers, and any of the objects or purposes listed as "Class 5 Blaster or Class 6 Blaster".
4 ☐ Petroleum Above/Below Ground Storage Tank Removal and Installation (Attach copies of State Certifications.)
5 ☐ Hazardous Material Removal (Contractor to be certified for asbestos and lead abatement per the Wisconsin Department of Health Services, Asbestos and Lead Section (A&LS).) See the following link for application: www.dhs.wisconsin.gov/Asbestos/Cert. State of Wisconsin Performance of Asbestos Abatement Certificate must be attached.
6 ☐ Certification number as a Certified Arborist or Certified Tree Worker as administered by the International Society of Arboriculture
7 ☐ Pesticide application (Certification for Commercial Applicator For Hire with the certification in the category of turf and landscape (3.0) and possess a current license issued by the DATCP)
8 ☐ State of Wisconsin Master Plumbers License.

SECTION B: PROPOSAL

Please refer to the Bid Express Website at https://bidexpress.com look up contract number and go to Section B: Proposal Page

You can access all City of Madison bid solicitations for FREE at www.bidexpress.com

Click on the "Register for Free" button and follow the instructions to register your company and yourself. You will be asked for a payment subscription preference, since you may wish to bid online someday. Simply choose the method to pay on a 'per bid' basis. This requires no payment until / unless you actually bid online. You can also choose the monthly subscription plan at this time. You will, however, be asked to provide payment information. Remember, you can change your preference at anytime. You will then be able to complete your free registration and have full access to the site. Your free access does not require completion of the 'Digital ID' process, so you will have instant access for viewing and downloading. To be prepared in case you ever do wish to bid online, you may wish to establish your digital ID also, since you cannot bid without a Digital ID.

If you have any problems with the free registration process, you can call the bidexpress help team, toll free at 1-888-352-2439 (option 1, option1).

SECTION C: SMALL BUSINESS ENTERPRISE

Instructions to Bidders
City of Madison
SBE Program Information

2 Small Business Enterprise (SBE) Program Information

2.1 Policy and Goal

The City of Madison reaffirms its policy of nondiscrimination in the conduct of City business by maintaining a procurement process which remains open to all who have the potential and ability to sell goods and services to the City. It is the policy of the City of Madison to allow Small Business Enterprises (SBE) maximum feasible opportunity to participate in City of Madison contracting. The bidder acknowledges that its bid has been submitted in accordance with the SBE program and is for the public's protection and welfare.

Please refer to the "ADVERTISEMENT FOR BIDS" for the goal for the utilization of SBEs on this project. SBEs may participate as subcontractors, vendors and/or suppliers, which provide a commercially useful function. The dollar value for SBE suppliers or 'materials only' vendors shall be discounted to 60% for purposes of meeting SBE goals.

A bidder which achieves or exceeds the SBE goal will be in compliance with the SBE requirements of this project. In the event that the bidder is unable to achieve the SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Failure to either achieve the goal or demonstrate a good faith effort to do so will be grounds for the bidder being deemed a non-responsible contractor ineligible for award of this contract.

A bidder may count towards its attainment of the SBE goal only those expenditures to SBEs that perform a commercially useful function. For purposes of evaluating a bidder's responsiveness to the attainment of the SBE goal, the contract participation by an SBE is based on the percentage of the total base bid proposed by the Contractor. The total base bid price is inclusive of all addenda.

Work performed by an SBE firm in a particular transaction can be counted toward the goal only if it involves a commercially useful function. That is, in light of industry practices and other relevant considerations, does the SBE firm have a necessary and useful role in the transaction, of a kind for which there is a market outside the context of the SBE Program, or is the firm's role a superfluous step added in an attempt to obtain credit towards goals? If, in the judgment of the Affirmative Action Division, the SBE firm will not perform a commercially useful function in the transaction, no credit towards goals will be awarded.

The question of whether a firm is performing a commercially useful function is completely separate from the question of whether the firm is an eligible SBE. A firm is eligible if it meets the definitional criteria and ownership and control requirements, as set forth in the City of Madison's SBE Program.

If the City of Madison determines that the SBE firm is performing a commercially useful function, then the City of Madison must then decide what that function is. If the commercially useful function is that of an SBE vendor / supplier that regularly transacts business with the respective product, then the City of Madison will count 60% of the value of the product supplied toward SBE goals.

To be counted, the SBE vendor / supplier must be engaged in selling the product in question to the public. This is important in distinguishing an SBE vendor / supplier, which has a regular trade with a variety of customers, from a firm which performs supplier-like functions on an ad hoc basis or for only one or two contractors with whom it has a special relationship.

A supplier of bulk goods may qualify as an eligible SBE vendor / supplier if it either maintains an inventory or owns or operates distribution equipment. With respect to the distribution equipment; e.g., a fleet of trucks, the term "operates" is intended to cover a situation in which the supplier leases the equipment on a regular basis for its entire business. It is not intended to cover a situation in which the firm simply provides drivers for trucks owned or leased by another party; e.g., a prime contractor, or leases such a party's trucks on an ad hoc basis for a specific job.

If the commercially useful function being performed is not that of a qualified SBE vendor / supplier, but rather that of delivery of products, obtaining bonding or insurance, procurement of personnel, acting as a broker or manufacturer's representative in the procurement of supplies, facilities, or materials, etc., only the fees or commissions will apply towards the goal.

For example, a business that simply transfers title of a product from manufacturer to ultimate purchaser; e. g., a sales representative who re-invoices a steel product from the steel company to the Contractor, or a firm that puts a product into a container for delivery would not be considered a qualified SBE vendor / supplier. The Contractor would not receive credit based on a percentage of the cost of the product for working with such firms.

Concerning the use of services that help the Contractor obtain needed supplies, personnel, materials or equipment to perform a contract: only the fee received by the service provider will be counted toward the goal. For example, use of a SBE sales representative or distributor for a steel company, if performing a commercially useful function at all, would entitle the Contractor receiving the steel to count only the fee paid to the representative or distributor toward the goal. This provision would also govern fees for professional and other services obtained expressly and solely to perform work relating to a specific contract.

Concerning transportation or delivery services: if an SBE trucking company picks up a product from a manufacturer or a qualified vendor / supplier and delivers the product to the Contractor, the commercially useful function it is performing is not that of a supplier, but simply that of a transporter of goods. Unless the trucking company is itself the manufacturer or a qualified vendor / supplier in the product, credit cannot be given based on a percentage of the cost of the product. Rather, credit would be allowed for the cost of the transportation service.

The City is aware that the rule's language does not explicitly mention every kind of business that may contribute work on this project. In administering these programs, the City would, on a case-by-case basis, determine the appropriate counting formula to apply in a particular situation.

2.2 Contract Compliance

Questions concerning the SBE Program shall be directed to the Contract Compliance Officer of the City of Madison Department of Civil Rights, Affirmative Action Division, 210 Martin Luther King, Jr. Blvd., Room 523, Madison, WI 53703; telephone (608) 266-4910.

2.3 Certification of SBE by City of Madison

The Affirmative Action Division maintains a directory of SBEs which are currently certified as such by the City of Madison. Contact the Contract Compliance Officer as indicated in Section 2.2 to receive a copy of the SBE Directory or you may access the SBE Directory online at www.cityofmadison.com/dcr/aaTBDir.cfm.

All contractors, subcontractors, vendors and suppliers seeking SBE status must complete and submit the **Targeted Business Certification Application** to the City of Madison Affirmative Action Division by the time and date established for receipt of bids. A copy of the Targeted Business Certification Application is available by contacting the Contract Compliance Officer at the address and telephone indicated in Section 2.2 or you may access the Targeted Business Certification Application online at www.cityofmadison.com/dcr/aaTBDir.cfm. Submittal of the Targeted Business Certification Application by the time specified does not guarantee that the applicant will be certified as a SBE eligible to be utilized towards meeting the SBE goal for this project.

2.4 Small Business Enterprise Compliance Report

2.4.1 Good Faith Efforts

Bidders shall take all necessary affirmative steps to assure that SBEs are utilized when possible and that the established SBE goal for this project is achieved. A contractor who self performs a portion of the work, and is pre-qualified to perform that category of work, may subcontract that portion of the work, but shall not be required to do so. When a bidder is unable to achieve the established SBE goal, the bidder must demonstrate that a good faith effort to do so was made. Such a good faith effort should include the following:

2.4.1.1 Attendance at the pre-bid meeting.

2.4.1.2 Using the City of Madison's directory of certified SBEs to identify SBEs from which to solicit bids.

2.4.1.3 Assuring that SBEs are solicited whenever they are potential sources.

2.4.1.4 Referring prospective SBEs to the City of Madison Affirmative Action Division for certification.

2.4.1.5 Dividing total project requirements into smaller tasks and/or quantities, where economically feasible, to permit maximum feasible SBE participation.

2.4.1.6 Establishing delivery schedules, where requirements permit, which will encourage participation by SBEs.

2.4.1.7 Providing SBEs with specific information regarding the work to be performed.

2.4.1.8 Contacting SBEs in advance of the deadline to allow such businesses sufficient time to prepare a bid.

2.4.1.9 Utilizing the bid of a qualified and competent SBE when the bid of such a business is deemed reasonable (i.e. 5% above the lowest bidder), although not necessarily low.

2.4.1.10 Contacting SBEs which submit a bid, to inquire about the details of the bid and confirm that the scope of the work was interpreted as intended.

2.4.2 Reporting SBE Utilization and Good Faith Efforts

The Small Business Enterprise Compliance Report is to be submitted by the bidder with the bid: This report is due by the specified bid closing time and date. Bids submitted without a completed SBE Compliance Report as outlined below

shall be deemed non-responsible and the bidder ineligible for award of this contract.

2.4.2.1 If the Bidder meets or exceeds the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.1.1 **Cover Page,** Page C-6; and
2.4.2.1.2 **Summary Sheet,** C-7.

2.4.2.2 If the bidder does not meet the goal established for SBE utilization, the Small Business Enterprise Compliance Report shall consist of the following:

2.4.2.2.1 **Cover Page,** Page C-6;
2.4.2.2.2 **Summary Sheet,** C-7; and
2.4.2.2.3 **SBE Contact Report,** C-8 and C-9. (A separate Contact Report must be completed for each applicable SBE which is not utilized.)

2.5 Appeal Procedure

A bidder which does not achieve the established goal and is deemed non-responsible for failure to demonstrate a good faith effort to achieve such goal and subsequently denied eligibility for award of contract may, within 72 hours of receiving such notification, appeal that decision to a special appeals committee composed of three (3) members of the Affirmative Action Commission, three (3) members of the Board of Public Works and a seventh member appointed by the Mayor. All appeals must be made in writing to the City Engineer and received within 72 hours of City of Madison's notice. Postmark not applicable.

2.6 SBE Requirements After Award of the Contract

The successful bidder shall identify SBE subcontractors, suppliers and vendors on the subcontractor list in accordance with the specifications. The Contractor shall submit a detailed explanation of any variances between the listing of SBE subcontractors, vendors and/or suppliers on the subcontractor list and the Contractor's SBE Compliance Report for SBE participation.

No change in SBE subcontractors, vendors and/or suppliers from those SBEs indicated in the SBE Compliance Report will be allowed without prior approval from the Engineer and the Affirmative Action Division. The contractor shall submit in writing to the City of Madison Affirmative Action Division a request to change any SBE citing specific reasons which necessitate such a change. The Affirmative Action Division will use a general test of reasonableness in approving or rejecting the contractor's request for change. If the request is approved, the Contractor will make every effort to utilize another SBE if available.

The City will monitor the project to ensure that the actual percentage commitment to SBE firms is carried out.

2.7 SBE Definition and Eligibility Guidelines

A Small Business Enterprise is a business concern awarded certification by the City of Madison. For the purposes of this program a Small Business Enterprise is defined as:

A. An independent business operated under a single management. The business may not be a subsidiary of any other business and the stock or ownership may not be held by any individual or any business operating in the same or a similar field. In determining whether an entity qualifies as a SBE, the City shall consider all factors relevant to being an independent business including, but not limited to, the date the business was established, adequacy of its resources for the work in which it proposes to involve itself, the degree to which financial, equipment leasing and other relationships exist with other ineligible firms in the same or similar lines of work. SBE owner(s) shall enjoy the customary incidents of ownership and shall share in the risks and profits commensurate with their enjoyment interests, as demonstrated by an examination of the substance rather than form or arrangements that may be reflected in its ownership documents.

B. A business that has averaged no more than $4.0 million in annual gross receipts over the prior three year period and the principal owner(s) do not have a personal net worth in excess of $1.32 million.

Firm and/or individuals that submit fraudulent documents/testimony may be barred from doing business with the City and/or forfeit existing contracts.

SBE certification is valid for one (1) year unless revoked.

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

Small Business Enterprise Compliance Report

This information may be submitted electronically through Bid Express or submitted with bid in sealed envelope.

Cover Sheet

Prime Bidder Information

Company:_____

Address:_____

Telephone Number:_____ Fax Number:_____

Contact Person/Title:_____

Prime Bidder Certification

I, _____, _____ of
Name Title

_____ certify that the information
Company

contained in this SBE Compliance Report is true and correct to the best of my knowledge and belief.

_____ _____
Witness' Signature Bidder's Signature

_____
Date

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

Small Business Enterprise Compliance Report

Summary Sheet

SBE Subcontractors Who Are NOT Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%
		%

Subtotal SBE who are NOT suppliers: _____ %

SBE Subcontractors Who Are Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%

Subtotal Contractors who are suppliers: _____ % x 0.6 = _____ % (discounted to 60%)

Total Percentage of SBE Utilization: _____%.

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

Small Business Enterprise Compliance Report

SBE Contact Report

Submit separate copy of this form for each SBE which you are not able to utilize towards meeting the SBE goal for this project. Attach separate sheets if necessary.

SBE Information

Company:_____

Address:_____

Telephone Number:_____

Contact Person/Title:_____

1. Outline below all efforts to solicit a bid from the above SBE. Include date, means of contact, who from your company made this contact and the result.

   _____

   _____

   _____

2. Describe the information provided to the aforementioned SBE regarding the scope of work for which he/she was to provide a bid.

   _____

   _____

   _____

   Is this the same scope of work on which the subcontractor you intend to utilize based his/her bid?

   ☐ Yes ☐ No

3. Did this SBE submit a bid? ☐ Yes ☐ No

4. Is the General Contractor pre-qualified to self-perform this category of work?

   ☐ Yes ☐ No

5. If you responded "Yes" to Question 3, please check the items below which apply and provide the requested detail. If you responded "No" to Question 3, please skip ahead to item 6 below.

☐ The SBE listed above is unavailable for work on this project for the following reasons. Provide specific detail for this conclusion.

_____

_____

☐ The SBE listed above is unqualified for work on this project. Provide specific details for this conclusion.

_____

_____

☐ The SBE listed above provided a price that was unreasonable (i.e. more than 5% above the lowest bidder). Provide specific detail for this conclusion including the SBE's price and the price of the subcontractor you intend to utilize.

_____

_____

☐ A contract with the SBE listed above may constitute a breach of the bidder's collective bargaining agreements. Provide specific detail for this conclusion including, but not limited to, correspondence from the SBE indicating it will not sign a project labor agreement and/or correspondence from the applicable trade union indicating a project labor agreement will not be allowed at the time of project bidding.

_____

_____

☐ Other; please specify reason(s) other than listed above which made it impossible for you to utilize this SBE on this project.

_____

_____

6. Describe any other good faith efforts:

_____

_____

SECTION D: SPECIAL PROVISIONS

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

It is the intent of these Special Provisions to set forth the final contractual intent as to the matter involved and shall prevail over the Standard Specifications and plans whenever in conflict therewith. In order that comparisons between the Special Provisions can be readily made, the numbering system for the Special Provisions is equivalent to that of the Specifications.

Whenever in these Specifications the term "Standard Specifications" appears, it shall be taken to refer to the City of Madison Standard Specifications for Public Works Construction and Supplements thereto.

SECTION 102.10: PREVAILING WAGE

For this project, payment of prevailing wages (white sheet) shall be required unless the box indicating prevailing wages are not required is checked below.

☐ Prevailing wages shall not be required when this box is checked.

If prevailing wages (white sheets) are required, the wages and benefits paid on the contract shall not be less than those specified in the Prevailing Wage Determination included with these contract documents for the following types of work:

☒ Building and Heavy Construction
☐ Sewer, Water, and Tunnel Construction
☐ Local Street and Miscellaneous Paving Operations
☐ Residential and Agricultural Construction

SECTION 102.12: BEST VALUE CONTRACTING

This Contract shall be considered a Best Value Contract if the Contractor's bid is equal to or greater than $53,000 for a single trade contract; or equal to or greater than $257,500 for a multi-trade contract pursuant to MGO 33.07(7).

SECTION 105.1: AUTHORITY OF THE ENGINEER

The Engineer shall resolve all questions which arise as to the quality and acceptability of materials furnished, work performed, manner of performance, rate of progress of the work, interpretation of the plans and Specifications, acceptable fulfillment of the contract, compensation, and disputes and mutual rights between Contractors under the Specifications. The Engineer shall determine the amount and quantity of work performed and materials furnished.

All decisions of the Engineer shall, when so requested, be rendered in writing. They shall be final and conclusive in all matters unless within ten (10) days after such decision the Contractor applies in writing to the Board of Public Works for a review of such decision.

Any change proposed by a Contractor in SBE subcontractors, vendors or suppliers from those SBEs indicated on the SBE Compliance Report must be approved by the Engineer and the City's Manager of the Affirmative Action Division (hereafter, AAD). When requested, such decision shall be rendered in writing. Such decisions shall be final and conclusive in all matters unless within ten (10) days after such decision the Contractor or the affected SBE applies in writing to the Board of Public Works for a review of such decision.

In the event the Engineer and the AAD disagree over the proper decision to be made regarding an SBE, the Mayor shall appoint a third person to resolve the disagreement, within 30 days of appointment. The decision thus rendered may be reviewed by the Board of Public Works upon request of the Contractor or the affected SBE as set forth in Sections 105.1 and 105.2 of the City's standard specifications.

SECTION 107.4(H): CERTIFICATES OF INSURANCE

Proof of Insurance, Approval. The Contractor shall provide the City with certificate(s) of insurance showing the type, amount, effective dates, and expiration dates of required policies prior to commencing work under this Contract. Contractor shall provide the certificate(s) to the City's representative upon execution of the Contract, or sooner, for approval by the City Risk Manager. If any of the policies required above expire while this Contract is in effect, Contractor shall provide renewal certificate(s) to the City for approval. Certificate Holder language should be listed as follows:

City of Madison
ATTN: Risk Management, Room 406
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703

The Contractor shall provide copies of additional insured endorsements or insurance policies, if requested by the City Risk Manager. The Contractor and/or Insurer shall give the City thirty (30) days advance written notice of cancellation, non-renewal or material changes to any of the above-required policies during the term of this Contract.

SECTION 107.4(I): INSURANCE FOR THE CONSTRUCTION OF BUILDINGS

The City will effect and maintain, Builder's Risk Insurance on a replacement cost basis in an amount equal to the estimated project cost. Coverage includes the building as well as materials stored on the site to be incorporated in the building, including form work in place, form lumber on site, temporary structures, equipment and supplies incidental to the construction of the building. The City's Builders Risk coverage is written on a per building basis and contains a $25,000 per occurrence deductible. If a loss under the City's Builders Risk policy is caused by the negligence of the Contractor or its Subcontractor(s), the Contractor will be responsible for paying the City's $25,000 deductible. The City Engineer has the authority to withhold such deductible from payments due to Contractor. In addition, City Engineer, in his/her sole authority, will determine whether the Contractor was negligent in causing the loss and therefore is responsible for the City's deductible.

The insured loss, if any, is to be adjusted with and payable to the City.

SECTION 109.7 TIME OF COMPLETION

Please refer to Section 105.15, 109.7, and 110.5 of the Standard Specifications, which can be found here: http://www.cityofmadison.com/Business/PW/specs.cfm

The successful Bidder must agree to commence the work on or before a date to be specified in a written "Start Work Letter" and to fully complete all the work within **320 calendar days** thereafter.

900001 CONDITIONS OF THE CONTRACT

PRE-BID INFORMATION

There will be a pre-bid meeting at **10:00am, Tuesday, December 17, 2013** at the Meadowood Shopping Center, ACE Hardware space (and existing Meadowood Neighborhood Center and Meadowridge Library) 5726 Raymond Road, Madison, WI, regarding questions on plans and specifications, to be answered in a written format via addendum to the contract. Representatives from Engberg Anderson, Inc. and City of Madison Engineering will be present.

There will be a pre-bid meeting at **1:00pm, Friday, January 3, 2014** at the Larry D. Nelson Engineering Operations Facility, 1600 Emil Street, Madison, WI, to discuss the Small Business Enterprise (SBE) specifications for the project. Representative from the Affirmative Action Office will be present.

SUMMARY OF WORK

This project is the phased remodeling of Meadowridge Branch Library and Meadowood Neighborhood Center located in the Meadowood Shopping Center, 5726 Raymond Rd., Madison, WI.
Phase 1: The Library will be moving into the existing vacated ACE Hardware store
Phase 2: The Neighborhood Center will be moving into the existing Library space
Phase 3: The Shared Space will be in the existing Neighborhood Center

Remodeling includes general construction, plumbing and fire protection, electrical and HVAC work.

GENERAL INFORMATION

Obtain and pay for permits and fees required for this project.

Obtain and pay for construction sets of plans and specifications required for this project.

Prior to bidding, visit site to become familiar with and verify existing job conditions.

Do not scale drawings for exact dimensions.

Work shall comply with applicable codes and regulations.

Schedule initial work with Jeanine Zwart, Architect 3, at 267-8749, at least 48 hours in advance.

Perform contract so as to minimize disruption of the operation of the building and personnel. Contractor and subcontractor personnel must check in with site contact person each time they arrive at the site to begin work.

Contractor shall be responsible for restoring, repairing and/or replacing any materials, equipment or site damage caused by the work of this project to its original finish and/or condition.

Work shall be performed by mechanics skilled in the area of work included in this contract; shall be of professional quality; and shall be completed according to the best practice of the trade.

Workers shall be knowledgeable with regard to products used and shall take appropriate precautions required to safeguard health and safety.

Existing building materials that may have hazardous content and are located within the work area (example: floor tile, ceiling tile, pipe insulation) shall be sampled, tested, and removed by the City. If any suspect hazardous building materials are found by the contractor during demolition or renovation work that have not been sampled and tested, work must stop and a certified hazardous material inspector must be contacted by the City to assess the situation. Inaccessible areas may exist within the facility.

The intent of the plans and specifications is to provide for the construction, execution and completion of a complete work or improvements, which the contractor undertakes to do in full compliance with the plans, specifications, and contract. The Contractor shall perform all items of work covered and stipulated in the proposal and perform altered and extra work necessary to the prosecution and completion of the work.

The Contractor shall take no advantage of any apparent error or omission in the plans or specifications, and the Owner shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the plans and specifications.

Conditions of the Contract and Division 1 Specification Sections are applicable to all Divisions of the Specifications and Drawings.

BID ITEM 90002 – INTRODUCTION OF NEIGHBORHOOD RESIDENTS INTO THE CONSTRUCTION WORKFORCE THROUGH THE EMPLOYMENT OF TWO (2) CONSTRUCTION CRAFT LABOR APPRENTICES

The City of Madison has determined that this contract would advance the goals of the City through the introduction of neighborhood residents into the construction workforce. To accomplish that goal, the City is working to provide Construction Craft Laborer Apprentices to the Contractor for this project. In addition to the Contractor's regular workforce, the Contractor or the Contractor's subcontractors shall establish a goal of employing at least two (2) Construction Craft Laborer Apprentices from City of Madison residents within aldermanic district 20 for a total of 1680 hours. The Contractor or Contractor's subcontractors also shall make a good faith effort to find additional jobs for City of Madison residents in the district, beyond the two (2) specified above, consistent with other requirements. The Contractor shall coordinate the hiring of apprentices through the Skilled Trades Apprentice Readiness Training program. Contact Mary Watrud, Program Coordinator, at (608) 628-3118.

The unit price bid for this item of work is based upon the wage of a Construction Craft Laborer Apprentice multiplied by the 1.85 full cost factor. Payment shall be based upon the actual hours worked by the Apprentices on this contract.

MEADOWRIDGE BRANCH LIBRARY & MEADOWOOD NEIGHBORHOOD CENTER

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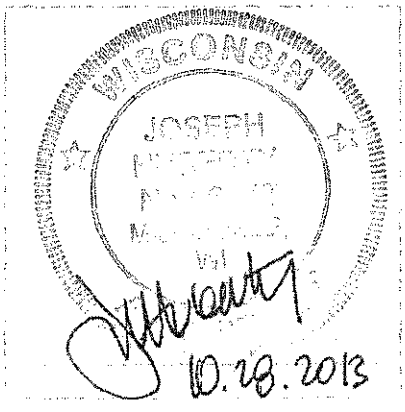

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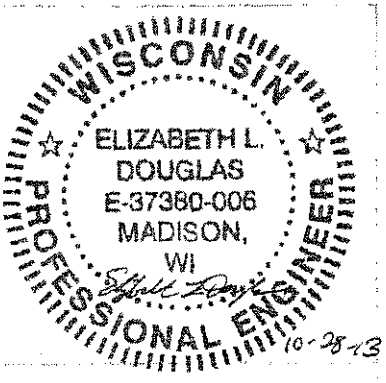

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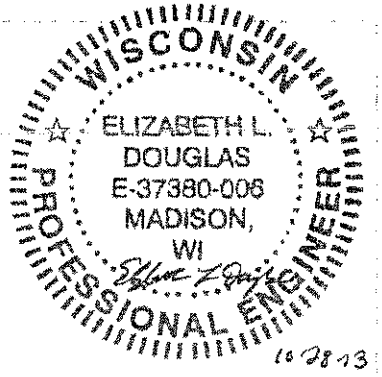

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction for Work with subsequent Owner Furnished Items.
4. Work by Owner.
5. Work under separate contracts.
6. Owner-furnished products.
7. Access to site.
8. Coordination with occupants.
9. Work restrictions.
10. Specification and drawing conventions.

B. Related Section:

1. Division 1 Section 01310 – Project Management and Coordination" for Contractor's requirements for establishing, administering and utilizing the project site.

1.3 PROJECT INFORMATION

A. Project Identification: Meadowridge Branch Library & Meadowood Neighborhood Center, Engberg Anderson Project Number 132273.00

1. Project Location: 5726, 5734 & 5740 Raymond Road Madison, Wisconsin, 53711. .

B. Owner: City of Madison, Madison Public Library.

1. Owner's Representative: Jeanine Zwart, City of Madison – Department of Public Works.
2. City-County Building, Room 115
3. 210 Martin Luther King Jr. Blvd.
4. Madison, WI 53703-3342
5. (608) 267-8749 phone
6. (608) 264-9275 fax
7. JZwart@cityofmadison.com

C. Architect: Mike Zuehlke, AIA - Engberg Anderson, Inc.
   1. 1 North Pinckney Street
   2. Madison, WI 53703
   3. 608-250-0100 phone
   4. 608-250-0200 fax
   5. mikez@engberganderson.com

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and consists of the following:

   1. The City of Madison plans to remodel three leased spaces which currently contain the currently occupied Meadowridge Library, the currently occupied Meadowood Neighborhood Center and a vacant tenant space. The current Library will move to the existing vacant space (7,755 sqft), the current Neighborhood center will move to the existing library space (5,671 sqft) and a shared community space (2,981 sqft.) will be created between the two entities in the location of the existing neighborhood center space. The combined square footage of the construction limits is 16,407 sqft. in an existing one story building that is classified as a type 5B construction of wood stud interior walls, wood trusses and masonry. Exterior improvements will be limited to new openings in the exterior skin, replacement of exterior concrete stoops and addition of new utilities. Interior construction includes new building systems, plumbing, fire protection, HVAC, electrical. Other building components will include a community room and a commercial kitchen which will be located in the central shared space. The occupancy for all spaces will be A-3.

   2. The contractor shall obtain a building permit from the City of Madison.

B. Type of Contract

   1. Project will be constructed under a single prime contract.

1.5 PHASED CONSTRUCTION

A. The work shall be conducted in three (3) phases. All interior and exterior work will coincide with each particular phase:

   1. Phase 1: Demolition of the existing unoccupied vacant space (7,755 sqft.) and construction of the new library.

   2. Phase 2: Demolition of the existing Library space (5,671 sqft.) and the construction of the new Neighborhood Center.

   3. Phase 3: Demolition of the existing neighborhood center space (2,981 sqft.) and the construction of the new shared space.

B. Each entity will occupy its space after completion of each phase and prior to the start of the next phase. A punch list and occupancy permit is required at the end of each phase.

C. Before commencing Work submit an updated copy of the Contractor's construction schedule showing the sequence, commencement and completion dates and move-out -in dates of Owner's Furnished Items for all phases of the Work.

1.6 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. Owner will award a Contract for the supply and installation of Furniture and Library Equipment which will commence at the end of each phase.

1.7 WORK UNDER SEPARATE CONTRACTS

A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

B. Subsequent Work: Owner will coordinate and award separate contract(s) for the following additional work to be performed at site during Construction and following Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. Furnishings Contract for furniture installation.
2. Shelving Contract for Shelving installation.
3. Appliances: Not in Contract
4. Audio Visual and Media Equipment: Not in Contract
5. Telecommunications Equipment: Not in Contract
6. Book Security and Building Security System: Not in Contract
7. Miscellaneous Office Equipment: Not in Contract

1.8 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products and making building services connections.

B. Owner-Furnished Products:

1. Items will be noted as Not in Contract and will be supplied and installed by Owner before and after Substantial Completion. Some items include:
   a. Movable Cabinets.
   b. Furnishings.

c. Shelving
d. Small equipment.
e. Theft Detection equipment for Book Security: Contractor shall provide under floor raceways and power as indicated in the project documents. Owner to provide equipment and proprietary cables(s).
f. Telephone and Computer equipment: Contractor shall provide conduits and raceways as indicated in the project documents. All electronic equipment and proprietary cables provided by the Owner.
g. Building Perimeter Security system including card readers: Contractor shall coordinate security requirements with the owner prior to enclosing exterior walls and drywall ceilings. Owner to provide connection to City Network, including configuration and programming as required.
h. Video surveillance cameras: Contractor shall coordinate security requirements with the owner. Owner to provide monitor for local viewing and Connection to City Network. Appliances:
i. Audio Visual equipment. Contractor shall provide conduits and raceways as indicated in the project documents. Owner, through preferred AV vendor, to provide cables, connections, electronics and cabinet(s) for AV system.

2. Administrative procedures for Owner Furnished Products:
   a. The Owner will arrange for and deliver necessary shop drawings, product data, and samples to the Contractor.
   b. The Owner will arrange and pay for the delivery of Owner Furnished Products according to the Contractor's Construction Schedule.
   c. Following delivery, the Owner will inspect items for damage.
   d. If Owner Furnished Products are damaged, defective, or missing, the Owner will arrange for replacement.
   e. The Owner will arrange for the manufacturer's field services and for the delivery of manufacturer's warranties to the appropriate Contractor.
   f. The Contractor shall designate delivery dates to the Owner-furnished items in the Contractor's Construction Schedule.
   g. The Contractor shall review shop drawings, product data, and samples and return them to the Architect noting discrepancies or problems anticipated in use of the product.
   h. The Contractor is responsible for receiving, unloading, and handling Owner-furnished items at the site.
   i. The Contractor is responsible for protecting Owner-furnished items from damage, including damage from exposure to the elements. The Contractor shall repair of replace items damaged as a result of his operations.

1.9 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine site construction operations to areas designated on the drawings.

2. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to building owner, building owner tenants, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
   a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.10 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: The Building tenants will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with the Building tenants during construction operations to minimize conflicts and facilitate Building tenants usage. Perform the Work so as not to interfere with Building tenants operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from the Building Developer and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect tenants operations.

1.11 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except as otherwise indicated.
   1. Weekend Hours: To be determined per Project Schedule.
   2. Early Morning Hours: Noisy work may not begin until 7am
   3. Hours for Utility Shutdowns: To be arranged with authorities having jurisdiction, City of Madison and building tenants

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by tenants or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Engberg Anderson, Inc. and City of Madison not less than three (3) days in advance of proposed utility interruptions.
   2. Obtain City of Madison's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to the Building tenant occupancy with the City of Madison

1. Notify Engberg Anderson, Inc. and City of Madison not less than three (3) days in advance of proposed disruptive operations.
2. Obtain Cityof Madison's written permission before proceeding with disruptive operations.

E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor air intakes.

F. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.

G. Employee Screening: Comply with Owner's requirements regarding drug and background screening of Contractor personnel working on the Project site.

1. Maintain list of approved screened personnel with Owner's Representative.

1.12 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 1 General Requirements: Requirements of Sections in Division 1 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
1. Administrative and procedural requirements for alternates.
2. Documentation of changes to the Contract Sum and Contract Time.
3. Schedule of alternates.

B. Related Sections.
1. Division 0 "Instructions to Bidders" for Instructions for preparation of pricing for alternates.
2. Division 0 – "Bid Form" for list of alternates as supplement to Bid Form.
3. Divisions 2 through 17 Sections: Coordinate Sections that specify or relate to items included in an alternate with this Section.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted alternates will be identified in the Owner-Contract Agreement.

1.5 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 01 Folding Panel Partition
1. Base Bid: Complete construction as indicated in the drawings and specifications.
2. Add Alternate: Addition of Folding Panel Partition, required trims and hanging rods as indicated on Drawings: A103, A203, A802 and related engineering documents and related specification sections.

END OF SECTION 012300

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:
1. Division 1 Section 012300 - "Alternates" for products selected under an alternate.
2. Division 1 Section 012500 – "Contract Modification Procedures" for determining which modification method and form is appropriate.
3. Division 1 Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
4. Divisions 2 through 17 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 SUBMITTALS

A. Substitution Requests: Submit electronic PDF of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
1. Substitution Request Form: Use form agreed to by the Architect and City of Madison.
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable specification section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
n. Product Data, outlining sustainable design qualification data, where applicable.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
   b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      b. Substitution request is fully documented and properly submitted.
      c. Requested substitution will not adversely affect Contractor's construction schedule.
      d. Requested substitution has received necessary approvals of authorities having jurisdiction.
      e. Requested substitution is compatible with other portions of the Work.
      f. Requested substitution has been coordinated with other portions of the Work.
      g. Requested substitution provides specified warranty.
      h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Architect will consider requests for substitution if received within 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
   1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
      a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
      b. Requested substitution does not require extensive revisions to the Contract Documents.
      c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
      d. Substitution request is fully documented and properly submitted.
      e. Requested substitution will not adversely affect Contractor's construction schedule.

f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.
h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

3.1 COORDINATION

A. Coordinate Substitution in the Contract Documents according to Section 012600 – "Contract Modification Procedures.

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Sections:
1. Division 1 Section 013200 – "Construction Progress Documentation" for administrative requirements for preparing and submitting the Contractor's construction schedule and the submittal schedule and updating of the schedules to reflect the impact of contract modifications.
2. Division 1 Section 016000 - "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.
3. Division 1 Section 012500 – "Substitution Procedures" for requirements for substituting one product or system for product or system specified.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on Madison City Contract, "Architect's Supplemental Instructions."

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within fourteen days (14) after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
e. Quotation Form: Use forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect and City of Madison.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Division 1 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use form acceptable to Architect and City of Madison.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on Madison City Contract.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on Madison City Contract. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

C. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

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SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Sections:
1. Division 1 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Division 1 Section "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of Contractor's construction schedule.
3. Division 1 Section "Submittal Procedures" for administrative requirements governing the preparation and submittal of submittal schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
1. Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
   a. Application for Payment forms with continuation sheets.
   b. Submittal schedule.
   c. Items required to be indicated as separate activities in Contractor's construction schedule.
   d. List of Subcontractors
   e. Schedule of Alternates

2. Submit the schedule of values to Architect and City of Madison at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.

B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:
   a. Project name and location.
   b. Name of Architect.
   c. Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.

2. Arrange schedule of values consistent with format of Madison City Contract.
3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
   a. Related Specification Section or Division.
   b. Description of the Work.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that affect value.
   g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
      1) Labor.
      2) Materials.
      3) Equipment.

4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of 5% percent of Contract Sum.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
   a. Differentiate between items stored on-site and items stored off-site. Provide evidence of insurance for items stored off-site.
7. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
   a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and City of Madison and paid for by Owner.
   1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

   1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect and City of Madison.

C. Application for Payment Forms: Use Madison City Contract form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect and City of Madison will return incomplete applications without action.
   1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
   2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
   3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
   4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
   1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
   2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
   3. Provide summary documentation for stored materials indicating the following:
      a. Materials previously stored and included in previous Applications for Payment.
      b. Work completed for this Application utilizing previously stored materials.
      c. Additional materials stored with this Application.
      d. Total materials remaining stored, including materials with this Application.

F. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to City of Madison and submit one (1) signed and notarized original copy of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy to the City of Madison shall include waivers of lien and similar attachments if required.
   1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application. Transmittal shall be as specified for Submittals in Section 013300.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
   1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
   2. When an application shows completion of an item, submit conditional final or full waivers.
   3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
   4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
   5. Submit final Application for Payment with or proceeded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
   1. List of subcontractors.
   2. Schedule of values.
   3. Contractor's construction schedule (preliminary if not final).
   4. Products list (preliminary if not final).
   5. Schedule of unit prices.
   6. Submittal schedule (preliminary if not final).
   7. List of Contractor's staff assignments.
   8. List of Contractor's principal consultants.
   9. Copies of building permits.
   10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   11. Initial progress report.
   12. Report of preconstruction conference.
   13. Certificates of insurance and insurance policies.
   14. Performance and payment bonds.
   15. Data needed to acquire Owner's insurance.

I. Intermediate Applications for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first and following Applications for Payment, include the following:
   1. Revisions to items identified in the Initial Application for Payment:
      a. List of Subcontractors
      b. List of principal suppliers and fabricators.
      c. Schedule of Values.
      d. Contractor's Construction Schedule.
      e. Schedule of principal products.
      f. Schedule of unit prices.
      g. Total completed and stored to date of Application.
      h. Balance to finish.
      i. Retainage.
      j. Submittal Schedule.
      k. List of Contractor's staff assignments.
      l. List of Contractor's principal consultants.

2. Copies of authorizations, inspection reports, and licenses from governing authorities for continued performance of the Work.
3. Progress Meeting Report.
4. Review and Completion of Administrative Requirements of the Work including:
   a. Resolution of Proposal Requests and Change Orders issued prior to 14 days preceding the current Application.
   b. Record documents, including log book, product data, test reports and record drawings are current with the progress of the Work.
   c. For purposes of accounting, the value of these functions shall be established at 5% of the payment Application in review.

J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
3. Administrative actions and submittals that shall precede or coincide with this application include:
   a. Occupancy permits and similar approvals.
   b. Warranties (guarantees) and maintenance agreements.
   c. Test/Adjust/Balance records.
   d. Maintenance instructions.
   e. Startup performance reports.
   f. Change-over information related to the Owner's occupancy, use, operation, and maintenance.
   g. Final cleaning.
   h. Application for reduction of retainage.
   i. Advice on shifting insurance coverages.
   j. List of incomplete Work, recognized as exceptions to the Architect's Certificate of Substantial Completion.

K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
4. Updated final statement, accounting for final changes to the Contract Sum.
5. Madison City Contract, "Contractor's Affidavit of Payment of Debts and Claims."
6. Madison City Contract, "Contractor's Affidavit of Release of Liens."
7. Madison City Contract, "Consent of Surety to Final Payment."
8. Evidence that claims have been settled.
9. Final meter readings for utilities, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
10. Final liquidated damages settlement statement.
11. Transmittal of required Project construction records to Owner.
12. Removal of temporary facilities and services.

13. Removal of surplus materials, rubbish and similar elements.
14. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Coordination drawings.
   4. Requests for Information (RFIs).
   5. Project Web site.
   6. Project meetings.

B. Related Sections:
   1. Division 1 Section 012600 – "Contract Modification Procedures" for the submission of Change Proposals resulting from Requests for Information that may change the Contract Time or the Contract Sum.
   2. Division 1 Section 013200 - "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   3. Division 1 Section 013300 – "Submittal Procedures" for preparing and submitting coordination drawing prints and submittal schedule.
   4. Division 1 Section 015240 - "Construction Waste Management" for requirements for disposition of salvage materials and equipment involved in performance of, but not actually incorporated in, the Work.
   5. Division 1 Section 017700 - "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate sub-contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of construction submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. Refer to other Sections for disposition of salvaged materials that are designated as Owner's property.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, mechanical, and electrical systems.

d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire alarm, and electrical equipment. Coordinate fire-protection drawings with owner.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from existing walls.
8. Fire Protection System: coordinate the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect will so inform the Contractor, who shall make changes as directed and resubmit.
10. Coordination Drawings: Prepare coordination drawing in accordance with requirements of Division 01 Section "Submittal Procedures."

1.6 KEY PERSONNEL

A. Key Personnel Names: Within fourteen (14) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect and Owner.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Madison City Contract.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following RFIs will be returned without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.

c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.

2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 1 Section "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect and City of Madison in writing within seven (7) days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, and Architect, within three (3) days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the

conference shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:
   a. Tentative construction schedule.
   b. Phasing.
   c. Critical work sequencing and long-lead items.
   d. Designation of key personnel and their duties.
   e. Lines of communications.
   f. Procedures for processing field decisions and Change Orders.
   g. Procedures for RFIs.
   h. Procedures for testing and inspecting.
   i. Procedures for processing Applications for Payment.
   j. Distribution of the Contract Documents.
   k. Submittal procedures.
   l. Preparation of record documents.
   m. Use of the premises and existing building.
   n. Work restrictions.
   o. Working hours.
   p. Coordination with Building owner & tenants
   q. Owner's occupancy requirements.
   r. Responsibility for temporary facilities and controls.
   s. Procedures for moisture and mold control.
   t. Procedures for disruptions and shutdowns.
   u. Construction waste management and recycling.
   v. Parking availability.
   w. Office, work, and storage areas.
   x. Equipment deliveries and priorities.
   y. First aid.
   z. Security.
   aa. Progress cleaning.
4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.

j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Coordination with Building owner & tenants.
t. Regulations of authorities having jurisdiction.
u. Testing and inspecting requirements.
v. Installation procedures.
w. Coordination with other work.
x. Required performance results.
y. Protection of adjacent work.
z. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, and Commissioning Agent but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Requirements for the commissioning process.
i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
j. Submittal procedures.
k. Coordination of separate contracts.

l. Coordination with Building owner & tenant.
m. Owner's partial occupancy requirements.
n. Installation of Owner's furniture, fixtures, and equipment.
o. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at bi-weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority as required and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.
   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Sequence of operations.
      3) Coordination with Building owner & tenants.
      4) Status of submittals.
      5) Deliveries.
      6) Off-site fabrication.
      7) Access.
      8) Site utilization.
      9) Temporary facilities and controls.
      10) Progress cleaning.
      11) Quality and work standards.
      12) Status of correction of deficient items.
      13) Field observations.
      14) Status of RFIs.
      15) Status of proposal requests.
      16) Pending changes.
      17) Status of Change Orders.
      18) Pending claims and disputes.
      19) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

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SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Start-up construction schedule.
   2. Contractor's construction schedule.
   3. Daily construction reports.
   4. Material location reports.
   5. Field condition reports.
   6. Special reports.

B. Related Sections:
   1. Division 1 Section 011000 – "Summary" for requirements for delivery dates furnished for products ordered in advance and Owner-furnished products.
   2. Division 1 Section 012900 – "Payment Procedures" for submitting the schedule of values.
   3. Division 1 Section 013100 – "Project Management and Coordination" for submitting and distributing meeting and conference minutes and the Contractor's coordination responsibilities, including schedule updating.
   4. Division 1 Section 013300 - "Submittal Procedures" for submitting schedules and reports.
   5. Division 1 Section 014000 - "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   2. Predecessor Activity: An activity that precedes another activity in the network.
   3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of the Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
1. PDF electronic file(s)

B. Start-up construction schedule.
1. Approval of cost-loaded start-up construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

D. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.

E. Daily Construction Reports: Submit at weekly intervals.

F. Material Location Reports: Submit at weekly intervals.

G. Field Condition Reports: Submit at time of discovery of differing conditions.

H. Special Reports: Submit at time of unusual event.

1.5 QUALITY ASSURANCE

A. Pre-scheduling Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss constraints, including phasing, work stages, area separations, interim milestones and partial Owner occupancy.
   4. Review delivery dates for Owner-furnished products.
   5. Review schedule for work of Owner's separate contracts.
   6. Review time required for review of submittals and resubmittals.
   7. Review requirements for tests and inspections by independent testing and inspecting agencies.
   8. Review time required for completion and startup procedures.
   9. Review and finalize list of construction activities to be included in schedule.
   10. Review submittal requirements and procedures.
   11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.

B. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion through final completion including each phase.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat phase as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.

2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include not less than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
6. Punch Lists and Final Completion: Include not more than 14 days for each punch list and 30 days for final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
4. Work Restrictions: Show the effect of the following items on the schedule:
   a. Coordination with existing construction.
   b. Limitations of continued occupancies.
   c. Uninterruptible services.
   d. Partial occupancy before Substantial Completion.
   e. Use of premises restrictions.
   f. Provisions for future construction.
   g. Seasonal variations.
   h. Environmental control.
5. Work Stages: Indicate important stages of construction for each phase and major portion of the Work, including, but not limited to, the following:
   a. Subcontract awards.
   b. Submittals.
   c. Purchases.
   d. Mockups.
   e. Fabrication.
   f. Sample testing.
   g. Deliveries.
   h. Installation.
   i. Tests and inspections.
   j. Adjusting.
   k. Curing.
   l. Startup and placement into final use and operation.
6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Completion of mechanical installation.
   b. Completion of electrical installation.
   c. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.

E. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
   1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
   1. Unresolved issues.
   2. Unanswered RFIs.
   3. Rejected or unreturned submittals.
   4. Notations on returned submittals.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven (7) days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the start-up network diagram, prepare a skeleton network to identify probable critical paths.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
      a. Preparation and processing of submittals.
      b. Mobilization and demobilization.
      c. Purchase of materials.
      d. Delivery.
      e. Fabrication.
      f. Utility interruptions.
      g. Installation.

h. Work by Owner that may affect or be affected by Contractor's activities.
i. Testing and commissioning.
j. Punch list and final completion.
k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
   a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, LEED documentation, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.
   a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
   b. Total cost assigned to activities shall equal the total Contract Sum.

B. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

C. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Principal events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

D. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
   1. List of subcontractors at Project site.
   2. List of separate contractors at Project site.
   3. Approximate count of personnel at Project site.
   4. Equipment at Project site.
   5. Material deliveries.
   6. High and low temperatures and general weather conditions, including presence of rain or snow.
   7. Accidents.
   8. Meetings and significant decisions.
   9. Unusual events (refer to special reports).
   10. Stoppages, delays, shortages, and losses.
   11. Meter readings and similar recordings.
   12. Emergency procedures.
   13. Orders and requests of authorities having jurisdiction.
   14. Change Orders received and implemented.
   15. Construction Change Directives received and implemented.
   16. Services connected and disconnected.
   17. Equipment or system tests and startups.
   18. Partial completions and occupancies.
   19. Substantial Completions authorized.

B. Material Location Reports: At weekly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At weekly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Architect Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections:

1. Division 1 Section 012900 - "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Division 1 Section 013100 – "Project Management and Coordination" for submitting and distributing meeting and conference minutes; for submitting administrative submittals, such as permits, bonds, and insurance certificates; and for submitting coordination drawings.
3. Division 1 Section 013200 - "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
4. Division 1 Section 014000 – "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
5. Division 1 Section 01770 – "Closeout Procedures" for submitting warranties.
6. Division 1 Section 017823 - "Operation and Maintenance Data" for submitting operation and maintenance manuals.
7. Division 1 Section 017839 – "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
8. Division 1 Section 017900 - "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as action submittals.

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as informational submittals.

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or modifications to submittals noted by the Architect and additional time for handling and reviewing submittals required by those corrections.
   1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   2. Initial Submittal: Submit concurrently with start-up construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
   3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
      a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
   4. Format: Arrange the following information in a tabular format:
      a. Scheduled date for first submittal.
      b. Specification Section number and title.
      c. Submittal category: Action, informational.
      d. Name of subcontractor.
      e. Description of the Work covered.
      f. Scheduled date for Architect's final release or approval.
      g. Scheduled dates for purchasing.
      h. Scheduled dates for installation.
      i. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's and Engineer's Digital Data Files: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
   1. Architect will furnish Contractor specific digital data drawing files of the Contract Drawings for use in preparing Shop Drawings
      a. Drawings are limited to plan drawings.
      b. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
      c. Digital Drawing Software Program: The Contract Drawings are available in AutoCad 2010.

d. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for re-submittals, as follows. Time for review shall commence on Architect's receipt of the paper copy submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Re-submittal Review: Allow 15 days for review of each re-submittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Specification Sections requiring sequential review include, but are not limited to:
   a. Building Developer
   b. Structural Engineering
   c. Plumbing
   d. Fire Protection
   e. HVAC
   f. Electrical
   g. Technology.
6. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Identification and Information: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
   a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., 06100-01). Resubmittals shall include a dash with another sequential number (e.g., 06100-02).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Include the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Contractor.
e. Name of firm or entity that prepared submittal.
f. Name of subcontractor.
g. Name of supplier.
h. Name of manufacturer.
i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Related physical samples submitted directly.
m. Other necessary identification.

5. Include the following information as keywords in the electronic file metadata:
   a. Project name.
   b. Number and title of appropriate Specification Section.
   c. Manufacturer name.
   d. Product name.

E. Options: Identify options requiring selection by the Architect.

F. Deviations: Identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

H. Transmittal: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
1. Transmittal Form: Use AIA Document G810
2. Transmittal Form: Provide locations on form for the following information:
   a. Project name.
   b. Date.
   c. Destination (To:).
   d. Source (From:).
   e. Names of subcontractor, manufacturer, and supplier.
   f. Category and type of submittal.
   g. Submittal purpose and description.
   h. Specification Section number and title.
   i. Indication of full or partial submittal.
   j. Drawing number and detail references, as appropriate.
   k. Transmittal number, numbered consecutively.
   l. Submittal and transmittal distribution record.
   m. Remarks.
   n. Signature of transmitter.

3. Provide a paper copy of transmittal form to all related physical samples submitted directly
4. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on

previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

I. Re-submittals: Make re-submittals in same form and number of copies as initial submittal.
   1. Note date and content of previous submittal.
   2. Note date and content of revision in label or title block and clearly indicate extent of revision.
   3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

K. Use for Construction: Use only final submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   1. Submit electronic submittals as PDF electronic files and upload to the City of Madison Sharepoint website

   2.
      a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
   3. Action Submittals: Submit one PDF file of each submittal, unless otherwise indicated.
   4. Informational Submittals: Submit one PDF file of each submittal, unless otherwise indicated.
   5. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Division 1 Section "Closeout Procedures."
   6. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
      b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
   7. Test and Inspection Reports Submittals: Comply with requirements specified in Division 1 Section "Quality Requirements."

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
   1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
   2. Mark each submittal to show which products and options are applicable.
   3. Include the following information, as applicable:
      a. Manufacturer's catalog cuts.

b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.
g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.
      1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches .
3. Submit Shop Drawings in the following format:
   a. PDF electronic file.
      1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:
   a. Generic description of Sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of applicable Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
   a. Number of Samples: Submit three full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect, will return two submittal with options selected.
5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
   a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project record sample.
      1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product indicated in the Contract Documents.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:
   a. PDF electronic file.
      1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."

G. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."

H. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."

I. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.
   4. Submit subcontract list in the following format:
      a. PDF electronic file.
         1) Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

J. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."

K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on American Welding Society (AWS) forms. Include names of firms and personnel certified.

M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

N. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

O. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

P. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

Q. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

R. Product Test Reports: Submit written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

S. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.

2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

T. Schedule of Tests and Inspections: Comply with requirements specified in Division 1 Section "Quality Requirements."

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Maintenance Data: Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."

Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally-signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance/Material Submittals: Refer to requirements in Division 1 Section "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:

1. REVIEWED WITH NO COMMENTS
2. REVIEWED WITH COMMENTS
3. REVISE AND RESUBMIT.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will upload to the City of Madison Share Point website each submittal and notify appropriate party.

D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect

E. Incomplete submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

F. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:
   1. Division 1 Section 013200 - "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Divisions 2 through 17 Sections for additional test and inspection requirements.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect

C. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into

compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
   1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
   1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
   2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of

manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. When testing is complete, remove test specimens, assemblies, mockups do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
   3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of the Contractor's

quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses. .

1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL CONSTRUCTION TESTING AND INSPECTION

A. Contractor will engage a testing agency to provide testing and inspection conducted in accordance with the requirements of this Section and of the specific technical Sections 2-17.

3.2 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.3 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 1 Section "Execution Requirements."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

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SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if

bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the United States."

AA	Aluminum Association, Inc. (The) www.aluminum.org	(703) 358-2960
AAADM	American Association of Automatic Door Manufacturers www.aaadm.com	(216) 241-7333
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216

AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AGC	Associated General Contractors of America (The) www.agc.org	(703) 548-3118
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, and Refrigeration Institute www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
APA	APA - The Engineered Wood Association	(253) 565-6600

	www.apawood.org	
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute (Now AHRI)	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Safety Engineers www.asse.org	(847) 699-2929
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association)	(205) 733-4077

	www.awpa.com	
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BWF	Badminton World Federation (Formerly: IBF - International Badminton Federation) www.internationalbadminton.org	6-03-9283 7155
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462

CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CPA	Composite Panel Association www.pbmdf.com	(703) 724-1128
CPPA	Corrugated Polyethylene Pipe Association www.plasticpipe.org	(800) 510-2772 (202) 462-9607
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(706) 278-3176
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200
CSA	Canadian Standards Association	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Cast Stone Institute www.caststone.org	(717) 272-3744
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electronic Components Association www.ec-central.org	(703) 907-8024

EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee www.ejdc.org	(703) 295-5000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek-etlsemko.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.org	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(202) 289-5440
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208

GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAS	International Approval Services (Now CSA International)	
IBF	International Badminton Federation (Now BWF)	
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society www.ies.org	(212) 248-5000
IESNA	Illuminating Engineering Society of North America (Now IES)	
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 981-0100

IGCC	Insulating Glass Certification Council www.igcc.org	(315) 646-2234
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
	Available from ANSI www.ansi.org	(202) 293-8020
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (702) 567-8150
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute	(888) 674-8937

	www.paintinfo.com	(604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6623 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453 (703) 476-3400
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCPI	National Clay Pipe Institute www.ncpi.org	(262) 248-9094
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 775-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200

NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.com	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NTRMA	National Tile Roofing Manufacturers Association (Now TRI)	
NWFA	National Wood Flooring Association www.woodfloors.org	(800) 422-4556 (636) 519-9663

NWWDA	National Wood Window and Door Association (Now WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDCA	Painting & Decorating Contractors of America www.pdca.com	(800) 332-7322 (314) 514-7322
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PLANET	Professional Landcare Network www.landcarenetwork.org	(800) 395-2522 (703) 736-9666
PTI	Post-Tensioning Institute www.post-tensioning.org	(602) 870-7540
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(301) 340-8580
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499
SAE	SAE International www.sae.org	(877) 606-7323 (724) 776-4841
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	

SGCC	Safety Glazing Certification Council www.sgcc.org	(315) 646-2234
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smainfo.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWRI	Sealant, Waterproofing, & Restoration Institute www.swrionline.org	(816) 472-7974
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700

TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WCSC	Window Covering Safety Council www.windowcoverings.org	(800) 506-4636 (212) 297-2109
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (847) 299-5200
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WIC	Woodwork Institute of California (Now WI)	
WMMPA	Wood Moulding & Millwork Producers Association	(800) 550-7889

	www.wmmpa.com	(530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut f?r Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543
UBC	Uniform Building Code (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://.dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167

FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science www.hhs.gov/ophs	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USPS	Postal Service www.usps.com	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and

regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dps.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CDHS	California Department of Health Services (See CDPH)	
CDPH	California Department of Public Health, Indoor Air Quality Section www.cal-iaq.org	(510) 620-2802
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforestservice.tamu.edu	(979) 458-6650

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Sections:

1. Division 1 Section 01100 - "Summary" for limitations on work restrictions and utility interruptions.
2. Division 1 Section 015240 – "Construction Waste Management" for construction waste disposal requirements.
3. Division 1 Section 017000 – "Execution Requirements" for progress cleaning requirements.
4. Division 1 Section 017700 – "Closeout Procedures" for final cleaning requirements.
5. Division 6 Section 061000 – "Rough Carpentry" for lumber and plywood for temporary facilities.
6. Divisions 2 through 17 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage by all entities for construction operations.

C. Water Service: Pay water service use charges for water used by all entities for construction operations.

D. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

C. Dust-Control and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust-control and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
   1. Locations of dust-control partitions at each phase of the work.
   2. HVAC system isolation schematic drawing.
   3. Location of proposed air filtration system discharge.
   4. Other dust-control measures.
   5. Waste management plan.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide galvanized steel bases for supporting posts.

B. Dust Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

2.2 TEMPORARY FACILITIES

A. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect and construction personnel office activities and to accommodate project meetings specified in other Division 1 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
   1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
   2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4-foot square tack and marker boards.
   3. Drinking water and private toilet.
   4. Coffee machine and supplies.
   5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
   6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control. It is the Contractor's responsibility to provide temporary conditioning including equipment.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Division 1 Section "Closeout Procedures".

C. Air Filtration Units: HEPA primary and secondary filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Developer, and Owner, for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
   1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Connect to buildings existing water service facilities. Clean and maintain water service facilities in a condition acceptable to the developer. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
   1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
      a. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
   2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
   3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
   1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   1. Connect temporary service to developer's existing power source, as directed by Building Developer.

I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project job sign.

J. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
1. Provide additional telephone lines for the following:
   a. Provide a dedicated telephone line for each facsimile machine in each field office.
2. At each telephone, post a list of important telephone numbers.
   a. Police and fire departments.
   b. Ambulance service.
   c. Contractor's home office.
   d. Architect's office.
   e. Owner's office.
   f. Principal subcontractors' field and home offices.
3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

K. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Contractor, Architect and Owner to access project electronic documents and maintain electronic communications. Subparagraphs below are examples only. Revise to suit Project.

3.3 SUPPORT FACILITIES INSTALLATION

A. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

B. Parking: Areas to be designated by the City of Madison for construction personnel.

C. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

D. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Job Signs: Provide Project job signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
   a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touchup signs so they are legible at all times.

E. Waste Disposal Facilities: Comply with requirements specified in Division 1 Section "Construction Waste Management."

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
   1. Comply with work restrictions specified in Division 1 Section "Summary."

B. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and sub-grade construction to prevent flooding by runoff of stormwater from heavy rains.

C. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

H. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by developer as required from fumes and noise.
   1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant plywood on construction operations side.
   2. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant treated plywood.
      a. Maintain water-dampened foot mats in vestibule.
   3. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
   4. Protect air-handling equipment.
   5. Provide walk-off mats at each entrance through temporary partition.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Prohibit smoking in construction areas.

2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

C. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
   1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
   1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project job signs.
   2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
   3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 1 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 015240 - CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Salvaging nonhazardous construction waste.
   2. Recycling nonhazardous construction waste.
   3. Disposing of nonhazardous construction waste.

B. Related Sections:
   1. Division 1 Section 01500 - "Temporary Facilities and Controls" for environmental-protection measures during construction, and location of waste containers at Project site.

1.3 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: . Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

1. Construction Waste:
   a. Site-clearing waste.
   b. Masonry and CMU.
   c. Lumber.
   d. Wood sheet materials.
   e. Wood trim.
   f. Metals.
   g. Insulation.
   h. Carpet and pad.
   i. Gypsum board.
   j. Piping.
   k. Electrical conduit.
   l. Packaging: Salvage or recycle 100 percent of the following uncontaminated packaging materials:
      1) Paper.
      2) Cardboard.
      3) Boxes.
      4) Plastic sheet and film.
      5) Polystyrene packaging.
      6) Wood crates.
      7) Plastic pails.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
2. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
3. Review waste management requirements for each trade.
4. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
5. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 RECYCLING CONSTRUCTION WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
   1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
      a. Inspect containers and bins for contamination and remove contaminated materials if found.
   2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
   4. Store components off the ground and protect from the weather.
   5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

3.2 RECYCLING CONSTRUCTION WASTE

A. Packaging:
   1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
   2. Polystyrene Packaging: Separate and bag materials.
   3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
   4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:
   1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
   2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

3.3 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
   1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 015240

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Sections:
1. Division 1 Section 012300 - "Alternates" for products selected under an alternate.
2. Division 1 Section 012500 - "Substitution Procedures" for requests for substitutions.
3. Division 1 Section 014200 - "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
   2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
      a. Form of Approval: As specified in Division 1 Section "Submittal Procedures."
      b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:
   1. Store products to allow for inspection and measurement of quantity or counting of units.
   2. Store materials in a manner that will not endanger Project structure.
   3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.

4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
   3. Refer to Divisions 2 through 17. Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
   1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
   2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
   4. Where products are accompanied by the term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
   6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
   1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
   3. Products:
      a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
      b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
   4. Manufacturers:
      a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered
      b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
   5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
   1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Division 1 Section "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

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SECTION 017000 - EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.
   9. Correction of the Work.

B. Related Sections:
   1. Division 1 Section 011000 – "Summary" for requirements for coordinating cutting and patching.
   2. Division 1 Section 013100 – "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
   3. Division 1 Section 013300 – "Submittal Procedures
   4. Division 1 Section 015240 – "Construction Waste Management" for requirements for waste disposal.
   5. Division 1 Section 017700 - "Closeout Procedures" for submitting Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:
   1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
   2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
   3. Products: List products to be used for patching and firms or entities that will perform patching work.
   4. Dates: Indicate when cutting and patching will be performed.
   5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Architect and Owner of locations and details of cutting and await directions from the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
      a. Primary operational systems and equipment.
      b. Fire separation assemblies.
      c. Air or smoke barriers.
      d. Fire-suppression systems.
      e. Mechanical systems piping and ducts.
      f. Control systems.
      g. Communication systems.
      h. Conveying systems.
      i. Electrical wiring systems.
      j. Operating systems of special construction.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
      a. Water, moisture, or vapor barriers.
      b. Membranes and flashings.
      c. Exterior curtain-wall construction.

d. Equipment supports.
e. Piping, ductwork, vessels, and equipment.
f. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

1.6 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to the Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
   a. Description of the Work.
   b. List of detrimental conditions, including substrates.
   c. List of unacceptable installation tolerances.
   d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility, Owner, and Architect that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 1 Section "Project Management and Coordination."

E. Surface and Substrate Preparation: Comply with manufacturer's recommendations for preparation of substrates to receive subsequent work.

3.3 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.

B. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect

3.4 FIELD ENGINEERING

A. Identification: Owner will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
   1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
   2. Replace lost o destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
   2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
   3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.
   2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
   3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
   4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
   1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
   2. Allow for building movement, including thermal expansion and contraction.
   3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
   1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching in accordance with requirements of Division 1 Section "Summary."

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

F. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   5. Proceed with patching after construction operations requiring cutting are complete.

G. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
      a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
      b. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
      a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
   1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
   2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
   2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
   3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
      a. Utilize containers intended for holding waste materials of type to be stored.
   4. Coordinate progress cleaning for joint-use areas where more than one installer has worked.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
   1. Remove liquid spills promptly.
   2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Division 1 Section "Construction Waste Management."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Division 1 Section "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.11 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
   1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Inspection Procedures.
   2. Substantial Completion procedures.
   3. Final completion procedures.
   4. Warranties.
   5. Final cleaning.

B. Related Sections:
   1. Division 1 Section 012900 – "Payment Procedures" for requirements for Applications for Payment for Substantial Completion and final completion.
   2. Division 1 Section 015240 – "Construction Waste Management" for requirements for waste disposal.
   3. Division 1 Section 017000 - "Execution Requirements" for progress cleaning of Project site.
   4. Division 1 Section 017839 - "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   5. Division 1 Section 017823 - "Operation and Maintenance Data" for operation and maintenance manual requirements.
   6. Division 1 Section 017900 - "Demonstration and Training" for requirements for instructing Owner's personnel.
   7. Divisions 2 through 17 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.3 SUBSTANTIAL COMPLETION

A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete with request.
   1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
   2. Advise Owner of pending insurance changeover requirements.
   3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.

4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit test/adjust/balance records.
10. Sign-off of commissioning issue log.
11. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
12. Advise Owner of changeover in heat and other utilities.
13. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
14. Complete final cleaning requirements, including touchup painting.
15. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.4 FINAL COMPLETION

A. Preliminary Procedures: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report and warranty.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.

Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. A list of incomplete items (punch list) is required at the end of each phase prior to occupancy of the space.

B. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:
   a. Project name.
   b. Date.
   c. Name of Architect.
   d. Name of Contractor.
   e. Page number.
4. Submit list of incomplete items in the following format:
   a. PDF electronic file.

1.6 WARRANTIES

A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Provide 3 copies of the Warranty binder.

5. Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
   1. Use cleaning products that meet Green Seal GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Final cleaning to be conducted at the end of each phase and shall include any disturbed areas in the previous phases.

C. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
   1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
      a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
      b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
      c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
      d. Remove tools, construction equipment, machinery, and surplus material from Project site.
      e. Remove snow and ice to provide safe access to building.
      f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.

g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    1) Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates.
m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
n. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
o. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
p. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
q. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter upon inspection.
    1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report upon completion of cleaning.
r. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
s. Leave Project clean and ready for occupancy.

D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

E. Construction Waste Disposal: Comply with waste disposal requirements in Division 1 Section "Construction Waste Management."

END OF SECTION 017700

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SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
   1. Operation and maintenance documentation directory.
   2. Emergency manuals.
   3. Operation manuals for systems, subsystems, and equipment.
   4. Product maintenance manuals.
   5. Systems and equipment maintenance manuals.

B. Related Sections:
   1. Division 1 Section 013300 - "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
   2. Division 1 Section 017700 "Closeout Procedures for submitting operation and maintenance manuals.
   3. Division 1 Section 017839 "Project Record Documents" for preparing record drawings for operation and maintenance manuals.
   4. Divisions 2 through 17 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual specification sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   1. Where applicable, clarify and update reviewed manual content to correspond to modifications and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically-indexed file. Submit on digital media acceptable to Architect.
   a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically-linked operation and maintenance directory.
   b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Agent will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Agent will return copy with comments.
   1. Correct or modify each manual to comply with Architect's and Commissioning Agent's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Organization: Include a section in the directory for each of the following:
   1. List of documents.
   2. List of systems.
   3. List of equipment.
   4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:
1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Architect.
7. Name and contact information for Commissioning Agent.
8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
9. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based upon file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel upon opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.

2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor is delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:
1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
2. Equipment or system break-in procedures.

3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:
1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
   1. Standard maintenance instructions and bulletins.
   2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   3. Identification and nomenclature of parts and components.
   4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
   1. Test and inspection instructions.
   2. Troubleshooting guide.
   3. Precautions against improper maintenance.
   4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   5. Aligning, adjusting, and checking instructions.
   6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
   1. Do not use original project record documents as part of operation and maintenance manuals.
   2. Comply with requirements of newly prepared record Drawings in Division 1 Section "Project Record Documents."

G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

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SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.
   4. Miscellaneous record submittals.

B. Related Sections:
   1. Division 1 Section 017000 - "Execution Requirements" for final property survey.
   2. Division 1 Section 017700 - "Closeout Procedures" for general closeout procedures.
   3. Division 1 Section 017823 - "Operation and Maintenance Data" for operation and maintenance manual requirements.
   4. Divisions 2 through 17 Sections for specific requirements for project record documents of the Work in those Sections.

1.3 CLOSEOUT SUBMITTALS

1. Number of Copies: Submit copies of record Drawings as follows:
   a. Final Submittal: Submit PDF electronic files of marked-up record prints. Include each Drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit PDF electronic files of each submittal.
   1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit PDF electronic files of each submittal.

E. Reports: Submit written report weekly indicating items incorporated in Project record documents concurrent with progress of the Work, including modifications, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.
   d. Record and check the markup before enclosing concealed installations.
   e. Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Depths of foundations below first floor.
   d. Locations and depths of underground utilities.
   e. Revisions to routing of piping and conduits.
   f. Revisions to electrical circuitry.
   g. Actual equipment locations.
   h. Duct size and routing.
   i. Locations of concealed internal utilities.
   j. Changes made by Change Order or Construction Change Directive.
   k. Changes made following Architect's written orders.
   l. Details not on the original Contract Drawings.
   m. Field records for variable and concealed conditions.
   n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file with comment function enabled. Use standard sheet size of 24"x36.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file. Provide files in AutoCAD 2010 or equivalent format approved by owner.

3. Identification: As follows:
   a. Project name.
   b. Date.
   c. Designation "PROJECT RECORD DRAWINGS."
   d. Name of Architect
   e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
   5. Note related Change Orders, and record Drawings where applicable.

B. Format: Submit record Specifications as PDF electronic file(s) of marked up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders, and record Drawings where applicable.

B. Format: Submit record Product Data as PDF electronic file(s) of marked up paper copy of Specifications.
   1. Include record Product Data directory organized by specification section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file(s) of marked up miscellaneous record submittals.

1. Include miscellaneous record submittals directory organized by specification section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and modifications to project record documents as they occur; do not wait until the end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.
   3. Demonstration and training video recordings.

B. Related Sections:
   1. Divisions 2 through 17 Sections for specific requirements for demonstration and training for products in those Sections.

1.3 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   1. Indicate proposed training modules utilizing manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For facilitator and instructor

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.4 CLOSEOUT SUBMITTALS

A. Demonstration and Training: Conduct on site training of all systems, subsystems, and equipment

B. Demonstration and Training Video Recordings: Submit three copies within fourteen days of end of each training module.
   1. Conduct Video Recording at each training secession.
   2. Identification: On each copy, provide an applied label with the following information:
      a. Name of Project.
      b. Name and address of videographer.
      c. Name of Architect.
      d. Name of Contractor.
      e. Date of video recording.

C. At completion of training, submit complete training manual(s) for Owner's use.

1.5 QUALITY ASSURANCE

A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

B. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
   1. Inspect and discuss locations and other facilities required for instruction.
   2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
   3. Review required content of instruction.
   4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.6 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
   1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
      a. System, subsystem, and equipment descriptions.
      b. Performance and design criteria if Contractor is delegated design responsibility.
      c. Operating standards.
      d. Regulatory requirements.
      e. Equipment function.
      f. Operating characteristics.
      g. Limiting conditions.
      h. Performance curves.
   2. Documentation: Review the following items in detail:
      a. Emergency manuals.
      b. Operations manuals.
      c. Maintenance manuals.
      d. Project record documents.
      e. Identification systems.
      f. Warranties and bonds.
      g. Maintenance service agreements and similar continuing commitments.
   3. Emergencies: Include the following, as applicable:
      a. Instructions on meaning of warnings, trouble indications, and error messages.
      b. Instructions on stopping.
      c. Shutdown instructions for each type of emergency.
      d. Operating instructions for conditions outside of normal operating limits.
      e. Sequences for electric or electronic systems.
      f. Special operating instructions and procedures.
   4. Operations: Include the following, as applicable:
      a. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      a. Alignments.
      b. Checking adjustments.
      c. Noise and vibration adjustments.
      d. Economy and efficiency adjustments.
   6. Troubleshooting: Include the following:
      a. Diagnostic instructions.
      b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.
8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Division 1 Section "Operations and Maintenance Data."

B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
   1. Owner will furnish an instructor to describe Owner's operational philosophy.
   2. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
   1. Schedule training with Owner through Architect with at least fourteen days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test as required.

E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. Video Recording Format: Provide high-quality color video recordings with menu navigation in format acceptable to Owner.

B. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.

END OF SECTION 017900

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SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Salvage of existing items to be reused or recycled.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site. Conference to coincide with a regularly scheduled progress meeting.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

4. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for dust control and for noise control. Indicate proposed locations and construction of barriers.

C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

D. Predemolition Photographs or Video: Submit before Work begins.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs and preconstruction videotapes.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain adequate ventilation when using cutting torches.
6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
9. Dispose of demolished items and materials promptly.

B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable,

protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings."

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 53 - MISCELLANEOUS CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including reinforcement, concrete materials, mixture design, placement procedures, and finishes.

B. Related Sections:

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1. Design Mixtures: For each concrete mixture.

1.4 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Comply with the following sections of ACI 301, unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated from as-drawn steel wire into flat sheets.

D. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout Project:

1. Portland Cement: ASTM C 150, Type I. Supplement with the following:

a. Fly Ash: ASTM C 618, Class C or F.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2-inch nominal maximum aggregate size.

C. Water: ASTM C 94/C 94M.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 RELATED MATERIALS

A. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick; or plastic sheet, ASTM E 1745, Class C.

B. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Slump Limit: 2 inches, plus or minus 1 inch.
3. Air Content: Maintain within range permitted by ACI 301. Do not allow air content of trowel-finished floor slabs to exceed 3 percent.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 VAPOR RETARDERS

A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.

1. Lap joints 6 inches and seal with manufacturer's recommended adhesive or joint tape.

3.4 STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Consolidate concrete with mechanical vibrating equipment.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched. Remove fins and other projections exceeding 1/2 inch.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.

1. Apply to concrete surfaces to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.

D. Nonslip Broom Finish: Apply a nonslip broom finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

3.9 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

C. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite sample shall be obtained for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.

3.11 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

END OF SECTION 033053

SECTION 035300 - POLISHED CONCRETE MICRO-TOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes self-leveling, cement-based topping for fast-track polishing and resurfacing of interior concrete surfaces for exposed applications.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's Material Safety Data Sheets.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: Signed by manufacturers of topping system certifying that products are compatible.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for concrete floor topping.

1.5 OPERATION AND MAINTENANCE SUBMITTALS

A. Maintenance Data: Provide instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under intended use. These instructions should contain precautions against cleaning products and methods that may be detrimental to finishes and performance.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of topping products and finishes required for this Project.

B. Product Compatibility: Manufacturers of topping and floor-covering systems certify in writing that products are compatible.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

D. Mockups: Place concrete floor topping mockups to demonstrate typical joints, surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Build mockups approximately 100 sq. ft. in the location indicated or, if not indicated, as directed by Architect.

E. Preinstallation Conference: Conduct conference at Project site. Conference to coincide with a regularly schedule progress meeting.

1. Attendees include the Owner, Architect, General Contractor, Subcontractor and Product Representative.
2. The minimum agenda shall include a review of the site conditions, construction documents, schedule, installation procedures, protection procedures and submittals.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage, mixing with other components, and application.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting concrete floor topping performance.

1. Place concrete floor topping only when ambient temperature and temperature of base slabs are between 50 and 85 deg F.

B. Close areas to traffic during topping application and, after application, for time period recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR TOPPINGS

A. Concrete Floor Topping: Factory-prepared and dry-packaged mixture to which only water needs to be added at Project site.

1. Basis-of-Design Product: Subject to compliance with requirements, provide MAPEI; Ultratop Polished Concrete or other products that may be incorporated into the Work include, but are not limited to, the following:

    a. ARDEX Engineered Cements.
    b. Anti-Hydro International, Inc..
    c. CONSPEC, by Dayton Superio.
    d. Dayton Superior Corporation.
    e. L&M Construction Chemicals, Inc..
    f. Metalcrete Industries.
    g. US Concrete Materials, LLC.

2. Compressive Strength (28 Days): 5,000 psi; ASTM C 109/C 109M.

2.2 CONCRETE STAIN

A. Concrete Stain: Water-based, high-performance formulation that produces a UV-stable, high-gloss, fast drying finish.

1. Basis-of-Design Product: Subject to comply with requirements, provide Prosoco; Consolideck, Gentone Stain or other comparable products.

2. Color: Concrete Gray.

2.3 DENSIFIER

A. Densifier: Lithium silicate sealer, hardener and densifier for concrete.

1. Basis-of-Design Product: Subject to comply with requirements, provide Prosoco; Consolideck, LS or other comparable products.

2.4 WATER & OIL REPELLENT

A. Water, Oil and Stain Blocker: Modified "neat" silane system.

1. Basis-of-Design Product: Subject to comply with requirements, provide Prosoco; Consolideck, SLX100 or other comparable products.

2.5 ACCESSORIES

A. Water: Potable and at a temperature of not more than 70 deg F.

B. Aggregate: Well-graded, washed coarse sand as recommended by topping manufacturer.

1. Provide aggregate when recommended in writing by topping manufacturer for topping thickness required.

C. Primer: Product of topping manufacturer recommended in writing for substrate, conditions, and application indicated.

2.6 MIXING

A. Bonding Slurry: Mix dry-packaged mixture with water in accordance with manufacturer's written instructions.

B. Floor Topping: Mix concrete floor topping materials and water in appropriate drum-type batch machine mixer or truck mixer according to manufacturer's written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance of concrete floor topping.

B. Verify that base concrete slabs comply with scratch finish requirements as required by topping manufacture.

C. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

3.3 APPLICATION

A. General: Mix and apply topping components according to manufacturer's written instructions.

1. Close areas to traffic during topping application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum topping-to-substrate and intercoat adhesion.

3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through topping.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

1. Sand broadcast per manufacture's Technical Data Sheets.

C. Apply topping to produce uniform, level surface.

1. Feather edges to match adjacent floor elevations.
2. Place concrete floor topping by tamping and consolidating to achieve tight contact with bonding surface.
3. Finish and measure surface so gap at any point between surface and an unleveled freestanding 10-foot- long straightedge, resting on 2 high spots and placed anywhere on the surface, does not exceed 1/4 inch.

D. Cure topping according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not begin polishing until after time period recommended in writing by topping manufacturer.

F. Remove and replace topping areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

G. Finishing: Allow topping to cure for 24 hours.

1. Begin the grinding process with an 80-grit metal bonded diamond pads. Polish with this gritted pad twice - first in a north-south direction and then in an east-west direction, to achieve and even scratch pattern.

2. Continue the grinding process with a 100-grit metal bonded diamond pads, first in a north-south direction and then in an east-west direction.

3. Continue the grinding process with a 100-grit resin bonded diamond pads.

4. Continue the grinding process with a 200-grit resin bonded diamond pads.

5. Apply Stain:
   a. Apply in a uniform coat at the recommended coverage rate. Let first coat dry 2-3 hours. Apply second coat.

6. Begin scrubbing the stained concrete: Use a burnishing machine at > 2,000 rpm along with a 3,000-grit burnishing pad to burnish the stain into the surface of the polished slab.

7. Continue the grinding process with a 400-grit resin bonded diamond pads.

8. Apply Stain:
   a. Apply in a uniform coat at the recommended coverage rate. Let first coat dry 2-3 hours. Apply second coat.

9. Clean: Sweep the surface with a micofiber mop to remove all dust.

10. Densifier: Apply a liquid-silicate-based densifier. Using a low pressure sprayer, apply in a single coat. Use enough material to wet the surface without producing puddles. Do not allow excess material to puddle.

11. Water & Oil Repellant: Apply in a single application. Use enough material to keep the surface wet for about a minute before penetrating.

3.4 PROTECTION

A. General: Protect freshly placed floor topping from premature drying and excessive cold or hot temperatures.

3.5 JOINT FILLING

A. Prepare and clean contraction joints and install semirigid joint filler, according to manufacturer's written instructions, once topping has fully cured.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth of contraction joints. Overfill joint and trim semirigid joint filler flush with top of joint after hardening.

3.6 REPAIRS

A. Defective Topping: Repair and patch defective concrete floor topping areas, including areas that have not bonded to concrete substrate.

END OF SECTION 035300

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Steel framing and supports for applications where framing and supports are not specified in other Sections.
2. Steel framing for operable partitions.
3. Loose steel lintels.
4. Steel tube handrails.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Paint products.
3. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
3. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.4 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.5 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Eyebolts: ASTM A 489.

E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

I. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

J. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

K. Post-Installed Anchors: Torque-controlled expansion anchors.

   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.4 MISCELLANEOUS MATERIALS

A. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.

1. Fabricate units from slotted channel framing where indicated.

C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Galvanize loose steel lintels.

2.8 RAILINGS

A. Steel Tube Railings: Fabricate railings to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.

1. Rails and Posts: 1-5/8-inch- diameter.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 3 welds: partially dressed weld with spatter removed as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. By flush bends or by inserting prefabricated flush-elbow fittings.

D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

E. Close exposed ends of railing members with prefabricated end fittings.

F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.

1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.

H. Galvanize steel railings.

I. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:
   a. Uniform load of 50 lbf/ft. applied in any direction.
   b. Concentrated load of 200 lbf applied in any direction.
   c. Uniform and concentrated loads need not be assumed to act concurrently.

2.9 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.11 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
   1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
   1. For interior items, prime with primer specified in Section 099123 "Interior Painting."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

3.3 INSTALLING RAILINGS

A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:

1. Anchor posts to steel by welding to steel supporting members.
2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with postinstalled anchors and bolts.

B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting."

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Framing with engineered wood products.
3. Wood blocking, cants, and nailers.
4. Plywood backing panels.

1.3 DEFINITIONS

A. Exposed Framing: Framing not concealed by other construction.

B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.

C. Lumber grading agencies, and the abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. RIS: Redwood Inspection Service.
4. SPIB: The Southern Pine Inspection Bureau.
5. WCLIB: West Coast Lumber Inspection Bureau.
6. WWPA: Western Wood Products Association.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

3. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

B. Fastener Patterns: Full-size templates for fasteners in exposed framing.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Engineered wood products.
3. Power-driven fasteners.
4. Powder-actuated fasteners.
5. Expansion anchors.
6. Metal framing anchors.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
3. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber and plywood with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions and applications: Construction, Stud, or No. 3 grade.

1. Application: All interior partitions and applications.
2. Species:

a. Hem-fir (north); NLGA.
b. Mixed southern pine; SPIB.
c. Spruce-pine-fir; NLGA.
d. Hem-fir; WCLIB, or WWPA.
e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
f. Northern species; NLGA.

2.4 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D 5456 and manufactured with an exterior-type adhesive complying with ASTM D 2559.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Boise Cascade Corporation.
b. Finnforest USA.
c. Georgia-Pacific.
d. Jager Building Systems Inc.
e. Louisiana-Pacific Corporation.
f. Pacific Woodtech Corporation.
g. Roseburg Forest Products Co.
h. Standard Structures Inc.
i. Stark Truss Company, Inc.
j. West Fraser Timber Co., Ltd.
k. Weyerhaeuser Company.

2.5 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Cants.
5. Furring.
6. Grounds.

B. For items of dimension lumber size, provide Standard, Stud, or No. 3 grade lumber of any species.

C. For concealed boards, provide lumber with 19 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 3 grade; SPIB.
2. Hem-fir or hem-fir (north); Standard or No. 3 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Standard or No. 3 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.6 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.7 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.

2.8 METAL FRAMING ANCHORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Simpson Strong-Tie Co. Inc. product indicated on drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those of basis-of-design products. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

2.9 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

B. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

D. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

E. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

F. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.

G. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

H. Do not splice structural members between supports unless otherwise indicated.

I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

J. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. NES NER-272 for power-driven fasteners.
2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

M. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

1. Comply with indicated fastener patterns where applicable.
2. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

3.3 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions. Fasten plates to supporting construction unless otherwise indicated.

1. For interior partitions and walls, provide 2-by-4-inch nominal- size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. Provide continuous horizontal blocking at midheight of partitions more than 96 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with two or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

END OF SECTION 061000

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Public Service Desks
      a. Ask Desk
      b. Concierge Desk
   2. Wood panels
   3. Plastic-laminate cabinets.
   4. Plastic-laminate countertops.
   5. Solid-surface material countertops.
   6. Solid-surface window sills.
   7. Shop finishing of interior woodwork.
   8. Hardware and accessories

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated including cabinet hardware and accessories and finishing materials and processes.

B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   1. Show details full size.
   2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   3. Show locations and sizes of cutouts and holes for plumbing fixtures faucets soap dispensers and other items installed in architectural woodwork.
   4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Verification:
   1. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
   2. Lumber and panel products with shop-applied opaque finish, 50 sq. in. (300 sq. cm) for lumber and 8 by 10 inches (200 by 250 mm) for panels, for each finish system and color, with exposed surface finished.

3. Plastic laminates, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish.
4. Solid-surfacing materials, 6 inches (150 mm) square.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: For each type of product, signed by product manufacturer.

C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products certified participant in AWI's Quality Certification Program.

B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with sequence-matched wood veneers and wood doors with face veneers that are sequence matched with woodwork and transparent-finished wood doors that are required to be of same species as woodwork.

C. Anodic Finisher Qualifications: A firm experienced in successfully applying anodic finishes of type indicated and employing competent control personnel to conduct continuing, effective quality-control program to ensure compliance with requirements.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products: Comply with the following:
   1. Hardboard: AHA A135.4.
   2. Medium-Density Fiberboard: ANSI A208.2, Grade MD made with binder containing no urea formaldehyde.
   3. Particleboard: ANSI A208.1, Grade M-2 made with binder containing no urea formaldehyde.
   4. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
   5. Softwood Plywood: DOC PS 1 Medium Density Overlay.
   6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1made with adhesive containing no urea formaldehyde.

C. Metals, General
   1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
   2. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
   3. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

D. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
   1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.

E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.

F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
   1. Type: Standard type or Veneer type made from material complying with requirements for Standard type, as indicated.

2.2 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING)

A. Grade: Custom

B. Wood Species, Cut and Finish:

Code	Species	Cut	Grade	Finish
WD-1	American Maple	Plain sliced	Premium	Transparent

1. Veneer face grade: Grade A.
2. Exposed Panel Edges: Inset solid-wood lumber edge.
3. Grain Direction: Horizontally as indicated on drawings.
4. Matching of wood paneling: Horizontal panels are a single veneered panel. Vertical matching of adjacent horizontal panels is to be random.

2.3 PLASTIC-LAMINATE CABINETS

A. Grade: Custom.

B. AWI Type of Cabinet Construction: Flush overlay.

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
   1. Horizontal Surfaces Other Than Tops: Grade HGS.
   2. Post-formed Surfaces: Grade HGP.
   3. Vertical Surfaces: Grade HGS.
   4. Edges: Grade HGS matching laminate in color, pattern, and finish.

D. Materials for Semi-exposed Surfaces:
   1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS
      a. Edges of Plastic-Laminate Shelves: PVC T-mold matching laminate in color, pattern, and finish.
      b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
   2. Drawer Sides and Backs: Solid-hardwood lumber
   3. Drawer Bottoms: Hardwood plywood.

E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.

F. Colors, Patterns, and Finishes:

Code	Manufacturer	Number	Name	
PLAM-1	Formica	6925-NT	Maple Woodline	
PLAM-2	Arborite	P-345 RM	Inukshuk Taupe	
PLAM-3	Lamin-Art	2300-T	Platinum	
PLAM-4	Lamin-Art	2429-T	Vapor	
PLAM-5	Pionite	AW 200 Suede	Bridal Blanco	

2.4 PLASTIC-LAMINATE COUNTERTOPS

A. Grade: Custom.

B. High-Pressure Decorative Laminate Grade: HGS.

C. Colors, Patterns, and Finishes:

Code	Manufacturer	Number	Name	
PLAM-1	Formica	6925-NT	Maple Woodline	
PLAM-2	Arborite	P-345 RM	Inukshuk Taupe	
PLAM-3	Lamin-Art	2300-T	Platinum	
PLAM-4	Lamin-Art	2429-T	Vapor	
PLAM-5	Pionite	AW 200 Suede	Bridal Blanco	

D. Edge Treatment: Waterfall edge.

E. Core Material: Medium-density fiberboard made with exterior glue.

F. Core Material at Sinks: Medium-density fiberboard made with exterior glue.

G. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

2.5 SOLID-SURFACING-MATERIAL FABRICATIONS

A. Grade: Premium.

B. Solid-Surfacing-Material Thickness: 1/2-inch- thick, solid surface material with front edge built up with same material to hide subtop. Provide 3/4" plywood subtop under tops and sills.

C. Configuration: Provide tops and sills with the following front and backsplash style:
1. Front: Straight, slightly eased at top.
2. Backsplash: 1/2-inch- thick, solid surface material straight, slightly eased at corner.
3. Endsplash: Matching backsplash.

D. Finish: Matte; gloss range of 5–20.

E. Integral bowl:
1. Manufacturer: Dupont.
2. Style: Model 810
3. Color: Match top

F. Colors, Patterns, and Finishes:

Code	Manufacturer	Name	Description
SS-1	Corian	Slate	Countertops
SS-2	Corian	Cameo White	Window sills and Vanity tops

G. Fabricate items in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
1. Fabricate tops with shop-applied edges of same material as countertop and of configuration indicated.
2. Fabricate tops with loose backsplashes for field application.

2.6 CABINET HARDWARE AND ACCESSORIES

A. Counter Support Brackets
1. Rakks/Rangine Corporation 1-800-826-6006
2. Product: EH-XXXX to match counter depth
3. Configuration: Flush Mount brackets use a 2" x 2" x 1/4" L-shaped vertical leg that is screwed to the side of the stud. After installation of the bracket, drywall is mounted to the studs, hiding the vertical support leg.
4. Material: 6063 T-6 extruded aluminum.
5. Finish: Mill aluminum.

B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135degrees of opening, self-closing.

C. Wire Pulls: Back mounted, solid metal, 4 inches (100 mm) long, 5/16 inch (8 mm) in diameter.

D. Catches: Magnetic catches, BHMA A156.9, B03141

E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests

F. Shelf Rests: BHMA A156.9, B04013; metal

G. Drawer Slides: BHMA A156.9, B05091.
   1. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full-extension type; zinc-plated steel ball-bearing slides.
   2. Trash Bin Slides: Grade 1HD-200; for trash bins not more than 20 inches (500 mm) high and 16 inches (400 mm) wide.

H. Door Locks: BHMA A156.11, E07121.
   1. Drawer Locks: BHMA A156.11, E07041.

I. Grilles for ventilation at woodwork:
   1. KEES Incorporated, 920-876-3391
   2. Material and Thickness: 3/16" Galvanized Steel
   3. Finishes: Epoxy Paint to match PT-15
   4. Pattern EG100 - Egyptian

J. Grommets for Cable Passage through Countertops:
   1. Grommets and matching caps with slot for wire passage.
   2. Provide Doug Mockett & Company, Inc. type BRV1 Series or comparable product.
   3. Color: to be selected from manufactures standard options.

K. Stand-offs: Brushed stainless steel barrels and caps.
   1. Barrels: Diameter not less than 1-1/2 inch. Height not more than 1 inch.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mockett; SO-151MPB9/.75-SSS or comparable product.

   2. Cap: 1-1/2 inch diameter by 1/2 inch high. Brushed aluminum finish.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mockett; MPB11/CAP1-94 or comparable product.

   3. Low Profile Cap: 1-1/2 inch diameter by 1/8 inch high. Brushed aluminum finish.
      a. Basis-of-Design Product: Subject to compliance with requirements, provide Mockett; MPB11/CAP2-94 or comparable product.

L. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

M. Anchors, Nylon Washers and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

N. Wire Management
   1. 1-inch J-Hook.
   2. Provide Erico International Corp. type ER-CAT16HP or comparable product.

O. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
   1. Satin Stainless Steel: BHMA 630 unless noted otherwise.

P. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.7 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Aluminum Items: Aluminum fasteners.
   2. Dissimilar Metals: Type 304 stainless-steel fasteners.

B. Fasteners for Anchoring to Other Construction: Unless otherwise indicated, select fasteners of type, grade, and class required to produce connections suitable for anchoring indicated items to other types of construction indicated.

C. Provide concealed fasteners for interconnecting components and for attaching decorative metal items to other work unless otherwise indicated.

D. Provide Square or hex socket flat-head machine screws for exposed fasteners unless otherwise indicated.

E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

2.8 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.

B. Adhesives, General: Adhesives shall not contain urea formaldehyde.

C. VOC Limits for Installation Adhesives: Installation adhesives shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Wood Glues: 30 g/L.
   2. Multipurpose Construction Adhesives: 70 g/L.
   3. Contact Adhesive: 250 g/L.

D. Adhesive for Bonding Plastic Laminate: Un-pigmented contact cement.
   1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.9 METAL REVEALS

A. Fabricate metal reveals for paneling from:
   1. 1 1/4-by-1 1/4-by-1/8-inch sharp corner aluminum angle.

B. Drill for mounting screws 6 inches (150 mm) from ends of channels and not more than 24 inches o.c. Locate mounting screws at same heights. Provide hex-socket, wafer-head screws for mounting reveals.

2.10 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

2.11 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.12 FABRICATION, GENERAL

A. Wood Moisture Content: Comply with requirements of referenced quality standards for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

B. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
   1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch (1.5 mm).

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
   1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
   2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
   1. Seal edges of openings in countertops with a coat of varnish.

2.13 SHOP FINISHING - WOOD

A. Grade: Provide finishes of same grades as items to be finished.

B. General: Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
   1. Back-priming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require back-priming when surfaced with plastic laminate, backing paper, or thermoset decorative panels.

D. Finish:
   1. AWI Finish System: Conversion varnish.
   2. Color: Clear.
   3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
   4. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and back-priming.

3.2 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of decorative metal.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION

A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.

B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches (3 mm in 2400 mm). Install with no more than 1/16 inch in 96-inch (1.6 mm in 2400-mm) vertical cup or bow and 1/8 inch in 96-inch (3 mm in 2400-mm) horizontal variation from a true plane.

D. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.

E. Anchor paneling to supporting substrate with concealed panel-hanger clips (3/8" lift off Z-clip which holds the panels 1/4" from substrate) where indicated. Do not use face fastening unless otherwise indicated.

F. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

G. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

H. Install metal reveals between wood panels as paneling is installed. Secure to wood grounds with specified screws.

I. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   2. Maintain veneer sequence matching of cabinets with transparent finish.
   3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches (400 mm) o.c. with No. 10 wafer-head screws sized for 1-inch (25-mm) penetration into wood framing, blocking, or hanging strips.

J. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
   1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   2. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.
   3. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) o.c. and to walls with adhesive.
   4. Calk space between backsplash and wall with sealant specified in Section 07 90 00 "Joint Sealants."

K. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

L. Install miscellaneous items as shown on the drawings.

3.4 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064023

SECTION 072100 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glass-fiber blanket insulation.
2. Loose-fill insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

1.5 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

PART 2 - PRODUCTS

2.1 GLASS-FIBER BLANKET INSULATION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. CertainTeed Corporation.
2. Guardian Building Products, Inc.
3. Johns Manville.
4. Knauf Insulation.
5. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

2.2 LOOSE-FILL INSULATION

A. Cellulosic-Fiber Loose-Fill Insulation: ASTM C 739, chemically treated for flame-resistance, processing, and handling characteristics.

2.3 VAPOR RETARDERS

A. Polyethylene Vapor Retarders: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

2.4 ACCESSORIES

A. Fiberglass Mesh Netting: Alkali-resistant fiberglass mesh fabric.
1. Average weight: 1.9 ox/sq yd.
2. ASTM D 1668 II
    a. Tensile strength - Warp: 85 psi.

B. Wood Lath: 3/8-inch x 1 1/2-inch wood lath.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Glass-Fiber Blanket Insulation: Install in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For wood-framed construction, install blankets according to ASTM C 1320.

C. Loose-Fill Insulation: Apply according to ASTM C 1015 and manufacturer's written instructions. Level horizontal applications to uniform thickness as indicated, lightly settle to uniform density, but do not compact excessively.

1. For cellulosic-fiber loose-fill insulation, comply with CIMA's Bulletin #2, "Standard Practice for Installing Cellulose Insulation."

D. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Loose-Fill Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

3.5 INSTALLATION OF FIBERGLASS MESH NETTING

A. Place mesh netting on underside of existing trusses to assist supporting the insulation above.

3.6 INSTALLATION OF VAPOR RETARDERS

A. Place vapor retarders on side of construction indicated on Drawings. Extend vapor retarders to extremities of areas to protect from vapor transmission. Secure vapor retarders in place with adhesives or other anchorage system as indicated. Extend vapor retarders to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal joints in vapor retarders over framing by lapping no fewer than two trusses / studs.

1. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.

C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarders.

D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarders.

3.7 INSTALLATION OF WOOD LATH

A. Pneumatically fasten wood lath strips to underside of existing trusses (after vapor retarder).

3.8 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Acoustical joint sealants.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each kind of sealant and joint substrate indicated.
    b. Complete attached Field Adhesion Test Form for each sealant / joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. LEED Submittals:

1. Product Data for Credit IEQ 4.1: For sealants and sealant primers used inside the weatherproofing system, documentation including printed statement of VOC content.

C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

D. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

E. Field-Adhesion Test Reports: For each sealant application tested.

F. Warranties: Sample of special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

E. Prior to commencing work, a pre-installation conference should be held at the project site with the contractor, subcontractor, sealant manufacturer's technical representative, and the construction representative in attendance. (Samples of typical work should be installed prior to such time so that the details of all typical sealant joints required can be evaluated.) Pre-installation conference shall coincide with a regularly schedule progress meeting.

1.7 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.8 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Ten years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Architectural Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range including custom colors.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 790.
b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
c. Tremco Incorporated; Spectrem 1.

B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Dow Corning Corporation; 786 Mildew Resistant.
b. GE Advanced Materials - Silicones; Sanitary SCS1700.
c. Tremco Incorporated; Tremsil 200 Sanitary.

C. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Pecora Corporation; 898.

2.3 URETHANE JOINT SEALANTS

A. Single-Component, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920. Type S, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
c. Tremco Incorporated; Vulkem 116.

B. Multicomponent, Nonsag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic NP 2.
b. Pecora Corporation; DynaTred.
c. Tremco Incorporated; THC 900/901.

C. Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. BASF Building Systems; Sonolastic NP 2.
b. Pecora Corporation; DynaTred.
c. Tremco Incorporated; THC 900/901.

2.4 ACOUSTICAL JOINT SEALANTS

A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Pecora Corporation; AC-20 FTR.
b. USG Corporation; SHEETROCK Acoustical Sealant.

2.5 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Joint subcaulking material should be sized to be under approximately 25% or less compression when in final position, except for joint configurations requiring 1/2 round or 1/4 round rod stock, which should be secured in position with a nonsmear adhesive.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.6 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems and direct applied finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Movement joints in clay products masonry should be caulked when dry and temperatures are 70F or above. Other joints may be caulked when surfaces are dry and air temperatures are over 40F.

C. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

D. Depth of sealant at the center of its cross section should be uniform and approximately 1/2 width of sealant, with no depth less than 1/3 the width. Depth of sealant at bond interface should be uniform and approximately equal to width of sealant with no depth less than 3/4 the width, except where a bond breaker is used.

E. Whenever a caulked joint is required between two surfaces which are at approximately 90° to each other, sealant should be provided with proper backing to obtain the reduced depth of the sealant required at the center of its cross section.

F. Joints in general should be 3/8" wide unless indicated otherwise on the drawings, with no joint less than 1/4" wide.

G. Sealant should be interrupted at open head ventilators, weep holes or similar construction where a continuous sealant application would tend to trap water in the wall.

H. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

I. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

J. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

K. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

L. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations.

3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:

    a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:

    a. Whether sealants filled joint cavities and are free of voids.
    b. Whether sealant dimensions and configurations comply with specified requirements.

c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Provide the following sealant types to the joint conditions described below including, but not limited to the following:

B. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

   a. Joints between metal panels.
   b. Perimeter joints between materials listed above and frames of doors, windows and louvers.
   c. Control / expansion joints in soffits / overhead surfaces of materials indicated above.
   d. Joints between different materials listed above.
   e. Other non-porous joints as indicated.

2. Silicone Joint Sealant: Single component, nonsag, neutral curing, Class 100/50.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints in stone (marble and granite) materials including countertops and between stone materials and adjoining surfaces including plumbing fixtures.
b. Other joints as indicated.

2. Silicone Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Class 25.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

D. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
b. Tile control and expansion joints where indicated.
c. Other joints as indicated.

2. Silicone Joint Sealant: Mildew resistant, single component, nonsag, neutral curing, Class 25.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

E. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between plant-precast architectural concrete paving units.
d. Joints in stone paving units.
e. Joints between different materials listed above.
f. Other porous joints as indicated.

2. Urethane Joint Sealant: Multicomponent, nonsag, traffic grade, Class 25.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

F. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Joints in dimension stone cladding.
e. Joints in glass unit masonry assemblies.
f. Joints in exterior insulation and finish systems.
g. Joints between different materials listed above.
h. Perimeter joints between materials listed above and frames of doors, windows and louvers.
i. Control / expansion joints in soffits / overhead surfaces of materials indicated above.

j. Other porous joints as indicated.

2. Urethane Joint Sealant: Multicomponent, nonsag, Class 25.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

G. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in stone flooring.
c. Control and expansion joints in brick flooring.
d. Control and expansion joints in tile flooring.
e. Other porous joints as indicated.

2. Urethane Joint Sealant: Single component, nonsag, traffic grade, Class 25.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors including custom colors.

H. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.
c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls and partitions.
e. Joints on underside of plant-precast structural concrete beams and planks.
f. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
g. Other joints as indicated.

2. Acoustical Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

I. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Location:

a. Acoustical joints where indicated.
b. Other joints as indicated.

2. Acoustical Joint Sealant: Acoustical.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

J. General Notes: For conditions not scheduled, provide manufacturer's recommendations.

END OF SECTION 079200

FIELD ADHESION TEST FORM

Manufacture's Technical Representative: _____

Sales Representative: _____

Project Name and Location: _____

Date of field Adhesion Test: _____

Contractor: _____

Site Conditions:

Ambient Air Temperature (Degree F): _____

Substrate Surface Temperature (Degree F): _____

Conditions at Time of Installation: __ Sunny __ Partly Cloudy __ Overcast

Location of Test on Building, Floor Level: _____

Building Elevation (N, S, E, W): _____

Information:

Field Adhesion test	Sealant	Batch #	Substrate	Surface Prep	Joint Width/ Depth	Approx. Linear Ft/Slope	Hours/ Days of Cure	Adhesive or Cohesive Failure
1								
2								
3								
4								

Observations / Questions:

Comments:

Attach photo of test site:

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SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Non-fire-rated steel doors and frames.
2. Fire-rated steel doors and frames.
3. Thermally insulated steel doors.

B. Related Sections:
1. Section 042113 "Brick Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Section 087100 "Door Hardware" for door hardware for hollow metal doors.
3. Sections 099123 "Interior Painting" and 099600 "High Performance Coatings" for field painting hollow metal doors and frames.
4. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 SYSTEM DESCRIPTION

A. Design Requirements
1. Steel Door and Frame Standard: Comply with ANSI A250.8, unless more stringent requirements are indicated.
2. All doors and frames including sidelights shall be galvanized.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:
1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.

4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Other Action Submittals:
1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

B. Installation Instructions: Manufacturer's published instructions including any special installation instructions relating to the Work.

C. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

1.8 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

1.10 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ceco Door Products; an ASSA ABLOY Group company.
2. Kewanee Corporation (The).
3. Steelcraft; an Ingersoll-Rand company.

2.2 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection rating indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.3 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) metallic coating.

D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z (12G) coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.4 STANDARD HOLLOW METAL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
1. Design: Flush panel.
2. Thickness: 1-3/4 inches.

3. Face: Metallic-coated, cold-rolled steel sheet.
4. Exposed finish: Prime.
5. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
   a. Fire Door Core: As required to provide fire-protection.
   b. Smoke Door Core: Mineral Board: As required to provide fire-protection.
      1) Maximum air leakage: 3.0 CFM per sq ft of door opening at 0.10 inch W.G. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
   c. Thermal-Rated (Insulated) Doors: Core: Polystyrene. Where indicated, provide doors fabricated with U value of 0.08 when tested according to ASTM C 1363.
      1) Locations: Exterior doors.
   d. Sound Insulated Door: Mineral Board: Doors located in walls with sound insulation. Square edge in first subparagraph below makes door non-handed but limits amount of clearance adjustability during installation.
6. Vertical Edges for Single-Acting Doors: Beveled edge
   a. Beveled Edge: 1/8 inch in 2 inches.
7. Edge Construction: Model 2, Seamless.
8. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
9. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 3 and Physical Performance Level A (Extra Heavy Duty).

C. Interior Doors: Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
   1. Level 2 and Physical Performance Level B (Heavy Duty).

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as full profile welded unless otherwise indicated.
   3. Frames for Level 3 Steel Doors: 0.053-inch- thick steel sheet.
   4. Exposed finish: Prime.

C. Interior Frames: Fabricated from cold-rolled steel sheet unless metallic-coated sheet is indicated.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as face welded unless otherwise indicated.
   3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
   4. Frames for Wood Doors: 0.053-inch- thick steel sheet.
   5. Frames for Borrowed Lights: Same as adjacent door frame.

6. Exposed finish: Prime.

D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.6 THERMALLY BROKEN HOLLOW METAL FRAMES (EXTERIOR)

A. Provide thermally broken frames at all exterior hollow metal openings. Frames shall conform to the Steel Door Institute guide specification, ANSI A250.8.
   1. Frames shall be welded unity type with 5/8" door stops with an integral 3/8" thick, vinyl, positive thermal break with a compression type gasket.
   2. Provide thermal barrier anchors for new wood wall construction.

2.7 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.8 STOPS AND MOLDINGS

A. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.

   1. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

   2. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

   3. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches apart. Spot weld to face sheets no more than 5 inches o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

C. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

D. Hollow Metal Doors:
   1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
   2. Glazed Lites: Factory cut openings in doors.
   3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch (19 mm) beyond edge of door on which astragal is mounted.

E. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
   1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
   2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
   4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
   5. Jamb Anchors: Provide number and spacing of anchors as follows:
      a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         1) Two anchors per jamb up to 60 inches (1524 mm) high.
         2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
         3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
         4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
      b. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
      c. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
         1) Three anchors per jamb up to 60 inches (1524 mm) high.
         2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
         3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
         4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.

5) Two anchors per head for frames above 42 inches (1066 mm) wide and mounted in metal-stud partitions.

6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
   a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
   b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

F. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 "Door Hardware."
   1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
   2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
   3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

H. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

I. Terminated Stops: Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
   1. Provide terminated stops unless otherwise indicated.

J. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.
   1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
   2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite are capable of being removed independently.
   3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   4. Provide loose stops and moldings on inside of hollow metal work.
   5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

2.11 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pre-treating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.12 GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces with non-petroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the

organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.

1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-protection-rated openings, install frames according to NFPA 80.
b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
c. Install frames with removable glazing stops located on secure side of opening.
d. Install door silencers in frames before grouting.
e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
g. Field apply bituminous coating to backs of frames that are filled with grout containing anti-freezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
   a. Floor anchors may not be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
7. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
   a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (50 mm) o.c. from each corner.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid-core doors with wood-veneer faces.
   2. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:
   1. Section 081113 "Hollow Metal Doors & Frames" for frames for flush wood doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.
   4. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification:
   1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
      a. Provide samples for each species of veneer and solid lumber required.
      b. Provide samples for each color, texture, and pattern of plastic laminate required.
      c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors from single manufacturer.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
   1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.

C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F (16 and 32 deg C) and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.
      b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
   2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
   3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Marshfield Door Systems, Inc.
   4. Oshkosh Architectural Door Company.

2.2 DOOR CONSTRUCTION, GENERAL

A. Particleboard-Core Doors:
   1. Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
   2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
      a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.

b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
c. 5-inch (125-mm) mid-rail blocking, in doors indicated to have exit devices.

B. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

C. Mineral-Core Doors:
1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
a. 5-inch (125-mm) top-rail blocking.
b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
c. 5-inch (125-mm) mid-rail blocking, in doors indicated to have armor plates.
d. 5-inch (125-mm) mid-rail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors
1. Grade: Premium, with Grade AA faces.
2. Species: American Maple
3. Cut: Plain sliced (flat sliced)
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 10 feet (3 m) or more.
8. Exposed Vertical and Top Edges: Applied wood-veneer edges of same species as faces and covering edges of faces.
9. Construction: Five or seven plies. Stiles and rails are bonded to core, and then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
10. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
1. Comply with requirements in NFPA 80 for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.

1. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

2.5 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
   1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:
   1. Grade: Premium.
   2. Finish: AWI system 5 conversion varnish system.
   3. Staining: None required.
   4. Effect: Open-grain finish.
   5. Sheen: Semi-gloss.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
   1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
   2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
   1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

3.3 ADJUSTING

A. Operation: Re-hang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083313 - COILING COUNTER DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Counter doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of coiling counter door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For coiling counter doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E 90, calculated according to ASTM E 413, and rated for not less than the STC value indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain coiling counter doors from single source from single manufacturer.

2.2 COUNTER DOOR ASSEMBLY

A. Counter Door: Coiling counter door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Series 652 or comparable product by one of the following:

a. ACME Rolling Doors.
b. Alpine Overhead Doors, Inc.
c. Alumatec Pacific Products.
d. Amarr Garage Doors.
e. C.H.I. Overhead Doors.
f. City-Gates.
g. Clopay Building Products.
h. Cookson Company.
i. Cornell Iron Works, Inc.
j. Lawrence Roll-Up Doors, Inc.
k. McKeon Rolling Steel Door Company, Inc.
l. Metro Door.
m. QMI Security Solutions.
n. Raynor.
o. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. Door Curtain Material: Aluminum.

D. Door Curtain Slats: Flat profile slats of 1-1/2-inch center-to-center height.

E. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, fabricated aluminum extrusion and finished to match door.

F. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats.

G. Hood: Galvanized steel.

1. Shape: Square.
2. Mounting: Face of wall.

H. Locking Devices: Equip door with slide bolt for padlock.

I. Manual Door Operator: Push-up operation.

J. Curtain Accessories: Equip door with push/pull handles.

K. Door Finish:

1. Aluminum Finish: Clear anodized.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate coiling counter-door curtain of interlocking metal slats in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Aluminum Door Curtain Slats: ASTM B 209 sheet or ASTM B 221 extrusions, alloy and temper standard with manufacturer for type of use and finish indicated; thickness of 0.050 inch; and as required.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.4 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch-thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.5 LOCKING DEVICES

A. Slide Bolt: Fabricate with side-locking bolts to engage through slots in tracks for locking by padlock, located on both left and right jamb sides, operable from coil side.

2.6 CURTAIN ACCESSORIES

A. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.

2.7 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 MANUAL DOOR OPERATORS

A. General: Equip door with manual door operator by door manufacturer.

B. Push-up Door Operation: Design counterbalance mechanism so that required lift or pull for door operation does not exceed 25 lbf.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.11 GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install coiling counter doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install coiling counter doors, hoods, controls, and operators at the mounting locations indicated for each door.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain coiling counter doors.

END OF SECTION 083313

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SECTION 083323 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Insulated service doors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E 90, calculated according to ASTM E 413, and rated for not less than the STC value indicated.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling door manufacturer.

2.2 DOOR ASSEMBLY

A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Model 625 or comparable product by one of the following:

a. ACME Rolling Doors.
b. Alpine Overhead Doors, Inc.
c. Alumatec Pacific Products.
d. Amarr Garage Doors.
e. ASTA Door Corporation.
f. C.H.I. Overhead Doors.
g. City-Gates.
h. Clopay Building Products.
i. Cookson Company.
j. Cornell Iron Works, Inc.
k. Janus International Corporation.
l. Lawrence Roll-Up Doors, Inc.

m. McKeon Rolling Steel Door Company, Inc.
n. Metro Door.
o. QMI Security Solutions.
p. Raynor.
q. Southwestern Rolling Steel Door Co.
r. Wayne-Dalton Corp.

B. Operation Cycles: Door components and operators capable of operating for not less than 20,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.

C. STC Rating: 21.

D. Curtain R-Value: 7.7 deg F x h x sq. ft./Btu.

E. Door Curtain Material: Galvanized steel.

F. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
1. Insulated-Slat Interior Facing: Metal.
2. Gasket Seal. Manufacturer's standard continuous gaskets between slats.

G. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch; fabricated from hot-dip galvanized steel and finished to match door.

H. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.

I. Hood: Match curtain material and finish.

1. Shape: Square.
2. Mounting: Face of wall.

J. Electric Door Operator:

1. Usage Classification: Medium duty, up to 15 cycles per hour and up to 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Push-up type.
6. Obstruction-Detection Device: Automatic sensor edge on bottom bar.

a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

7. Control Station(s): Interior mounted. Verify location with Architect prior to installation.

K. Curtain Accessories: Equip door with weatherseals.

L. Door Finish:

1. Baked-Enamel or Powder-Coated Finish: Color as selected by Architect from manufacturer's full range of 215 colors.
2. Interior Curtain-Slat Facing: Match finish of exterior curtain-slat face.

2.3 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:

1. Steel Door Curtain Slats: Zinc-coated (galvanized), cold-rolled structural steel sheet; complying with ASTM A 653/A 653M, with G90 zinc coating; nominal sheet thickness (coated) of 0.028 inch; and as required.
2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E 84 or UL 723. Enclose insulation completely within slat faces.
3. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face, with matching steel thickness of exterior facing.

B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

2.5 HOODS

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

2.6 CURTAIN ACCESSORIES

A. Weatherseals: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.

1. At door head, use 1/8-inch- thick, replaceable, continuous-sheet baffle secured to inside of hood or field- installed on the header.
2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch- thick seals of flexible vinyl, rubber, or neoprene.

2.7 COUNTERBALANCING MECHANISM

A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.8 ELECTRIC DOOR OPERATORS

A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Model RSX or comparable product.
2. Comply with NFPA 70.
3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

C. Door Operator Location(s): Operator location indicated for each door.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of door and connected to door drive shaft with drive chain and sprockets. Side room is

required for this type of mounting. Wall mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type moto for motor exposure indicated.

1. Electrical Characteristics:

a. Phase: Single phase.
b. Volts: 120V
c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

F. Obstruction Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.

2. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three stop control station in fixed location with single key controls labeled "Open", "Close" and "Stop".

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount

mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.9 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.

C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Doors: Install according to UL 325.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Perform installation and startup checks according to manufacturer's written instructions.
2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

C. Adjust seals to provide tight fit around entire perimeter.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 083323

SECTION 083326 - OVERHEAD COILING GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Open-curtain overhead coiling grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of overhead coiling grille and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.

B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction.
5. Show locations of controls, locking devices, and other accessories.
6. Include diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For overhead coiling grilles to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.

B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC A117.1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS, GENERAL

A. Source Limitations: Obtain overhead coiling grilles from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-grille manufacturer.

2.2 OPEN-CURTAIN GRILLE ASSEMBLY

A. Open-Curtain Grille: Overhead coiling grille with a curtain having a network of horizontal rods that interconnect with vertical links.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation, Series 670 or comparable product by one of the following:

a. ACME Rolling Doors.
b. Alpine Overhead Doors, Inc.
c. AlumaTek, Inc.
d. City-Gates.
e. Cookson Company.
f. Cornell Iron Works, Inc.
g. Dynamic Closures Corp.
h. Lawrence Roll-Up Doors, Inc.
i. Mahon Door Corporation.
j. McKeon Rolling Steel Door Company, Inc.
k. Metro Door.
l. Raynor.

B. Operation Cycles: Grille components and operators capable of operating for not less than 20,000. One operation cycle is complete when a grille is opened from the closed position to the fully open position and returned to the closed position.

C. Grille Curtain Material: Aluminum.

1. Rod Spacing: Approximately 1-1/2 inches o.c.
2. Link Spacing: Approximately 6 inches apart in a straight in-line pattern.
3. Spacers: Metal tubes matching curtain material.

D. Bottom Bar: Continuous tubular shape, fabricated from aluminum extrusion and finished to match grille.

E. Curtain Jamb Guides: Aluminum with exposed finish matching curtain slats. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise.

F. Hood: Galvanized steel.

1. Shape: Square.
2. Mounting: Face of wall.

G. Electric Grille Operator:

1. Usage Classification: Medium duty, up to 15 cycles per hour and up to 50 cycles per day.
2. Operator Location: Wall.
3. Safety: Listed according to UL 325 by a qualified testing agency for commercial or industrial use; moving parts of operator enclosed or guarded if exposed and mounted at 8 feet or lower.
4. Motor Exposure: Interior.
5. Emergency Manual Operation: Push-up type.
6. Obstruction-Detection Device: Automatic electric sensor edge on bottom bar.

    a. Sensor Edge Bulb Color: As selected by Architect from manufacturer's full range.

7. Control Station: Interior mounted. Verify location with Architect prior to installation.

H. Grille Finish:

1. Aluminum Finish: Clear anodized.

2.3 MATERIALS, GENERAL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.4 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.

1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Bottom Bar: Manufacturer's standard continuous shape unless otherwise indicated, finished to match grille.

1. Astragal: Equip grille bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
2. Provide motor-operated grilles with combination bottom astragal and sensor edge.

C. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.5 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Galvanized Steel: Nominal 0.028-inch- thick, hot-dip galvanized-steel sheet with G90 zinc coating, complying with ASTM A 653/A 653M.

B. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36/A 36M structural-steel tubes or shapes, hot-dip galvanized per ASTM A 123/A 123M; fastened to floor and structure above grille; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.6 COUNTERBALANCING MECHANISM

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.7 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Model RMX or comparable product.
2. Comply with NFPA 70.
3. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.

B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each grille.

C. Grille Operator Location(s): Operator location indicated for each grille.

1. Wall Mounted: Operator is mounted to the inside front wall on the left or right side of grille and connected to grille drive shaft with drive chain and sprockets. Side room is required for this type of mounting. Wall-mounted operator can also be mounted above or below shaft; if above shaft, headroom is required.

D. Motors: Reversible-type motor for motor exposure indicated.

1. Electrical Characteristics:

   a. Phase: Single phase.
   b. Volts: 120V
   c. Hertz: 60.

2. Motor Size: Minimum size as indicated. If not indicated, large enough to start, accelerate, and operate grille in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
3. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
4. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

E. Limit Switches: Equip motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

F. Obstruction-Detection Device: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.

a. Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensor edge.

2. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal mounted to bottom bar. Contact with sensor activates device.

G. Control Station: Three-stop control station in fixed location with single key controls labeled "Open", "Close" and "Stop".

1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.

H. Emergency Manual Operation: Equip electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.

I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.8 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA's "Metal Finishes Manual for Architectural and Metal Products (AMP 500-06)" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.10 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for cleaning, pretreatment, application, and minimum dry film thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports, according to manufacturer's written instructions and as specified.

B. Install overhead coiling grilles, hoods, controls, and operators at the mounting locations indicated for each grille.

C. Accessibility: Install overhead coiling grilles, switches, and controls along accessible routes in compliance with regulatory requirements for accessibility.

D. Power-Operated Grilles: Install according to UL 325.

3.3 STARTUP SERVICE

A. Perform installation and startup checks according to manufacturer's written instructions.

B. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust hardware and moving parts to function smoothly, so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling grilles.

END OF SECTION 083326

SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Exterior storefront framing for punched openings.
   2. Exterior and interior manual-swing entrance doors and door-frame units.

1.3 DEFINITIONS

A. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:
   1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
   2. Dimensional tolerances of building frame and other adjacent construction.
   3. Failure includes the following:
      a. Deflection exceeding specified limits.
      b. Thermal stresses transferring to building structure.
      c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
      d. Noise or vibration created by wind and by thermal and structural movements.
      e. Loosening or weakening of fasteners, attachments, and other components.
      f. Sealant failure.
      g. Failure of operating units.

B. Delegated Design: Design aluminum-framed systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Structural Loads:
   1. Wind Loads: As indicated on Drawings

D. Deflection of Framing Members:
   1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane shall not exceed L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch (19 mm), whichever is less.

2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or 1/8 inch (3.2 mm), whichever is smaller.

E. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.

F. Windborne-Debris-Impact-Resistance Performance: Provide aluminum-framed systems that pass missile-impact and cyclic-pressure tests when tested according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506.
1. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.
2. Small-Missile Impact: For aluminum-framed systems located more than 30 feet (9.1 m) above grade.

G. Story Drift: Provide aluminum-framed systems that accommodate design displacement of adjacent stories indicated.
1. Design Displacement: As indicated on Drawings
2. Test Performance: Meet criteria for passing, based on building occupancy type, when tested according to AAMA 501.4 at design displacement and 1.5 times design displacement.

H. Air Infiltration: For single acting entrances in the closed and locked position, the test specimen shall be tested in accordance with ASTM E 283 at a pressure differential of 6.24 psf (300 Pa) for single doors and 1.567 psf (75 Pa) for pair of doors.
1. A single 3'0" x 7'0" (915 x 2134) entrance door and frame shall not exceed 0.50 cfm per square foot.
2. A pair of 6'0" x 7'0" (1830 x 2134) entrance doors and frame shall not exceed 1.0 cfm per square foot.

I. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of 0.06 cfm/sq. ft. (0.03 L/s per sq. m) of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of 6.24 lbf/sq. ft. (300 Pa).

J. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa)

K. Water Penetration under Dynamic Pressure: Provide aluminum-framed systems that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. (300 Pa).
1. Maximum Water Leakage: No uncontrolled water penetrating aluminum-framed systems or water appearing on systems' normally exposed interior surfaces from sources other than condensation. Water leakage does not include water controlled by flashing and gutters that is drained to exterior and water that cannot damage adjacent materials or finishes.

L. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
   2. Interior Ambient-Air Temperature: 75 deg F (24 deg C).

M. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 45 when tested according to AAMA 1503.

N. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than 0.69 Btu/sq. ft. x h x deg F (3.92 W/sq. m x K) when tested according to AAMA 1503.

O. Sound Transmission: Provide aluminum-framed systems with fixed glazing and framing areas having the following sound-transmission characteristics:
   1. Sound Transmission Class (STC): Minimum 35 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.
   2. Outdoor-Indoor Transmission Class (OITC): Minimum 30 OITC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 1332.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.

B. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
   1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Other Action Submittals:
   1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

E. Delegated-Design Submittal: For aluminum-framed systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail fabrication and assembly of aluminum-framed systems.
   2. Include design calculations.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

C. Product Options: Information on Drawings and in Specifications establishes requirements for systems' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.
   1. Do not revise intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If revisions are proposed, submit comprehensive explanatory data to Architect for review.

D. Accessible Entrances: Comply with applicable provisions in ICC/ANSI A117.1.

E. Source Limitations for Aluminum-Framed Systems: Obtain from single source from single manufacturer.

F. Preinstallation Conference: Conduct conference at Project site.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.

1.10 MAINTENANCE SERVICE

A. Entrance Door Hardware:
   1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

1.11 WARRANTY

A. Special Assembly Warranty: Standard form in which manufacturer and installer agree to repair or replace components of glazed aluminum curtain walls that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
1. Kawneer North America; an Alcoa company.
2. Pittco Architectural Metals, Inc.
3. Tubelite.
4. Vistawall Architectural Products; the Vistawall Group; a Bluescope Steel company.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
1. Sheet and Plate: ASTM B 209 (ASTM B 209M).
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221 (ASTM B 221M).
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308/B 308M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required supporting imposed loads.
1. Construction: Thermally broken
2. Glazing System: Retained mechanically with gaskets on four sides.
3. Glazing Plane: Front.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concealed Flashing: Dead-soft, 0.018-inch- (0.457-mm-) thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.
   1. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
      a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
   2. Door Design: Wide stile; 5-inch nominal width.
      a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
   3. Glazing Stops and Gaskets: Square snap-on, extruded-aluminum stops and preformed gaskets.
      a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Section 087100 "Door Hardware."

2.6 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified
   1. See Section 07 92 00 "Joint Sealants."
   2. Sealants used inside the weatherproofing system shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
   1. Profiles that is sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints with ends coped or mitered.
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. If required or recommended by manufacturer, set continuous sill members and flashing in full sealant bed to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Section 08 80 00 "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.3 ERECTION TOLERANCES

A. A.Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet (3 mm in 3.7 m); 1/4 inch (6 mm) over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch (1.5 mm).
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch (0.8 mm).

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
   1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to 3 inches (75 mm) from the latch, measured to the leading door edge.

3.5 PROTECTION AND CLEANING

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum storefront system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 084113

SECTION 086200 - UNIT SKYLIGHTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Self-flashing unit skylights with integral curbs.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of unit skylight.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for unit skylights.

B. Shop Drawings: For unit skylight work.

1. Include plans, elevations, sections, details, and connections to supporting structure and other adjoining work.

C. Glazing Samples: For each color and finish of glazing indicated, 12 inches square and of same thickness indicated for the final Work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For each type and size of unit skylight, for tests performed within the last four years by a qualified testing agency. Test results based on testing of smaller unit skylights than specified will not be accepted.

C. Field quality-control reports.

D. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For unit skylights to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating unit skylights that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

B. Installer Qualifications: An installer acceptable to unit skylight manufacturer for installation of units required for this Project.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of unit skylights that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Uncontrolled water leakage.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Yellowing of acrylic glazing.
d. Breakage of polycarbonate glazing.
e. Deterioration of insulating-glass hermetic seal.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Solatube International, Inc.; Model 330 DS-C Penetrating Ceiling System or comparable product by one of the following:

1. Acralight International.
2. American Skylites; a division of the Andi Group, Inc.
3. Auburn Skylights; Major Industries, Inc.
4. Bristolite Skylights.
5. CPI Daylighting Inc.
6. Dur-Red Products.
7. Exarc Skylights, Inc.
8. Fiore Skylights, Inc.; a division of Pepco Manufacturing Co.
9. Fox Lite, Inc.; Skymaster Skylights.

10. Glazed Structures Inc.
11. Kalwall Corporation.
12. Lane-Aire Manufacturing Corporation.
13. Naturalite Skylight Systems; Oldcastle Glass Engineered Products.
14. PECOT Skylights; Plastic Engineering Company of Tulsa, Inc.
15. Plasteco, Inc.
16. SABIC Polymershapes.
17. Skyline Sky-Lites, LLC.
18. Solar Industries, Inc.
19. Sunglo Skylight Products.
20. VELUX America Inc.
21. Wasco Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Completed tubular daylighting device assemblies shall be capable of meeting the following performance requirements:

1. Air Infiltration Test: Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.

2. Water Resistance Test: No uncontrolled water leakage at 10.5 psf pressure differential with water rate of 5 gallons/hour/sf when tested in accordance with ASTM E 547.

3. Uniform Load Test:
   a. No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).
   b. All units shall be tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.

2.3 UNIT SKYLIGHTS

A. General: Provide factory-assembled unit skylights that include glazing, extruded-aluminum glazing retainers, gaskets, and inner frames and that are capable of withstanding performance requirements indicated.

B. Unit Shape and Size: Circular, 21-inch- diameter inside curb.

C. Acrylic Glazing: ASTM D 4802, thermoformable, monolithic sheet, category as standard with manufacturer, Finish 1 (smooth or polished), Type UVF (formulated with UV absorber).

1. Single-Glazing Profile: Dome.

   a. Thickness: 0.143-inch.
   b. Color: Colorless, transparent.

2. Self-Ignition Temperature: 650 deg F or more for plastic sheets in thickness indicated when tested according to ASTM D 1929.
3. Smoke-Production Characteristics: Smoke-developed index of 450 or less when tested according to ASTM E 84, and smoke density of 75 or less when tested according to ASTM D 2843
4. Burning Characteristics: Tested according to ASTM D 635. Class CC2, burning rate of 2-1/2 inches per minute or less for nominal thickness of 0.060 inch or thickness indicated for use.

D. Glazing Gaskets: Manufacturer's standard.

E. Curb and Integral Curb Flashing: Steel, self-flashing type.

1. Corrosion resistant steel conforming to ASTM A 653, ASTM A 792, ASTM A 463 to suit structural and finish requirements.
2. Height: 12 inches.
3. Construction: Single wall.
4. Insulation: Manufacturer's standard rigid or semirigid type.

    a. Exposed Insulation: Cover face of insulation exposed to interior of building with aluminum liner.

F. Flashing Insulator: Type FI, Thermal isolation material for use under flashing.

G. Curb Insulator: Type CI, Thermal isolation material for use at curb base.

H. Condensation Control: Fabricate unit skylights with integral internal gutters and nonclogging weeps to collect and drain condensation to the exterior.

I. Thermal Break: Fabricate unit skylights with thermal barrier separating exterior and interior metal framing.

J. Diffuser Assemblies for Tubes Penetrating Ceilings: Solatube Model 330 DS-C. Ceiling mounted box transitioning from round tube to square ceiling assembly, supporting light transmitting surface at bottom termination of tube 23.8 inches by 23.8 inches (605 mm by 605 mm) square frame to fit standard suspended ceiling grids or hard ceilings.

1. Round to square transition box made of opaque polymeric material, classified as CC2, Class C, 0.110 inch (2.8 mm) thick.

2. Lens: Type L1 OptiView Fresnel lens design to maximize light output and diffusion with extruded aluminum frame and EPDM foam seal to minimize condensation and bug, dirt and air infiltration per ASTM E 283. Visible Light Transmission shall be greater than 90 percent at 0.022 inch (0.6 mm) thick. Classified as CC2.

2.4 ACCESSORY MATERIALS

A. Fasteners: Same metal as metal being fastened, nonmagnetic stainless steel, or other noncorrosive metal as recommended by manufacturer. Finish exposed fasteners to match material being fastened.

1. Where removal of exterior exposed fasteners might allow access to building, provide nonremovable fastener heads.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat.

2.5 ALUMINUM FINISHES

A. Mill Finish: Manufacturer's standard.

B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate installation of unit skylight with installation of substrates, vapor retarders, roof insulation, roofing membrane, and flashing as required to ensure that each element of the Work performs properly and that combined elements are waterproof and weathertight.

B. Comply with manufacturer's written instructions for installing unit skylights.

C. Install unit skylights level, plumb, and true to line, without distortion.

D. Anchor unit skylights securely to supporting substrates.

E. Where aluminum surfaces of unit skylights will contact another metal or corrosive substrates, such as preservative-treated wood, apply bituminous coating on concealed metal surfaces or provide other approved permanent separation recommended in writing by unit skylight manufacturer.

3.3 CLEANING

A. Clean exposed unit skylight surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes.

B. Remove excess sealants, glazing materials, dirt, and other substances.

C. Remove and replace glazing that has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect unit skylight surfaces from contact with contaminating substances resulting from construction operations.

END OF SECTION 086200

SECTION 087100 - DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.
      b. Sliding doors.
   2. Cylinders for door hardware specified in other Sections.
   3. Electrified door hardware.

B. Products furnished, but not installed, under this Section include the products listed below. Coordinating and scheduling the purchase and delivery of these products remain requirements of this Section.
   1. Lock cylinders to be installed under other Sections.

C. Related Sections:
   1. Section 081113 "Hollow Metal Doors and Frames"
   2. Section 081416 "Flush Wood Doors"
   3. Section 084113 "Aluminum Entrances and Storefronts"
   4. Section 084126 "All Glass Entrances"

1.3 ALTERNATES

A. Alternate No. 2 – All Glass to Hollow Metal Frames with Wood Doors
   1. Base Bid: Provide doors and frames as specified.
   2. Alternate Bid: At openings 204-1, 205-1, 206-1 and 207-1 substitute hollow metal frames and wood doors with full lights for the all glass doors and frames specified.
   3. Sections included in this alternate:
      a. Section 081113 – "Hollow Metal Doors and Frames"
      b. Section 081416 – "Flush Wood Doors"
      c. Section 084126 – "All Glass Entrances"
      d. Section 087100 – "Door Hardware"
      e. Section 088000 – "Glass and Glazing"

B. See Section 012300 for procedure for bidding alternates.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: For power, signal, and control wiring and including the following:

a. Details of interface of electrified door hardware and building safety and security systems.
b. Schematic diagram of systems that interface with electrified door hardware.
c. Point-to-point wiring.
d. Risers.
e. Elevations doors controlled by electrified door hardware.

2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

1. Sample Size: Full-size units or minimum 2-by-4-inch (51-by-102-mm) Samples for sheet and 4-inch (102-mm) long Samples for other products.

D. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   a. Submittal Sequence: Submit door hardware schedule [after] [or] [concurrent with] submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
   b. Format: Use same scheduling sequence, format and use same door numbers as in the Contract Documents.
   c. Content: Include the following information:
      1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
      5) Fastenings and other pertinent information.
      6) Explanation of abbreviations, symbols, and codes contained in schedule.
      7) Mounting locations for door hardware.
      8) List of related door devices specified in other Sections for each door and frame.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: For electrified door hardware, from the manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.

B. Warranty: Special warranty specified in this Section.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware schedule.

1.7 QUALITY ASSURANCE

A. Supplier Qualifications: The hardware supplier shall be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least on Architectural Hardware Consultant (AHC) who is currently participating in DHI's continuing education program (CEP).

B. Source Limitations: Obtain each type of door hardware from a single manufacturer.
   1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

C. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated. Provide positive latching and self closing, regardless if specified in hardware sets.

D. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
   1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
      b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
      c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
   3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
   4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

H. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Requirements for access control.
5. Address for delivery of keys.

I. Preinstallation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.

J. Post Installation Fire Door Inspections: At the time of completion, the hardware supplier shall provide a certified Fire Door Assembly Inspector (FDAI) to perform a walk-thru inspection of every fire-rated opening on the project. The FDAI shall provide a detailed, opening-by-opening, written document for the owner that ensures all of the specified component parts of the fire-rated assembly have been properly installed and are functioning as designed, in accordance with the criteria of a fire door assembly as per NFPA 80 2007 edition.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.9 COORDINATION

A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.

E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking, or breakage.
      b. Faulty operation of doors and door hardware.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
      a. Locks: 7 years from date of Substantial Completion.
      b. Exit Devices: 5 years from date of Substantial Completion.
      c. Manual Closers: 25 years from date of Substantial Completion.
   3. Factory direct order number shall be provided for each shipment of locks, closers and exit devices with warranty, prior to final payment.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products complying with BHMA designations referenced.
   2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required. Provide products from the specified manufacturer in hardware sets or equal product from specified approved manufacturers. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
   2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

C. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

D. Include such nuances as strike type, strike lip length, raised barrel hinges, mounting brackets, blade stop spacers, special templates, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.

2.2 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
   1. Quantity: Provide the following, unless otherwise indicated:
      a. Two Hinges: For doors with heights up to 60 inches. Three Hinges: For doors with heights 61 to 90 inches.
      b. Four Hinges: For doors with heights 91 to 120 inches.
      c. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
      d. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
   2. Hinge Weight: Unless otherwise indicated, provide the following:
      a. Entrance Doors: Heavy-weight hinges.
      b. Doors with Closers: Antifriction-bearing hinges.
      c. Interior Doors: Standard-weight hinges.
   3. Hinge Base Metal: Unless otherwise indicated, provide the following:
      a. Exterior Hinges: Stainless steel, with stainless-steel pin.
      b. Interior Hinges: Stainless steel, with stainless-steel pin.
      c. Hinges for Fire-Rated Assemblies: Stainless steel, with stainless-steel pin.
   4. Hinge Options: Where indicated in door hardware sets or on Drawings:
      a. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
      b. Corners: Square.
   5. Fasteners: Comply with the following:
      a. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
      b. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
      c. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors. Finish screw heads to match surface of hinges.

B. Hinges:
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Hager Companies.
      b. McKinney; an ASSA ABLOY Group Company.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

B. Continuous Geared Hinges:
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Hager Companies.
      b. Select Products.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Cylindrical Locks: Minimum 1/2-inch (13-mm) latch bolt throw.
   2. Deadbolts: Minimum 1.25-inch (32-mm) bolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:
   1. Dummy Trim: Match lever lock trim and escutcheons.
   2. Operating Device: Lever with rose. Verify design with architect.

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latch bolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

   1. Flat-Lip Strikes: For locks with three-piece antifriction latch bolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
   3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
   4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

F. Cylindrical Locks: BHMA A156.2; Operational Grade 1; Series 4000.
   1. Approved Manufacturer:
      a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
      b. No substitutions will be accepted (per owner's standard).

2.5 MANUAL FLUSH BOLTS

A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Hager Companies
      b. Rockwood Manufacturing

2.6 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS FOR INACTIVE LEAF OF A PAIR OF DOORS

A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch (19-mm) throw; designed for mortising into door edge.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Hager Companies
      b. Rockwood Manufacturing

2.7 EXIT DEVICES AND AUXILIARY ITEMS

A. Exit Devices and Auxiliary Items: BHMA A156.3.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Sargent Manufacturing Company; an ASSA ABLOY Group company.
      b. Corbin; an ASSA ABLOY Group company.

2.8 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
   1. Manufacturer: Sargent, to match existing key system.

B. Lock Cylinders: BHMA A156.5; Grade 1; interchangeable cores that are removable; face finished to match lockset.

C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 5 construction master keys and 2 construction core control keys.

2.9 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
   1. Master key or grand master key locks to Owner's requirements.

B. Keys: Nickel silver.
   1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
      a. Notation: "DO NOT DUPLICATE."

C. Key Quantity:
   1. Cylinder change keys: Three
   2. Masterkeys: Five
   3. Grand Master Keys: Five
   4. Control Keys: Two

2.10 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of 150 percent of the number of locks.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. American Key Boxes and Cabinets.
      b. HPC, Inc.
      c. Lund Equipment Co., Inc.
      d. MMF Industries.
   2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.

2.11 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

2.12 CLOSERS

A. Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

B. Closers:

1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
   a. Norton; an ASSA ABLOY Group company; 7500 Series.
   b. LCN Closers; an Ingersoll-Rand company; 4040XP Series.
   c. Sargent Manufacturing Company; an ASSA ABLOY Group company 351 Series.

2.13 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; aluminum base metal.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Hager Companies.
      b. Rockwood Manufacturing Company.

2.14 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. National Guard Products.
      b. Hager Companies.

2.15 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. National Guard Products.
      b. Hager Companies.

2.16 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- (1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Rockwood Manufacturing Company.
      b. Hager.

2.17 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
   1. Approved Manufacturers: Subject to compliance with requirements, provide product indicated on schedule or equal product by one of the following:
      a. Rockwood Manufacturing Company.
      b. Hager.

2.18 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
   1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
   2. Fire-Rated Applications:
      a. Wood or Machine Screws: For the following:
         1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames].
         2) Strike plates to frames.
         3) Closers to doors and frames.
      b. Steel Through Bolts: For the following unless door blocking is provided:
         1) Surface hinges to doors.
         2) Closers to doors and frames.
         3) Surface-mounted exit devices.
   3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
   4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
   5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.19 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
   1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
   2. Custom Steel Doors and Frames: HMMA 831.
   3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening with electrified door hardware.

F. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

G. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

H. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

I. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

J. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.4 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.5 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.6 DOOR HARDWARE SCHEDULE

A. Schedule

SET 1A

2	EA	CONTINUOUS HINGE	780-112HD	CLR HAGER
1	EA	EXIT DEVICE	16-AD8610 x 106	626 SARGENT
1	EA	EXIT DEVICE	16-AD8610 x EXIT ONLY	626 SARGENT
3	EA	CLINDER	AS REQUIRED	626 SARGENT
2	EA	PULL	BF158	630 ROCKWOOD
1	EA	AUTOMATIC OPERATOR	4000LE	689 HORTON
2	EA	ACTUATOR	AS REQUIRED	689 HORTON
1	EA	CLOSER	351 P10	EN SARGENT
2	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	THRESHOLD	403S	MIL HAGER

REMAINDER OF SEALS AND SWEEPS BY DOOR SUPPLIER

SET 2A

2	EA	CONTINUOUS HINGE	780-112HD	CLR HAGER
2	SET	PUSH/PULL	BF15847	630 ROCKWOOD
1	EA	AUTOMATIC OPERATOR	4000LE	689 HORTON
2	EA	ACTUATOR	AS REQUIRED	689 HORTON
1	EA	CLOSER	351 P10	EN SARGENT
2	EA	WALL STOP	409	630 ROCKWOOD

SET 3A

	EA	HINGES	AS REQUIRED	652
1	EA	STOREROOM LOCK	10G04	626 SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 3B

	EA	HINGES	AS REQUIRED	652
1	EA	STOREROOM LOCK	10G04	626 SARGENT
1	EA	CLOSER	351 UO x 351-B	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 3C

	EA	HINGES	AS REQUIRED	652
1	EA	STOREROOM LOCK	10G04	626 SARGENT
1	SET	CONSTANT LATCHING FLUSH BOLTS & DUST PROOF STRIKE	2845 x 570	626 ROCKWOOD
2	EA	OVERHEAD STOP	690S	630 SARGENT

SET 3D

	EA	HINGES	AS REQUIRED	652
1	EA	STOREROOM LOCK	10G04	626 SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 4A

	EA	HINGES	AS REQUIRED	652
1	EA	EXIT DEVICE	8815 x ETX	626 SARGENT
1	EA	CLOSER	351 P10	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 4B

	EA	HINGES	AS REQUIRED	652
1	EA	EXIT DEVICE w/ALARM	AL-8804 x ETX	626 SARGENT
2	EA	CYLINDER	AS REQUIRED	626 SARGENT
1	EA	CLOSER	351 P10	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 4C

	EA	HINGES	AS REQUIRED	652
1	EA	EXIT DEVICE (CLASS. SECURITY)	8816 x ETX	626 SARGENT
2	EA	CYLINDER	AS REQUIRED	626 SARGENT
1	EA	CLOSER	351 UO	EN SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 4D

	EA	HINGES	AS REQUIRED	652
1	EA	EXIT DEVICE	8815 x ETX	626 SARGENT
1	EA	CLOSER	351 UO	EN SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 5A

1	EA	CONTINUOUS HINGE	780-224HD	CLR HAGER
1	EA	EXIT DEVICE W/ ALARM	AL-8804 x ETX	626 SARGENT
1	EA	CYLINDER	AS REQUIRED	626 SARGENT
1	EA	CLOSER	351 P10	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	THRESHOLD	410S	MIL HAGER
1	EA	SWEEP	750SN	CLR HAGER
1	SET	SEALS	891SV	MIL HAGER

SET 6A

	EA	HINGES	AS REQUIRED	652
1	EA	PASSAGE LATCH	10U15	626 SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	SET	SEALS	5050	CLR NGP

SET 6B

	EA	HINGES	AS REQUIRED	652
1	EA	PASSAGE LATCH	10U15	626 SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT

SET 6C

	EA	HINGES	AS REQUIRED	652
1	EA	PASSAGE LATCH	10U15	626 SARGENT
1	EA	CLOSER w/HOLDER	351 PH10	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 7A

	EA	HINGES	AS REQUIRED	652
1	EA	CLASSROOM	10G37	626 SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT

SET 7B

	EA	HINGES	AS REQUIRED	652
1	EA	CLASSROOM	10G37	626 SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD

SET 7C

	EA	HINGES	AS REQUIRED	652
1	EA	CLASSROOM	10G37	626 SARGENT
1	EA	CLOSER	351 O x 351-B	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 8A

	EA	HINGES	AS REQUIRED	652
1	EA	CLASSROOM SECURITY	10G38	626 SARGENT
1	EA	CLOSER	351 P10	EN SARGENT
1	EA	OVERHEAD STOP	690S	630 SARGENT
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 9A

	EA	HINGES	AS REQUIRED	652
1	EA	PRIVACY LATCH	10U65	626 SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	SET	SEALS	5050	CLR NGP
1	EA	AUTOMATIC DOOR BOTTOM	730SN	MIL HAGER

SET 10A

	EA	HINGES	AS REQUIRED	652
1	EA	PULL w/PLATE	BF111 x 70C	630 ROCKWOOD
1	EA	PUSH PLATE	70E	630 ROCKWOOD
1	EA	CLOSER	351 UO	EN SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 11A – *EXISTING OPENING*

1	EA	NARROW STILE EXIT DEVICE	16-8804 x LESS PULL	626 SARGENT
1	EA	NARROW STILE EXIT DEVICE	16-8810	626 SARGENT
3	EA	CYLINDER	AS REQUIRED	626 SARGENT
2	EA	AUTOMATIC OPERATOR	4000LE	689 HORTON
2	EA	ACTUATOR (WIRELESS)	AS REQUIRED	689 HORTON
2	EA	THRESHOLD	403S	MIL HAGER

CONTRACTOR SHALL REMOVE AND/OR DEACTIVATE AND COVER EXISTING LOCKS AND ASSESS WHETHER EXISTING WEATHER STRIPPING NEEDS TO BE REPLACED

AUTOMATIC OPERATORS TO BE SETUP FOR SEQUENTIAL OPERATION; REPLACE EXISTING ACTUATORS WITH NEW; USE WIRELESS IF NO EXISTING WIRES

EXISTING PULLS SHALL BE REUSED ALONG WITH OTHER REQUIRED, EXISTING HARDWARE NOT BEING REPLACED ABOVE

SET 11B – *EXISTING OPENING*

2	EA	AUTOMATIC OPERATOR	4000LE	689 HORTON
2	EA	ACTUATOR (WIRELESS)	AS REQUIRED	689 HORTON

CONTRACTOR SHALL REMOVE AND/OR DEACTIVATE AND COVER EXISTING LOCKS AND ASSESS WHETHER EXISTING WEATHER STRIPPING NEEDS TO BE REPLACED

AUTOMATIC OPERATORS TO BE SETUP FOR SEQUENTIAL OPERATION; REPLACE EXISTING ACTUATORS WITH NEW; USE WIRELESS IF NO EXISTING WIRES

EXISTING PUSH/PULLS SHALL BE REUSED ALONG WITH OTHER REQUIRED, EXISTING HARDWARE NOT BEING REPLACED ABOVE

SET 11C – *EXISTING OPENING*

1	EA	NARROW STILE EXIT DEVICE	16-8804 x LESS PULL	626 SARGENT
2	EA	CYLINDER	AS REQUIRED	626 SARGENT
2	EA	THRESHOLD	403S	MIL HAGER

ON OUT-SWINGING LEAF, CONTRACTOR SHALL REMOVE AND/OR DEACTIVATE AND COVER EXISTING LOCK AND ASSESS WHETHER EXISTING WEATHER STRIPPING NEEDS TO BE REPLACED. ON IN-SWINGING LEAF, CONTRACTOR SHALL REMOVE ALL OPERATING HARDWARE AND EITHER PREPARE IT TO BE PERMANANTLY LOCKED OR REPLACE WITH DEADBOLT TO BE SECURED IN LOCKED POSITION.

SET 12A – *NEW DOOR, EXISTING FRAME*

1	EA	CONTINUOUS HINGE	780-224HD	CLR HAGER
1	EA	EXIT DEVICE W/ ALARM	AL-8904 x ETX	626 SARGENT
1	EA	CYLINDER	AS REQUIRED	626 SARGENT
1	EA	THRESHOLD	410S	MIL HAGER
1	EA	SWEEP	750SN	CLR HAGER
1	SET	SEALS	891SV	MIL HAGER
1	EA	LATCH GUARD	326	626 ROCKWOOD

REMAINDER OF EXISTING HARDWARE TO BE REUSED AND UNUSED HARDWARE PREP'S TO BE FILLED

SET 12B – *NEW DOOR IN EXISTING FRAME*

1	EA	CONTINUOUS HINGE	780-224HD	CLR HAGER
1	EA	EXIT DEVICE	8904 x ETX	626 SARGENT
1	EA	CYLINDER	AS REQUIRED	626 SARGENT
1	EA	CLOSER w/HOLDER & STOP	351 CPSH	EN SARGENT
1	EA	THRESHOLD	410S	MIL HAGER
1	EA	SWEEP	750SN	CLR HAGER
1	SET	SEALS	891SV	MIL HAGER
1	EA	LATCH GUARD	326	626 ROCKWOOD

REMAINDER OF EXISTING HARDWARE TO BE REUSED AND UNUSED HARDWARE PREP'S TO BE FILLED

SET 13A

	EA	HINGES	AS REQUIRED	652
1	EA	STORE LOCK	10G26	626 SARGENT
1	EA	CLOSER w/HOLDER	351 PH10	EN SARGENT
1	EA	WALL STOP	409	630 ROCKWOOD
1	EA	KICKPLATE	10" x 1 ½" LDW	630 ROCKWOOD

SET 14A – *NEW DOOR IN EXISTING FRAME*

2	EA	CONTINUOUS HINGE	780-224HD	CLR HAGER
1	EA	STOREROOM LOCK	10G04	626 SARGENT
2	EA	MANUAL FLUSH BOLT	555	626 ROCKWOOD
1	EA	DUST PROOF STRIKE	570	626 ROCKWOOD
1	EA	THRESHOLD	410S	MIL HAGER
2	EA	SWEEP	750SN	CLR HAGER
1	SET	SEALS	891SV	MIL HAGER
1	EA	LATCH GUARD	326	626 ROCKWOOD

REMAINDER OF EXISTING HARDWARE TO BE REUSED AND UNUSED HARDWARE PREP'S TO BE FILLED

END OF SECTION 087100

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SECTION 088000 – GLASS AND GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes;
   1. Glass for windows, doors, interior borrowed lites, storefront framing.
   2. Glazing sealants and accessories.
   3. Glass and glazing including those specified in other Sections where glazing requirements are specified by reference to this Section.
      a. Section 081113 "Hollow Metal Doors and Frames" for glass in metal frames.
      b. Section 084113 "Aluminum Entrances & Storefront Systems" for glass in entrances and storefront systems

1.3 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit.

D. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

E. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1.4 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Design glass, including comprehensive engineering analysis according to ICC's 2003 International Building Code by a qualified professional engineer, using the following design criteria:

1. Design Wind Pressures: As indicated on Drawings.
2. Wind Design Data: As indicated on Drawings.
3. Vertical Glazing: For glass surfaces sloped 15 degrees or less from vertical, design glass to resist design wind pressure based on glass type factors for short-duration load.
4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
5. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

1.5 ACTION SUBMITTALS

A. Product Data: For each glass product and glazing material indicated.

B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For installers.

B. Product Certificates: For glass and glazing products, from manufacturer.

C. Manufacturer's Instructions for Inspection, preparation, and installation instructions.

D. Maintenance Data

E. Warranties: Sample of special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Source Limitations for Glass: Obtain insulating glass from single source from single manufacturer for each glass type.

D. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

E. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

F. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

G. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
   1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or below 40 deg F (4.4 deg C).

B. Field Measurements.
   1. Field Verify locations and dimensions of items critical to the design, fit or assembly of the work of this section. Complete field dimensioning prior to fabrication of components.
   2. Verify that field measurements are as indicated on shop drawings.

1.10 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
   1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Deflection: Limit deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing material.

C. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
   1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.2 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
   2. For uncoated glass, comply with requirements for Condition A.
   3. For coated vision glass, comply with requirements for Condition C (other coated glass).

2.3 LAMINATED GLASS

A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

   1. Construction: Laminate glass with polyvinyl butyral interlayer, ionomeric polymer interlayer or cast-in-place and cured-transparent-resin interlayer to comply with interlayer manufacturer's written instructions.
   2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
   3. Interlayer Color: Color as indicated.

2.4 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated inter space, qualified according to ASTM E 2190, and complying with other requirements specified.
   1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
   2. Spacer: Manufacturer's standard spacer material and construction. Aluminum with mill or clear anodic finish.
   3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from the following:
   1. Silicone complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned **silicone** complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
   1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

2.6 GLAZING SEALANTS

A. General:
   1. Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
   2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
   3. Sealants used inside the weatherproofing system, shall have a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.

2.7 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
   1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
   2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
   1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
   2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.8 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

G. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

2.9 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Grind smooth and polish exposed glass edges and corners.

2.10 MONOLITHIC-GLASS TYPES

A. Glass Type GL- 1: Clear, fully tempered float glass:
1. Shall pass test requirements of Consumer Product Safety Commission 16 CFR; 1201-77.
2. 1/4 inch, unless shown otherwise on drawings.
3. Safety glazing required.
4. Provide at interior door lites, glazed locations within 24" of any door edge, windows and borrowed lights adjacent to and within 5 feet of the top or bottom of stairs and at all other locations required by code.

B. Glass Type GL-2: Clear laminated glass with two plies of fully tempered float glass and tinted interlayer.
1. Basis-of-Design Product: Bendheim; ENGA - 1386.
2. Minimum Thickness of Each Glass Ply: 3 mm.
3. Interlayer Thickness: 0.090 inch.
4. Safety glazing required.

C. Glass Type GL-3: Clear laminated glass with two plies of fully tempered float glass and tinted interlayer.
1. Basis-of-Design Product: Bendheim; ENGA - 1324.
2. Minimum Thickness of Each Glass Ply: 3 mm.
3. Interlayer Thickness: 0.090 inch.
4. Safety glazing required.

2.11 INSULATING-GLASS TYPES

A. Glass Type GL-4: Double Pane Insulating Glass:
1. 1" insulating unit:
   a. Outboard lite 1/4" clear with coating on #2 surface,
   b. 1/2" airspace.

c. Inboard lite: 1/4" clear glass.
d. Lights shall be tempered where noted on drawings or as required to meet Code.

2. Products of PPG are used as a reference. Products of other manufacturers shall meet or exceed performance criteria established below.
   a. Performance Data:

Manufacturer	PPG
Product	Solarban 60 (2) Clear Low-E insulating glass.
Shading Coefficient	0.44
Solar Heat Gain Coefficient	0.38
Winter Nighttime U-Value, (English, gas)	0.29
Summer Daytime U-Value, (English, gas)	0.27
Visible Transmittance	70%
Total Solar Energy Transmittance	33%
Visible Reflectance (Out)	11%
Total Solar Energy (Out)	29%

B. Glass Type GL-5: Double Pane Insulating Glass:
   1. 1" insulating unit:
      a. Outboard lite 1/4" clear with coating on #2 surface to match existing.
      b. 1/2" airspace.
      c. Inboard lite: 1/4" clear glass.
      d. Lights shall be tempered where noted on drawings or as required to meet Code.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Beginning of installation means acceptance of substrate.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
   1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
   2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.6 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088000

SECTION 088300 - MIRRORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the following types of silvered flat glass mirrors:

1. Annealed monolithic glass mirrors.
2. Tempered glass mirrors qualifying as safety glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.

B. Shop Drawings: Include mirror elevations, edge details, mirror hardware, and attachment details.

C. Samples: For each type of the following:

1. Mirrors: 12 inches square, including edge treatment on two adjoining edges.
2. Mirror Clips: Full size.
3. Mirror Trim: 12 inches long.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For mirrors to include in maintenance manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.

1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Avalon Glass and Mirror Company.
2. Binswanger Glass.
3. Donisi Mirror Company.
4. D & W Incorporated.
5. Gardner Glass Products, Inc.
6. Glasswerks LA, Inc.
7. Guardian Industries Corp.
8. Independent Mirror Industries, Inc.
9. Lenoir Mirror Company.
10. National Glass Industries.
11. Trulite Glass & Aluminum Solutions.
12. Virginia Mirror Company, Inc.
13. Walker Glass Co., Ltd.

B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.

C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.

2.2 SILVERED FLAT GLASS MIRRORS

A. Mirrors, General: ASTM C 1503.

B. Annealed Monolithic Glass Mirrors: Mirror Glazing Quality, clear.

1. Nominal Thickness: 6.0 mm.

C. Tempered Glass Mirrors: Mirror Glazing Quality for blemish requirements and complying with ASTM C 1048 for Kind FT, Condition A, tempered float glass before silver coating is applied; clear.

1. Nominal Thickness: 6.0 mm.

2.3 MISCELLANEOUS MATERIALS

A. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

B. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Franklin International.
b. Laurence, C. R. Co., Inc.
c. Liquid Nails Adhesive.
d. Palmer Products Corporation.
e. Royal Adhesives & Sealants, LLC.

C. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

2.4 MIRROR HARDWARE

A. Stand-offs: Brushed stainless steel barrels and low profile cap.

1. Barrels: Diameter not less than 3/4 inch. Height not more than 1 inch.

a. Basis-of-Design Product: Subject to compliance with requirements, provide Mockett; MPB9/.75-SSS or comparable product.

2. Low Profile Cap: 7/8 inch diameter by 1/2 inch high. Brushed aluminum finish.
a. Basis-of-Design Product: Subject to compliance with requirements, provide Mockett; MPB9/CAP2-94 or comparable product.

B. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.

C. Anchors, Nylon Washers and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield, expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.5 FABRICATION

A. Fabricate mirrors in the shop to greatest extent possible.

B. Fabricate cutouts for notches and holes in mirrors without marring visible surfaces. Locate and size cutouts so they fit closely around penetrations in mirrors.

C. Mirror Edge Treatment: Flat polished.

1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, over which mirrors are to be mounted, with Installer present, for compliance with installation tolerances, substrate preparation, and other conditions affecting performance of the Work.

B. Verify compatibility with and suitability of substrates, including compatibility of existing finishes or primers with mirror mastic.

C. Proceed with installation only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. GANA Publications: "Glazing Manual" and "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

B. Provide a minimum airspace of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

C. Install mirrors with hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.

1. Stand Offs: Place a nylon washer between mirror and the barrel and cap to prevent spalling of mirror edges. Locate stand offs where indicated.

D. Install mirrors with mastic.

1. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.

2. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.

3. After mastic is applied, align mirrors and press into place while maintaining a minimum airspace of 1/8 inch between back of mirrors and mounting surface.

3.4 CLEANING AND PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

C. Maintain environmental conditions that prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

END OF SECTION 088300

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 FRAMING SYSTEMS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.

C. Studs and Runners: ASTM C 645.

1. Steel Studs and Runners:

    a. Flange Size: 1 1/4 inch (32mm).
    b. Minimum Base-Metal Thickness: As indicated on Drawings.
    c. Web Depth: As indicated on Drawings.

D. Slip-Type Head Joints: Where indicated, provide one of the following:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

    a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.

E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Metal Thickness: 0.027 inch (0.68 mm).

F. Cold-Rolled U-Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).
2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.053-inch- (1.34-mm-) thick, galvanized steel.

G. Channel Bridging, Bracing and Spacer: Steel, 0.0538-inch (1.37-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 7/8 inch by 7/8 inch by 50 inches (22.2 mm by 22.2 mm by 1270 mm).

H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).
2. Depth: 7/8 inch (22.2 mm).

I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission (3/8" wide slots 3" long, spaced 4 inches on center).

1. Configuration: Asymmetrical.

    a. Products: Subject to compliance with requirements, provide the following:

        1) ClarkDietrich Building Systems; Resilient Channel RC Deluxe – (RCSD).

J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1 1/2 inch (38 mm).
2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.018 inch (0.45 mm), and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

B. Hanger Attachments to Concrete:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

   a. Type: Postinstalled, expansion anchor.

2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.

C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.

D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.

1. Depth: 1-1/2 inches (38 mm).

E. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
2. Steel Studs and Runners: ASTM C 645.

   a. Minimum Base-Metal Thickness: As indicated on Drawings.
   b. Depth: As indicated on Drawings.

3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.

   a. Minimum Base-Metal Thickness: 0.018 inch (0.45 mm).

4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.

a. Configuration: Asymmetrical.

1) Products: Subject to compliance with requirements, provide the following:

a) ClarkDietrich Building Systems; Resilient Channel RC Deluxe – (RCSD).

F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Armstrong World Industries, Inc.; Drywall Grid Systems.
b. Chicago Metallic Corporation; Drywall Grid System.
c. USG Corporation; Drywall Suspension System.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide one of the following:

1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials

below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C 754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

C. Install bracing at terminations in assemblies.

D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly where indicated.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.

5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.

E. Resilient Channel:

1. Attach at right angles to studs, spaced 24-inches o.c. Center slotted holes over framing members.
2. Attach to steel stud flanges with 3/8-inch type S pan head screws driven through holes in channel mounting flange.
3. Attach to wood stud with 1 1/4-inch type S pan head screws driven through holes in channel mounting flange (single layer application).
4. Attach to wood stud with 1 7/8-inch type S pan head screws driven through holes in channel mounting flange (double layer application).
5. Install channel with mounting flange down, except at floor to accommodate attachment.
6. Locate channels 2-inches from floor and within 6-inches of ceiling.

F. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

G. Z-Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

    a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.

    a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
4. Do not attach hangers to steel roof deck.
5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
7. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.

E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

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SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Interior gypsum board.
2. Moisture resistant gypsum board.
3. Tile backing panels.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Install mockups for the following:
   a. Each level of gypsum board finish indicated for use in exposed locations.
2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch (15.9 mm).
2. Long Edges: Tapered.

B. Gypsum Ceiling Board: ASTM C 1396/C 1396M.
1. Thickness: 1/2 inch (12.7 mm).
2. Long Edges: Tapered.

C. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: 5/8 inch (15.9 mm), Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

D. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
2. Long Edges: Tapered.

2.4 TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Thickness: 1/2 inch (12.7 mm).
2. Mold Resistance: ASTM D 3273, score of 10.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
2. Shapes:

a. Cornerbead.
b. U-Bead: J-shaped; exposed short flange does not receive joint compound.
c. Expansion (control) joint.

B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221 (ASTM B 221M), Alloy 6063-T5.
2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.
3. Products: Fry Reglet or equal:
a. Fry Reglet DRAT-75, for installation as acoustic ceiling trim.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use setting-type, sandable topping compound.
4. Finish Coat: For third coat, use setting-type, sandable topping compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

D. Joint Compound for Tile Backing Panels:
1. Cementitious Backer Units: As recommended by backer unit manufacturer.

2.7 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

1. Acoustical joint sealant shall have a VOC content of [250] <Insert value> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
   1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
   2. Fit gypsum panels around ducts, pipes, and conduits.
   3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

A. Single-Layer Application:
   1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
   2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
      a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
      b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
   3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
   4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Multilayer Application:
   1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
   2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
   3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
   4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.5 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim: Install in the following locations:
   1. Cornerbead: Use at outside corners unless otherwise indicated.
   2. U-Bead: Use at exposed panel edges.

C. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
   1. Level 2: Panels that are substrate for tile. Panels that are substrate for acoustical tile
   2. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
      a. Primer and its application to surfaces are specified in other Division 09 Sections.
   3. Level 5: At Community Room as substrate for Dry Erase Wallcovering.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.7 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093100 – CERAMIC TILE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Ceramic tile
2. Crack isolation/waterproof membrane
3. Setting materials
4. Metal edge strips

1.3 DEFINITIONS

A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.

B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."

C. Module Size: Actual tile size plus joint width indicated.

D. Face Size: Actual tile size, excluding spacer lugs.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

C. Samples for Verification:
1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
2. Full-size units of each type of trim and accessory for each color and finish required.
3. Metal edge strips in 6-inch (150-mm) lengths.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Test Reports: For tile-setting and -grouting products.

1.7 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
   2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.8 QUALITY ASSURANCE

A. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.

C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
   1. Crack isolation/waterproofing membrane.
   2. Joint sealants.
   3. Grout & Mortar
   4. Soft Joints sealant

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.

B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.

C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

D. Store liquid materials in unopened containers and protected from freezing.

E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.10 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

A. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

B. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
   1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

C. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.2 TILE PRODUCTS

A. Provide the following as indicated in the Room Finish Schedule and drawings;

Code	Manufacturer	Product	Name	Size/Notes	Contact
CT-1	Interceramic	Solids InDesign Collection	White Gloss	2 1/8" x 8 1/2"	Insulation & Supply 800-223-1061
CT-2	Imola Ceramica	VEIN A 36W LP	Semi-polished	12" x 24"	Lexco Tile & Stone 800-242-2249
CT-3	Imola Ceramica	VEIN A 36T N	Natural	12"x 24"	Lexco Tile & Stone 800-242-2249
CT-4	Imola Ceramica	VEIN A 159W LP	Semi-polished	6" x 36"	Lexco Tile & Stone 800-242-2249
CT-6	Imola Ceramica	MU.VEIN A 36T	Natural	12"x 24"	Lexco Tile & Stone 800-242-2249

2.3 WATERPROOF / CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

B. Fluid Applied Membrane: Liquid-latex rubber or elastomeric polymer.
   1. Provide the following or approved equal.
      a. LATICRETE Hydro Ban, Liquid applied anti-fracture/waterproofing membrane. Follow manufactures written instructions.

2.4 SETTING MATERIALS

A. Provide the following or approved equal:
   1. LATICRETE 255 MultiMax Polymer Modified thinset, non-sag, maximum build-up of 3/4-inch without shrinkage. Follow manufacturer's written instructions.

2.5 GROUT MATERIALS

A. Provide the following or approved equal:

1. LATICRETE SpectraLock PRO Premium Grout, high performance epoxy grout. Follow manufacturer's written instructions.
2. Colors:
   a. To be selected from manufacture's standard.

2.6 SOFT JOINTS

A. Provide the following or approved equal:
   1. LATICRETE Latasil, high performance, one component, neutral cure, 100% silicone sealant. Follow manufacturer's written instructions.

2.7 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, designed specifically for wall applications;

Code	Manufacturer	Product	Number	Finish/Notes
	Schluter Systems	JOLLY	A100ATGB	Satin nickel anodized aluminum. Vertical tile corner bead and horizontal top trim.

C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.

D. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.

2.8 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.

B. Add materials, water, and additives in accurate proportions.

C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other

substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

2. Verify that concrete substrates for tile floors comply with surface finish requirements in ANSI A108.01 for installations indicated.
   a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
   b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Fill cracks, holes, and depressions in concrete substrates with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.

C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CRACK ISOLATION MEMBRANE INSTALLATION

A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.

B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

3.4 TILE INSTALLATION

A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.

1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
   a. Tile floors in wet areas.
   b. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
   c. Tile floors composed of rib-backed tiles.

B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for

straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.

E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
   1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
   2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
   3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
   1. Ceramic Tile: 1/8 inch (3.2mm).

H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
   1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
   2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

J. Metal Edge Strips: Install at locations indicated.

3.5 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
   3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.

C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.6 INTERIOR TILE INSTALLATION SCHEDULE

A. Interior Floor Installations, Concrete Subfloor:
   1. Tile Installation F113: Thin-set mortar; TCA F113.

B. Interior Wall Installations, Metal Studs or Furring:
   1. Tile Installation W244C: Thin-set mortar on cementitious backer units or fiber cement underlayment TCA W244.

END OF SECTION 093000

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes
   1. Acoustical tiles for ceilings.
   2. Exposed suspension systems for ceilings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each acoustical panel ceiling.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
   2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete,

and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
   2. Smoke-Developed Index: 450 or less.

2.2 ACOUSTICAL PANELS, GENERAL

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
   2. Suspension System: Obtain each type from single source from single manufacturer.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

C. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

D. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.

E. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.

F. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
   1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

A. Manufactures

1. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Armstrong World Industries, Inc.
   b. CertainTeed Corp.
   c. Chicago Metallic Corporation.
   d. Tectum Inc.
   e. USG Interiors, Inc.; Subsidiary of USG Corporation.

B. Products

1. ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACT-1)

   a. Basis-of-Design Product: Armstrong World Industries, Inc.
   b. Style: Optima - Open Plan
   c. Color: White
   d. Classification: ASTM E1264.
   e. Type and Form: Type XII, mineral base with painted finish; Form 2.
   f. Pattern: E (lightly textured)
   g. Modular Size: 24" x 48"
   h. Thickness: 1-inch
   i. LR: Not less than .90
   j. NRC: Not less than .95
   k. Edge/Joint Detail: Tegular
   l. Recycled Content: High
   m. Grid: (MSS-1)

2. ACOUSTICAL PANELS FOR ACOUSTICAL PANEL CEILING (ACT-2)

   a. Basis-of-Design Product: Armstrong World Industries, Inc.
   b. Style: Clean Room VL
   c. Color: White
   d. Classification: ASTM E1264.
   e. Type and Form: Type IV; Form 2.
   f. Pattern: E (lightly textured)
   g. Modular Size: 24" x 48"
   h. Thickness: 5/8-inch
   i. LR: Not less than .80
   j. CAC: Not less than 40
   k. Edge/Joint Detail: Square
   l. Recycled Content: Standard
   m. Grid: (MSS-2)

C. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.

B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
   1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
   2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.

D. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.

E. Products

   1. METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING (MSS-1)

      a. Basis-of-Design Product: Armstrong World Industries, Inc.
      b. Style: Suprafine
      c. Narrow-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 9/16-inch- wide metal caps on flanges.
      d. Structural Classification: Heavy-duty system.
      e. End Condition of Cross Runners: Override (stepped) or butt-edge type.
      f. Face Design: Flat, flush.
      g. Cap Material: Steel cold-rolled sheet.
      h. Cap Finish: Painted white.

   2. METAL SUSPENSION SYSTEM FOR ACOUSTICAL PANEL CEILING (MSS-2)

      a. Basis-of-Design Product: USG Interiors, Inc.; Subsidiary of USG Corporation.
      b. Style: AX
      c. Wide-Face, Capped, Double-Web, Aluminum Suspension System: Main and cross runners formed from aluminum to produce structural members with 15/16-inch-wide aluminum caps on flanges.
      d. Structural Classification: Intermediate Duty System
      e. End Condition of Cross Runners: Override (stepped) or butt-edge type.
      f. Face Design: Flat, flush.
      g. Cap Material: Aluminum cold-rolled sheet.
      h. Cap Finish: Painted White

2.5 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

2.6 ACOUSTICAL SEALANT

A. Products: Subject to compliance with requirements, provide one of the following:
   1. Acoustical Sealant for Exposed and Concealed Joints:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
      b. USG Corporation; SHEETROCK Acoustical Sealant.

B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
   2. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

B. Suspend ceiling hangers from building's structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard

suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
8. Do not attach hangers to steel deck tabs.
9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   1. Arrange directionally patterned acoustical panels as follows:
      a. As indicated on reflected ceiling plans.
   2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

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SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Resilient base.
   2. Transitions strips.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 MATERIALS MAINTENANCE SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
   1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C)] or more than 95 deg F (35 deg C) in spaces to receive resilient products during the following time periods:
   1. 48 hours before installation.
   2. During installation.
   3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOPLASTIC-RUBBER BASE

A. Manufacturers:

1. Basis of Design Product: Subject to compliance with requirements, provide products comparable to: Johnsonite

Code	Manufacturer	Number	Description
RB-1	Johnsonite	29 Moon rock WG	4" high base, coved
RB-2	Johnsonite	130 Sisal	4" high base, coved

2. Subject to compliance with requirements, provide comparable products from the following:
   a. Allstate Rubber Corp.; Stoler Industries.
   b. Armstrong World Industries, Inc.
   c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
   d. Endura Rubber Flooring; Division of Burke Industries, Inc.
   e. Estrie Products International; American Biltrite (Canada) Ltd.
   f. Flexco, Inc.
   g. Mondo Rubber International, Inc.
   h. Musson, R. C. Rubber Co.
   i. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
   j. PRF USA, Inc.
   k. Roppe Corporation, USA.
   l. VPI, LLC; Floor Products Division.

B. Resilient Base Standard: ASTM F 1861.
   1. Material Requirement: TP (rubber, thermoplastic).
   2. Manufacturing Method: Group I (solid, homogeneous).
   3. Style: Cove (base with toe).

C. Minimum Thickness: 0.125 inch (3.2 mm).

D. Height: 4 inches (152 mm).

E. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Preformed.

H. Finish: Matte.

2.2 ACCESSORIES

A. Basis of Design Product: Subject to compliance with requirements, provide products comparable to: Johnsonite

Code	Manufacturer	Name	Color	Number	Description
TS-1	Johnsonite	Slim Line Transitions	29 Moon Rock	SLT-XX-F	Carpet to Concrete topping
TS-2	Johnsonite	Reducers	29 Moon Rock	CRS-XX-A	Carpet to Existing concrete
TS-3	Johnsonite	Reducers	130 Sisal	CTA-XX-K	Sheet flooring to Concrete topping

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until they are same temperature as the space where they are to be installed.
   1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:
   1. Remove adhesive and other blemishes from exposed surfaces.
   2. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes vinyl sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of flooring. Include flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

1. Show details of special patterns.

C. Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch sections.

D. Samples for Initial Selection: For each type of resilient sheet flooring indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C). Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 VINYL SHEET FLOORING WITH CUSHION BACKING

A. Basis-of-Design Product: Subject to compliance with requirements, provide Tajima; Sports flooring, Crossover 50 or comparable product to include, but are not limited to, the following:

1. Altro Group
2. Armstrong World Industries, Inc
3. Congoleum Corporation
4. Forbo Industries, Inc
5. Gerflor
6. Lonseal, Inc
7. Mannington Mills, Inc
8. Polyflor, Ltd., Distributed by Gerbert Limited
9. TOLI International

B. Product Standard: ASTM F 1303.

1. Wear-Layer Thickness: Grade 1.
2. Overall Thickness: 5.0 mm.

C. Sheet Width: 6 feet.

D. Seamless-Installation Method: Heat welded.

E. Colors and Patterns: 1002 2nd Maple.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

1. Mapei: Ultrabond ECO 360.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Color: Match flooring.

D. Floor Sealing: Provide protective, liquid floor-sealer products recommended by resilient sheet flooring manufacturer.

a. PROTECH UV cured, polyurethane finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 8 pH.
4. Moisture Testing: Proceed with installation only after substrates pass testing according to resilient sheet flooring manufacturer's written recommendations, but not less stringent than the following:

a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until it is the same temperature as the space where it is to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

H. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless flooring. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Sealer: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor sealer.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 096516

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes
   1. Modular carpet tile

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
   2. Include installation recommendations for each type of substrate.

B. Samples:
   1. Submit 12" x 12" samples of each carpet for color/pattern verification.

C. Shop Drawings: Show the following:
   1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
   2. Carpet tile type, color, and dye lot.
   3. Type of subfloor.
   4. Type of installation.
   5. Pattern of installation.
   6. Pattern type, location, and direction.
   7. Pile direction.
   8. Type, color, and location of insets and borders.
   9. Type, color, and location of edge, transition, and other accessory strips.
   10. Transition details to other flooring materials.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
   1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Carpet Tile: Full-size units equal to 2 percent of amount installed for each type indicated, but not less than 10 sq. yd. (8.3 sq. m).

1.7 QUALITY ASSURANCE

A. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.9 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
   1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
   2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
   3. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

A. Products: Subject to compliance with the requirements, provide the following:

Code	MFR	Product	Color	Install Method	Size
CPT-1	Interface Flor	Exposed 1383202500	8687 Iron Works	Non-Directional	50 cm x 50 cm
CPT-2	Interface Flor	Exposed 1383202500	8690 Water Mill	Non-Directional	50 cm x 50 cm

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
   1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Transition Strips: See section 096513 "Resilient Base and Accessories".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
   2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
   2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
   3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
   4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
      a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
      b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.

C. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch (3 mm) wide or wider and protrusions more than 1/32 inch (0.8 mm) unless more stringent requirements are required by manufacturer's written instructions.

D. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.

E. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.

F. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

B. Installation Conditions: Verify that heated floors have been off for at least 48 hours prior to installation or as recommended by carpet manufacturer.

C. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

D. Maintain dye lot integrity. Do not mix dye lots in same area.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:
   1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
   2. Remove yarns that protrude from carpet tile surface.
   3. Vacuum carpet tile using commercial machine with face-beater element.

B. Verify that the heated floor system will remain out of service for at least 48 hours after installation or as recommended by the carpet manufacturer.

C. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

D. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

SECTION 097723 – WALL PANELS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Sound-absorbing wall panels.
2. Fabric wrapped wall panels

1.3 DEFINITIONS

A. NRC: Noise Reduction Coefficient.

B. SAA: Sound Absorption Average.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For wall units. Include mounting devices and details; details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge and core materials.

1. Include elevations showing panel sizes, direction of fabric weave, and pattern matching.

C. Samples: For each exposed product and for each color and texture specified. For each type of fabric facing material from fabric-wrapped panel manufacturer's full range.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by sound-absorbing wall units including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.

f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to sound-absorbing wall units.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance data. Include fabric manufacturers' written cleaning and stain-removal recommendations.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 yards.
2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.8 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide sound-absorbing wall units meeting the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: As determined by testing per ASTM E 84.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Meeting acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265.

PART 2 - PRODUCTS

2.1 SOUND-ABSORBING WALL UNITS

A. Manufacturers: Subject to compliance with requirements, provide Tectum Inc. products or comparable product by one of the following:

1. Acoustical Panel Systems (APS, Inc.).
2. Acoustical Solutions, Inc.
3. Armstrong World Industries.
4. AVL Systems, Inc.
5. Benton Brothers Solutions, Inc.
6. Conwed Designscape; an Owens Corning company.
7. Decoustics Limited; a CertainTeed Ceilings company.
8. Essi Acoustical Products.
9. Golterman & Sabo.
10. Kinetics Noise Control, Inc.
11. Lamvin, Inc.
12. MBI Products Company, Inc.

13. Panel Solutions, Inc.
14. Perdue Acoustics.
15. Pinta Acoustic, Inc.
16. Proudfoot Company, Inc. (The).
17. Sound Concepts Canada, Inc.
18. Sound Management Group LLC.
19. Wall Technology, Inc.; an Owens Corning company.
20. Working Walls, Inc.

B. Sound-Absorbing Wall Panel: Manufacturer's standard panel construction

1. Mounting: As indicated on drawings.
2. Core: Manufacturer's standard.
3. Edge Construction: Manufacturer's standard.
4. Edge Profile: Chamfered (beveled) where indicated.
5. Corner Detail in Elevation: Square with continuous edge profile indicated.
6. Reveals between Panels: Flush reveals as indicated on Drawings.
7. Acoustical Performance: Sound absorption NRC of 0.95 to 1.00 according to ASTM C 423 for Type C-20 / C-40 mounting according to ASTM E 795.
8. Nominal Overall Panel Thickness: As indicated on Drawings.
9. Panel Width: As indicated on Drawings.
10. Panel Height: As indicated on Drawings.
11. Mounting Devices: Stainless steel, washer-head, wood screws in pattern as indicated on drawings.

2.2 FABRIC WRAPPED WALL PANELS

A. Wall panel core material:

1. Mineral-Fiber Board: With maximum flame-spread and smoke-developed indexes of 15 and 5, respectively.

   a. Product: Subject to compliance with requirements, provide "Micore" by United States Gypsum Company.

B. Manufacturers: Subject to compliance with requirements, provide Maharan products or comparable product.
1. Width: 54 inches.
2. Applied Treatments: Stain resistance.

C. Panel Width and Height: As indicated on Drawings.

D. Panel Edge and Frame: Extruded-aluminum or zinc-coated, rolled-steel shape.

1. Edge and Corner Detail: Square.

E. Mounting Devices: Concealed on back of panel, recommended to support weight of panel and as follows:

1. Metal "Z" Clips: Two-part panel clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate, designed to allow for panel removal.

F. Schedule of Tackable Wall Panels

Code	Manufacturer	Style	Color
FWP-1	Maharan	Metric	466014-003 Fleece
FWP-2	Maharan	Manner	466177-006 Nuance
FWP-3	Maharan	Manner	466177-021 Greenway
FWP-4	Maharan	Medium	463490-013 Persimmon
FWP-5	Maharan	Messenger	458640-072 Maize
FWP-6	Maharan	Medium	463490-053 Nasturtium
FWP-7	Maharan	Messenger	458640-041 Azure

2.3 FABRICATION

A. Fabric-Wrapped Panels: Panel construction consisting of facing material adhered or attached to face, edges and back border of dimensionally stable core; with rigid edges to reinforce panel perimeter against warpage and damage.

B. Fabric Facing: Stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter. Applied with visible surfaces fully covered.

1. Where square corners are indicated, tailor corners.
2. Where fabrics with directional or repeating patterns or directional weave are indicated, mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

C. Dimensional Tolerances of Finished Units: Plus or minus 1/16 inch.

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Verify field dimensions where panels are shown as wall to wall.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, substrates, blocking, and conditions, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of fabric-wrapped panels.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install units in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of units using type of mounting devices indicated. Mount units securely to supporting substrate.

C. Installation Tolerances: As follows:

1. Variation from Plumb and Level: Plus or minus 1/16 inch.
2. Variation of Panel Joints from Hairline: Not more than 1/32 inch wide.

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that fabric-wrapped panels are without damage or deterioration at time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 097723

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Steel.
2. Galvanized metal.
3. Gypsum board.
4. Sound absorbing wall panels

1.3 DEFINITIONS

A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.

D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.

1.6 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Benjamin Moore & Co.
   2. Hallman Lindsay Paints.
   3. ICI Paints.
   4. PPG Architectural Finishes, Inc.
   5. Pratt & Lambert.
   6. Sherwin-Williams Company (The).

2.2 PAINT, GENERAL

A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

B. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   1. Flat Paints and Coatings: 50 g/L.
   2. Nonflat Paints and Coatings: 150 g/L.
   3. Dry-Fog Coatings: 400 g/L.
   4. Primers, Sealers, and Undercoaters: 200 g/L.
   5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
   6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
   7. Pretreatment Wash Primers: 420 g/L.
   8. Floor Coatings: 100 g/L.
   9. Shellacs, Clear: 730 g/L.

10. Shellacs, Pigmented: 550 g/L.

2.3 COLOR SCHEDULE

Code	Manufacturer	Number	Name
PT-1	Sherwin Williams	SW6385	Dover White
PT-2	Sherwin Williams	SW7046	Anonymous
PT-3	Sherwin Williams	SW6726	Talipot Palm
PT-4	Sherwin Williams	SW6789	Blue Mosque
PT-5	Sherwin Williams	SW6635	Determined Orange
PT-6	Sherwin Williams	SW6675	Afternoon
PT-7	Sherwin Williams	SW6881	Cayenne
PT-8	Sherwin Williams	SW7044	Amazing Gray
PT-9	Sherwin Williams	SW7019	Gauntlet Gray

2.4 PRIMERS/SEALERS

A. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.

B. Primer, Latex, for Interior Wood: MPI #39.

2.5 METAL PRIMERS

A. Primer, Rust-Inhibitive, Water Based: MPI #107.

B. Primer, Galvanized, Water Based: MPI #134.

2.6 FLOOR COATINGS

A. Sealer, Water Based, for Concrete Floors: MPI #99.

2.7 WATER-BASED PAINTS

A. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 3): MPI #145.

B. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147.

2.8 SOURCE QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
   1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
   2. Testing agency will perform tests for compliance with product requirements.
   3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Wood: 15 percent.
   2. Concrete: 12 percent.
   3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.
   1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
   1. SSPC-SP 2, "Hand Tool Cleaning."

F. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

G. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

A. Steel Substrates:
1. Institutional Low-Odor/VOC Latex System, MPI INT 5.1S:
   a. Prime Coat: Primer, rust-inhibitive, water based MPI #107.
   b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
   c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 5), MPI #147.

B. Concrete Substrates, Traffic Surfaces:

1. Water-Based Clear Sealer System:
   a. First Coat: Sealer, water based, for concrete floors, MPI #99.
   b. Topcoat: Sealer, water based, for concrete floors, MPI #99.

C. Galvanized-Metal Substrates:
   1. Institutional Low-Odor/VOC Latex System, MPI INT 5.3N:
      a. Prime Coat: Primer, galvanized, water based, MPI #134.
         1) For use on galvanized metal substrates that are not chromate passivated. If galvanized metal is chromate passivated, consult manufacturers for appropriate primers
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.

D. Wood Substrates: Including wood trim.
   1. Institutional Low-Odor/VOC Latex System:
      a. Prime Coat: Primer, latex, for interior wood, MPI #39.
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.

E. Gypsum Board Substrates:
   1. Institutional Low-Odor/VOC Latex System, MPI INT 9.2M.:
      a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
      b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
      c. Topcoat: Latex, interior, institutional low odor/VOC, (Gloss Level 3), MPI #145.

END OF SECTION 099123

SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Markerboards (WB-_).
2. Tackboards (CB-1).
3. Visual display rails. (PR-1).

1.3 DEFINITIONS

A. Tackboard: Framed or unframed, tackable, visual display board assembly.

B. Visual Display Board Assembly: Visual display surface that is factory fabricated into composite panel form, either with or without a perimeter frame; includes markerboards and tackboards.

C. Visual Display Surface: Surfaces that are used to convey information visually, including surfaces of markerboards and tackboards, and surfacing materials that are not fabricated into composite panel form but are applied directly to walls.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.

B. Shop Drawings: For visual display units.

1. Include plans, elevations, sections, details, and attachment to other work.
2. Show locations of panel joints.
3. Include sections of typical trim members.

C. Samples: For each type of visual display unit indicated.

1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For visual display units to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.9 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.

1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.10 WARRANTY

A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Surfaces lose original writing and erasing qualities.

b. Surfaces exhibit crazing, cracking, or flaking.

2. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Porcelain-Enamel Face Sheet: Manufacturer's standard steel sheet with porcelain-enamel coating fused to steel; uncoated thickness indicated.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Claridge Products and Equipment, Inc.
b. PolyVision Corporation; a Steelcase company.

2. Matte Finish: Low reflective; chalk wipes clean with dry cloth or standard eraser.

B. Natural Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.

C. Hardboard: ANSI A135.4, tempered.

D. Particleboard: ANSI A208.1, Grade M-1.

E. Fiberboard: ASTM C 208.

F. Extruded Aluminum: ASTM B 221, Alloy 6063.

2.2 MARKERBOARD ASSEMBLIES

A. Porcelain-Enamel Markerboards: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction consisting of backing sheet, core material, and porcelain-enamel face sheet with low-gloss finish.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. AARCO Products, Inc.
b. ADP Lemco, Inc.
c. Aywon.
d. Bangor Cork Company, Inc.
e. Best-Rite Manufacturing.
f. Claridge Products and Equipment, Inc.
g. Egan Visual Inc.

h. Ghent Manufacturing, Inc.
i. Marsh Industries, Inc.; Visual Products Group.
j. Platinum Visual Systems; a division of ABC School Equipment, Inc.
k. PolyVision Corporation; a Steelcase company.
l. Tri-Best Visual Display Products.

2. Manufacturer's Standard Core: Minimum 1/4 inch thick, with manufacturer's standard moisture-barrier backing.
3. Laminating Adhesive: Manufacturer's standard, moisture-resistant thermoplastic type.

2.3 TACKBOARD ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. A-1 Visual Systems.
2. AARCO Products, Inc.
3. ADP Lemco, Inc.
4. Aywon.
5. Bangor Cork Company, Inc.
6. Best-Rite Manufacturing.
7. Claridge Products and Equipment, Inc.
8. Egan Visual Inc.
9. EverProducts by Glenroy Inc.
10. Ghent Manufacturing, Inc.
11. Marsh Industries, Inc.; Visual Products Group.
12. Platinum Visual Systems; a division of ABC School Equipment, Inc.
13. PolyVision Corporation; a Steelcase company.
14. Tri-Best Visual Display Products.

B. Natural-Cork Tackboard: 1/4-inch- thick, natural cork sheet factory laminated to 1/4-inch- thick hardboard backing.

2.4 VISUAL DISPLAY RAILS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AARCO Products, Inc.
2. Bangor Cork Company, Inc.
3. Best-Rite Manufacturing.
4. Claridge Products and Equipment, Inc.
5. Ghent Manufacturing, Inc.
6. Marsh Industries, Inc.; Visual Products Group.
7. Platinum Visual Systems; a division of ABC School Equipment, Inc.
8. PolyVision Corporation; a Steelcase company.
9. Tri-Best Visual Display Products.

B. Support Rails: 72-inch- long, horizontal, wall-mounted, extruded-aluminum rails designed to receive hanger clips.

1. Height: 1 3/16 inches.
2. Depth: 3/8-inches
3. Finish: Clear anodic.

C. Hanger Clips: Extruded aluminum with finish to match rails; designed to support independent visual display boards by engaging support rail and top trim of board.

2.5 MARKERBOARD AND TACKBOARD ACCESSORIES

A. Aluminum Frames: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.

1. Factory-Applied Trim: Manufacturer's standard.

2.6 FABRICATION

A. Porcelain-Enamel Visual Display Assemblies: Laminate porcelain-enamel face sheet and backing sheet to core material under heat and pressure with manufacturer's standard flexible, waterproof adhesive.

B. Visual Display Boards: Factory assemble visual display boards unless otherwise indicated.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display boards at manufacturer's factory before shipment.

C. Aluminum Frames: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.

1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

2.7 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

2.9 VISUAL DISPLAY SURFACE SCHEDULE

A. Visual Display Board (WB-_): Factory assembled.

1. Markerboard: Porcelain-enamel markerboard assembly.

a. Color: White.

2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Factory-Applied Aluminum Trim: Manufacturer's standard with clear anodic finish.

B. Tackboard (CB-1): Factory assembled.

1. Tack Surface: Natural-cork tackboard assembly.

a. Color: As selected by Architect from full range of industry colors.

2. Corners: Square.
3. Width: As indicated on Drawings.
4. Height: As indicated on Drawings.
5. Mounting: Wall.
6. Mounting Height: As indicated on Drawings.
7. Edges: Concealed by trim.

a. Factory-Applied Aluminum Trim: Manufacturer's standard style, with clear anodic finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.

B. Examine walls and partitions for proper preparation and backing for visual display units.

C. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.

C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.

3.3 INSTALLATION, GENERAL

A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

3.4 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

A. Visual Display Boards (WB-): Attach visual display boards to wall surfaces with thin layer of adhesive over entire wall surface.

B. Visual Display Boards (CB-1): Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.

3.5 CLEANING AND PROTECTION

A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.

B. Touch up factory-applied finishes to restore damaged or soiled areas.

C. Cover and protect visual display units after installation and cleaning.

END OF SECTION 101100

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SECTION 101423 - SIGNAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Room-identification signs.
2. Field-applied, vinyl-character signs.
3. Cutout dimensional characters.

1.3 DEFINITIONS

A. Accessible: In accordance with the accessibility standard.

1.4 COORDINATION

A. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For panel signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Room-Identification Signs: Full-size Sample.
2. Field-Applied, Vinyl-Character Signs: Full-size Sample of characters on glass.

3. Dimensional Characters: Full-size Sample dimensional character.
4. Exposed Accessories: Full-size sample of each accessory type.

D. Sign Schedule: Use same designations specified or indicated on Drawings or in a sign schedule.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Sample Warranty: For special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify locations of anchorage devices embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

2.2 ROOM IDENTIFICATION SIGNS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

1. ASI Sign Systems, Inc.
2. Ace Sign Systems, Inc.
3. Advance Corporation; Braille-Tac Division.
4. Allen Industries, Inc.
5. Allen Markings International.
6. APCO Graphics, Inc.
7. ASE, Inc.
8. ASI Sign Systems, Inc.
9. Best Sign Systems Inc.
10. Bunting Graphics, Inc.
11. Clarke Systems.
12. Diskey Sign Company.
13. Fossil Industries, Inc.
14. InPro Corporation.
15. Mohawk Sign Systems.
16. Nelson-Harkins Industries.
17. Poblocki Sign Company, LLC.
18. Seton Identification Products.
19. Supersine Company (The); Division of Stamp-Rite, Inc.
20. Vista System.
21. Vomar Products, Inc.

B. Signs with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:

1. Basis-of-Design Product: 2/90 Sign Systems; Modular Essentials.
2. Profile: Modular Thin.
3. End cap: Aluminum, Slimline (Satin Natural Finish).
4. Insert finish: ADA, Integral photopolymer.
5. Mounting: Manufacturer's standard method for substrates indicated.
6. Text and Typeface: Accessible raised characters in typeface as selected by Architect from manufacturer's full range and Braille. Finish raised characters and Braille to contrast with background color.
7. Accessories: Top and bottom trim.
8. Colors: Selected by Architect from manufacturer's full range
9. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of transparent covers with paper inserts printed by Owner.
    a. Finger notch to be located on the back panel to easily access paper when changing out inserts.
    b. Insert material text created via PC-Windows computers for Owner production of paper inserts.

10. Sign Schedule:

Plan ID	Room #	Sign Type	Text	Location Notes (see drawings)
ID-R1	104	C	Study Room A	Wall mounted
ID-R2	105	A	Youth Services	Wall mounted at latch side
ID-R3	106	A	Branch Supervisor	Wall mounted at latch side
ID-R4	107	A	Staff Only	Wall mounted at latch side
ID-R5	110	C	Study Room B	Wall mounted
ID-R6	111	A	Comfort Room	Wall mounted at latch side
ID-R7	201	C	Small Activity Room	Wall mounted
ID-R8	202	C	Gaming Room	Wall mounted
ID-R9	203	C	Community Groups Room	Wall mounted at latch side
ID-R10	204	C	Large Activity Room	Wall mounted
ID-R11	207	C	Pantry	Wall mounted at latch side
ID-R12	300	D	Occupancy 50	See Drawings 1" block letters
ID-R13	300	D	Occupancy 54	See Drawings 1" block letters
ID-R14	300	D	Combined Occupancy 104	See Drawings 1" block letters
ID-R15	307	A	Staff Only	Wall mounted at latch side
ID-R16	116	C	Community Room A	Wall mounted at latch side
ID-R17	114	C	Community Room B	Wall Mounted
ID-R18	211	C	Community Room A	Wall mounted at latch side
ID-R19	211	C	Community Room B	Wall mounted at latch side

ID-T1	112	B	Men Pictogram, HC	Wall mounted at latch side
ID-T2	113	B	Women Pictogram, HC	Wall mounted at latch side
ID-T3	208	B	Men Pictogram, HC	Wall mounted at latch side
ID-T4	209	B	Women Pictogram, HC	Wall mounted at latch side
ID-T5	306	B	Staff Restroom Unisex Pictogram, HC	Wall mounted at latch side

C. Type A Signs:

1. Basis-of-Design Product: 2/90 Sign Systems; Modular Essentials.
   a. Identification, M.3.

D. Type B Signs:

1. Basis-of-Design Product: 2/90 Sign Systems; Modular Essentials.
   a. Regulatory, M.10.

E. Type C Signs:

1. Basis-of-Design Product: 2/90 Sign Systems; Modular Essentials.
   a. Regulatory, M.21.
   b. Changeable Message Inserts.

F. Type D Signs:

1. Basis-of-Design Product: 2/90 Sign Systems; Modular Essentials.
   a. Directionals/Identification, M.12.

2.3 FIELD-APPLIED, VINYL-CHARACTER SIGNS

A. Field-Applied, Vinyl-Character Sign: Prespaced characters die cut from 3- to 3.5-mil thick, weather-resistant vinyl film with release liner on the back and carrier film on the front for on-site alignment and application.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Allen Markings International.
   b. APCO Graphics, Inc.
   c. ASI Sign Systems, Inc.
   d. Best Sign Systems Inc.

e. Mohawk Sign Systems.
f. Nelson-Harkins Industries.
g. Seton Identification Products.

2. ID-EX1
   a. Text: **MEADOWRIDGE BRANCH LIBRARY**
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Architect to select
   d. Refer to Architect's drawings for location.
   e. Text height: 6"
   f. Substrate: Glass.

3. ID-EX2
   a. Text: **Mon-Fri: 10am-8pm, Sat: 9am-5pm, Sun: Closed** (coordinate hours of operation with owner)
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Architect to select
   d. Refer to Architect's drawings for location.
   e. Text height: 1"
   f. Substrate: Glass.
4. ID-EX3
   a. Text: **MEADOWOOD NEIGHBORHOOD CENTER**
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Architect to select
   d. Refer to Architect's drawings for location.
   e. Text height: 6"
   f. Substrate: Glass.
5. ID-EX4
   a. Text: **Mon-Fri: 8am-8pm, Sat: 12pm-5pm, Sun: Closed** (coordinate hours of operation with owner)
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Architect to select
   d. Refer to Architect's drawings for location.
   e. Text height: 1"
   f. Substrate: Glass.
6. ID-EX5
   a. Text: **Emergency Exit Only - Alarm will sound**
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Red
   d. Refer to Architect's drawings for location.
   e. Text height: 1"
   f. Substrate: Door.
7. ID-EX6
   a. Text: **Emergency Exit Only**
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: *Red
   d. Refer to Architect's drawings for location.
   e. Text height: 1"
   f. Substrate: Door.

8. ID-EX7
   a. Text: **Deliveries Only**
   b. Typeface: * Architect to select, Upper and Lower case.
   c. Letter Color: * Architect to select
   d. Refer to Arc2hitect's drawings for location.
   e. Text height: 1"
   f. Substrate: Door.

2.4 CUTOUT CHARACTERS: Characters with uniform faces; square-cut, smooth edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. ACE Sign Systems, Inc.
   b. APCO Graphics, Inc.
   c. A. R. K. Ramos Signage Systems.
   d. ASI Sign Systems, Inc.
   e. Charleston Industries, Inc.
   f. Diskey Sign Company.
   g. Gemini Incorporated.
   h. InPro Corporation.
   i. Matthews International Corporation; Bronze Division.
   j. Metal Arts; Division of L & H Mfg. Co.
   k. Metallic Arts.
   l. Nelson-Harkins Industries.
   m. Southwell Company (The).
   n. Steel Art Company.

2. Character Material: Sheet or plate aluminum.
3. Thickness: 0.25 inch.
4. Finishes:
   a. Integral Aluminum Finish: Clear anodized.
   b. Overcoat: Manufacturer's standard baked-on clear coating.
5. Signs
   a. ID-D1
      1) Typeface: **ASK DESK**
      2) Font: * Architect to select, Uppercase.
      3) Location: Room 115 - Refer to Architect's drawings.
      4) Text height: 10"
      5) Mounting: Concealed studs with 1-inch stand-off.
   b. ID-D2
      1) Typeface: **CHECK IN**
      2) Font: * Architect to select, Uppercase.
      3) Location: Room 214 - Refer to Architect's drawings.
      4) Text height: 3"
      5) Quantity: 2 - each side of panel
      6) Mounting: Concealed studs with flush mounting.

c. ID-D3
   1) Typeface: **CHECK OUT**
   2) Font: * Architect to select, Uppercase.
   3) Location: Room 116 - Refer to Architect's drawings.
   4) Text height: 10"
   5) Mounting: Concealed studs with 1-inch stand-off.

2.5 PANEL-SIGN MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Steel Materials:

1. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed.
2. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi minimum yield strength.
3. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.

D. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

E. Polycarbonate Sheet: ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), with coating on both sides.

F. Fiberglass Sheet: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

G. PVC Sheet: Manufacturer's standard, UV-light stable, PVC plastic.

H. Plastic-Laminate Sheet: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.

I. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated and suitable for exterior applications.

J. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.6 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signage, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.
2. Exposed Metal-Fastener Components, General:

a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
b. Fastener Heads: For nonstructural connections, use flathead or oval countersunk screws and bolts with tamper-resistant Allen-head slots unless otherwise indicated.

3. Sign Mounting Fasteners:

a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly, unless otherwise indicated.

B. Adhesives: As recommended by sign manufacturer and that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.7 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners.

B. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

C. Signs with Changeable Message Capability: Fabricate signs to allow insertion of changeable messages as follows:

1. For slide-in changeable inserts, fabricate slot without burrs or constrictions that inhibit function. Initial and subsequent changeable inserts are by Owner.

2.8 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.9 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611.

B. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

2.10 STEEL FINISHES

A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, and prepare for coating according to coating manufacturer's written instructions.

1. For Baked-Enamel or Powder-Coat Finish: After cleaning, apply a conversion coating compatible with the organic coating to be applied over it.

B. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of signage work.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that anchor inserts are correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Install signs so they do not protrude or obstruct according to the accessibility standard.
3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Room-Identification Signs and Other Accessible Signage: Install in locations on walls according to accessibility standard.

C. Mounting Methods:

1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.

    a. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.

2. Through Fasteners: Drill holes in substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
3. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position so that signage is correctly located and aligned.
4. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
5. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

D. Field-Applied, Vinyl-Character Signs: Clean and dry substrate. Align sign characters in final position before removing release liner. Remove release liner in stages, and apply and firmly press characters into final position. Press from the middle outward to obtain good bond without blisters or fishmouths. Remove carrier film without disturbing applied vinyl film.

E. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

SECTION 102113 - TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Solid-polymer toilet compartments configured as toilet enclosures and urinal screens.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of centerlines of toilet fixtures.
   3. Show ceiling grid and overhead support or bracing locations.

C. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
   1. Each type of material, color, and finish required for units, prepared on 6-inch- (152-mm-) square Samples of same thickness and material indicated for Work.
   2. Each type of hardware and accessory.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Comply with requirements in GSA's CID-A-A-60003, "Partitions, Toilets, Complete."

B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84, or another standard acceptable to authorities having jurisdiction, by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Flame-Spread Index: 75 or less.
   2. Smoke-Developed Index: 450 or less.

C. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1 for toilet compartments designated as accessible.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Basis of Design Product: Subject to compliance with requirements, provide one of the following;
   1. Bobrick Partitions, "Sierra" Series.
   2. Bradley, Mills Partitions, Bradmar Series

2.2 SOLID-POLYMER UNITS

A. Toilet-Enclosure Style: Overhead braced, floor mounted.

B. Urinal-Screen Style: Wall hung.

C. Door, Panel, Screen, and Pilaster Construction: Solid, high-density polyethylene (HDPE) or polypropylene (PP) panel material, not less than 1 inch (25 mm) thick, seamless, with eased edges, no-sightline system, and with homogenous color and pattern throughout thickness of material.
   1. Heat-Sink Strip: Manufacturer's standard continuous, stainless-steel strip fastened to exposed bottom edges of solid-polymer components to prevent burning.
   2. Color and Pattern: Color as selected from manufacturer's full color range.

D. Pilaster Sleeves (Caps): Manufacturer's standard design; stainless steel.

E. Brackets (Fittings):
   1. Manufacturer's standard design; stainless steel.

2.3 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Stainless steel.
   2. Hinges: Manufacturer's standard top and bottom hinges that swings to a closed or partially open position.
   3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
   6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match the items they are securing, with theft-resistant-

type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized steel, or other rust-resistant, protective-coated steel.

2.4 FABRICATION

A. Door Size and Swings: Unless otherwise indicated, provide 24-inch- (610-mm-) wide, in-swinging doors for standard toilet compartments and 36-inch- (914-mm-) wide, out-swinging doors with a minimum 32-inch- (813-mm-) wide, clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch (13 mm).
      b. Panels and Walls: 1 inch (25 mm).

B. Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.

3.2 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113

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SECTION 102239 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Manually operated, acoustical panel partitions.

1.3 ALTERNATES

A. Alternate #1: Manually operated, acoustical panel partitions.
1. Provide cost to supply and install manually operated, acoustical panel partitions.
2. Alternate includes the adjustable hanger rods and attachment to the steel support beam. The base bid includes the steel support beam as prepared to accept the adjustable hanger rods and manually operated, acoustical panel partitions as specified.

1.4 DEFINITIONS

A. STC: Sound Transmission Class.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For operable panel partitions.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.

C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.

1. Include Samples of accessories involving color selection.

1.6 INFORMATIONAL SUBMITTALS

A. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.

B. Qualification Data: For qualified Installer.

C. Sample Warranty: For manufacturer's special warranty.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.

1. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.

2. Seals, hardware, track, track switches, carriers, and other operating components.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.9 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Faulty operation of operable panel partitions.

b. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:

1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E 90, determined by ASTM E 413, and rated for not less than the STC indicated.

B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 OPERABLE ACOUSTICAL PANELS

A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Hufcor, Inc.; Series 632 or comparable product by one of the following:

a. Advanced Equipment Corporation.
b. FolDoor.
c. KWIK-WALL Company.
d. Moderco Inc.
e. Modernfold, Inc.
f. Panelfold Inc.

B. Panel Operation: Manually operated, paired panels.

C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.

1. Panel Width: As indicated.

E. STC: Not less than 49.

F. Panel Weight: 12 lb/sq. ft. maximum.

G. Panel Thickness: Not less than 3 inches.

H. Panel Materials:

1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.

2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B 221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.

a. Frame Reinforcement: Manufacturer's standard steel or aluminum.

4. Medium-Density Fiberboard: ANSI A208.2.

I. Panel Closure: Manufacturer's standard unless otherwise indicated.

1. Initial Closure: Flexible, resilient PVC, bulb-shaped acoustical seal.
2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.

J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.

1. Hinges: Manufacturer's standard.

2.3 SEALS

A. General: Provide seals that produce operable panel partitions complying with performance requirements and the following:

1. Manufacturer's standard seals unless otherwise indicated.

2. Seals made from materials and in profiles that minimize sound leakage.
3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

B. Horizontal Top Seals: Continuous-contact, extruded-PVC seal exerting uniform constant pressure on track or PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended if needed to achieve Specified STC rating.

C. Horizontal Bottom Seals: PVC-faced, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.

1. Mechanically Operated for Acoustical Panels: Extension and retraction of bottom seal by operating handle or built-in operating mechanism, with operating range not less than 2 inches between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

A. General: Provide finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.

1. Apply one-piece, seamless facings free of air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal butted edges or seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.

B. Vinyl-Coated Fabric Wall Covering: Manufacturer's standard, mildew-resistant, washable, vinyl-coated fabric wall covering; complying with CFFA-W-101-D for type indicated; Class A.

1. Total Weight: 15 oz. per lineal yard.
2. Antimicrobial Treatment: Additives capable of inhibiting growth of bacteria, fungi, and yeasts.
3. Color/Pattern: As selected by Architect from manufacturer's full range.

C. Cap-Trimmed Edges: Protective perimeter-edge trim with tight hairline joints concealing edges of panel and finish facing, finished as follows:

1. Aluminum: Finished with manufacturer's standard clear anodic finish.

2.5 SUSPENSION SYSTEMS

A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket

supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.

1. Multidirectional Carriers: Capable of negotiating intersections without track switches.

C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

D. Aluminum Finish: Manufacturer's standard anodized finish unless otherwise indicated.

2.6 ACCESSORIES

A. Pass Doors: Swinging door built into and matching panel materials, construction, and acoustical qualities, finish and thickness, complete with frames and operating hardware. Hinges finished to match other exposed hardware.

1. Accessibility Standard: Fabricate doors to comply with applicable provisions in ICC A117.1 and the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities
2. Single Pass Door: 36 by 84 inches.
3. Pass-Door Hardware: Equip pass door with the following:

    a. Door Seals: Mechanically operated floor seal on panels containing pass doors.
    b. Panic hardware.
    c. Exit Sign: Recessed, self-illuminated.
    d. Latchset: Passage set.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with ASTM E 557 except as otherwise required by operable panel partition manufacturer's written installation instructions.

B. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.

C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.

E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals.

3.3 FIELD QUALITY CONTROL

A. NIC Testing: Owner may engage a qualified testing agency to perform tests and inspections.

1. Testing Extent: Testing agency shall randomly select one operable panel partition installation(s) for testing.
2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E 336, determined by ASTM E 413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.

B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust pass doors to operate smoothly and easily, without binding or warping.

C. Verify that safety devices are properly functioning.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 102239

SECTION 102600 – WALL PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Wall protection (WP-1).
   2. Corner guards (C-_).

1.3 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
   1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Division 01 Section "Quality Requirements."
   1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

E. Regulatory Requirements: Comply with applicable provisions in [he U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F (21 deg C) during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.
   3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F (21 deg C).
      a. Store corner-guard covers in a vertical position.
      b. Store **wall-guard** covers in a horizontal position.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F (21 deg C) for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Deterioration of plastic and other materials beyond normal use.
   2. Warranty Period: two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; thickness as indicated.
   1. Impact Resistance: Minimum 25.4 ft-lbf/in. (1356 J/m) of notch when tested according to ASTM D 256, Test Method A.
   2. Self-extinguishing when tested according to ASTM D 635.
   3. Flame-Spread Index: 25 or less.
   4. Smoke-Developed Index: 450 or less.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. (800 J/m) of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 CORNER GUARDS (C-_)

A. Surface-Mounted, Resilient, Plastic Corner Guards. Assembly consisting of snap-on plastic cover installed over continuous retainer; including mounting hardware; fabricated with 90- or 135-degree turn to match wall condition.

1. Basis-of-Design Product: Subject to compliance with requirements, provide InPro, IPC; Style 160 or comparable product by one of the following:

   a. Construction Specialties; Acrovyn Corner Guards
   b. Pawling Corporation

2. Cover: Extruded rigid plastic, minimum 0.08-inch wall thickness.

   a. Profile: Nominal 2-inch- long leg and 1/4-inch corner radius.
   b. Height: 4 feet.
   c. Color: Refer to color schedule.

3. Retainer: Minimum 0.070-inch- thick, one-piece, extruded aluminum.
4. Retainer Clips: Manufacturer's standard impact-absorbing clips.
5. Top and Bottom Caps: Prefabricated, injection-molded plastic; color matching cover; field adjustable for close alignment with snap-on cover.

2.3 WALL PROTECTION (WP-1): CONSISTING OF MINIMUM 0.040-INCH- THICK, PVC PLASTIC SHEET WALL-COVERING MATERIAL.

1. Basis-of-Design Product: Subject to compliance with requirements, provide InPro, IPC; Rigid Sheet or comparable product by one of the following:

   a. Construction Specialties; Acrovyn Corner Guards
   b. Pawling Corporation

2. Height: As indicated on drawings.
3. Color: Feather 0238.
4. Texture: Velvet.
5. Accessories: Provide all required top caps, divider bars, inside and outside corners, and color-matched caulk
6. Mounting: Surface mounted with adhesive.

2.4 FABRICATION

A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.

B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For impact-resistant wall protection units attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. General: Install impact-resistant wall protection units as level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Corner Guards
1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
   a. Provide anchoring devices to withstand imposed loads.
   b. Adjust end and top caps as required to ensure tight seams.

C. Impact-Resistant Wall Covering: Install top and edge moldings, corners, and divider bars as required for a complete installation

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

3.5 COLOR SCHEDULE

C1 - 0257 Cinnabar

C2 - 0351 River rock

C3 - 0238 Feather

C4 - 0278 Sand dune

C5 - 0232 Linen

END OF SECTION 102600

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SECTION 102800 – TOILET ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Public-use washroom accessories.
2. Custodial accessories

B. Owner-Furnished contractor installed material:

1. Surface mounted Soap Dispenser.
2. Surface mounted Roll Towel Dispenser.
3. Surface mounted Toilet Tissue Dispenser.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:
1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required preventing delaying the Work.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch (0.8-mm) minimum nominal thickness unless otherwise indicated.

B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.

C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch (0.9-mm) minimum nominal thickness.

D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

2.2 WASHROOMROOM ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or comparable product by one of the following:

   1. A & J Washroom Accessories, Inc.
   2. American Specialties, Inc.
   3. Bobrick Washroom Equipment, Inc.
   4. Bradley Corporation.
   5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
   6. Tubular Specialties Manufacturing, Inc.

B. Grab Bar (TA-01):

1. Basis-of-Design Product: BOBRICK; B-6106 series.
   a. Mounting: Flanges with exposed fasteners.
   b. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
   c. Finish: Smooth, No. 4 finish (satin).
   d. Outside Diameter: 1-1/2 inches (38 mm).
   e. Configuration and Length: As indicated on Drawings.

C. Robe/Coat Hook (CH-1):

1. Basis-of-Design Product: Mockett; CH11.
   a. Description: Double-prong unit.
   b. Material and Finish: Satin Chrome.

D. Baby Changing Station (TA-06):

1. Basis-of-Design Product: Koala Bear Kare, KB100-00.
   a. Description: Horizontal, wall-mounted, changing station.
   b. Material: High Density polyethylene.
   c. Color: Cream.

E. Sanitary Napkin disposal (TA-03):

1. Basis-of-Design Product: BOBRICK; B-353 series (fully recessed - wall).
   a. Mounting: Flanges with concealed fasteners.
   b. Material: Stainless steel.
   c. Finish: Smooth, No. 4 finish (satin).
   d. Waste receptacle: Removable for servicing.
   e. Locations: As indicated on Drawings.

2. Basis-of-Design Product: BOBRICK; B-254 series (surface mounted - toilet partition).
   a. Mounting: Concealed fasteners.
   b. Material: Stainless steel.
   c. Finish: Smooth, No. 4 finish (satin).
   d. Waste receptacle: Removable for servicing.
   e. Locations: As indicated on Drawings.

2.3 CUSTODIAL ACCESSORIES

F. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. GAMCO Specialty Accessories; a division of Bobrick Washroom Equipment, Inc.
6. Tubular Specialties Manufacturing, Inc.

G. Mop and Broom Holder (MBH-1)
1. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
2. Locations: Provide one at each mop basin.
3. Length: 36 inches (914 mm).
4. Hooks: Three.
5. Mop/Broom Holders: Four spring-loaded, rubber hat, cam type.

6. Material and Finish: Stainless steel, No. 4 finish (satin).
   a. Shelf: Not less than nominal 0.05-inch- (1.3-mm-) thick stainless steel.
   b. Rod: Approximately 1/4-inch- (6-mm-) diameter stainless steel.

2.3 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

3.2 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to ASTM F 446.

3.3 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 103100 – MANUFACTURED FIREPLACES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK.

A. Section Includes.
1. Manufactured fireplace.
2. Manufactured fireplace flue with exterior wall power vent.

B. Related Sections:
1. Section 097500 "Stone Facing" for surrounding finishes.
2. Section 055000 "Metal Fabrications" for fireplace screen & lintel.
3. Section 092216 "Non-Structural Metal Framing" for surrounding framing.
4. Section 092900 "Gypsum Board Assemblies" for surrounding wall construction.
5. Division 23 "HVAC" for ductwork and supply of gas to manufactured fireplace.
6. Division 27 "Electronic Safety and Security" for CO detector and connection to detection and alarm systems.

1.3 SYSTEM DESCRIPTION.

A. Design Requirements
1. Proved a complete assembly utilizing the specified manufactured fireplace. Provide all needed flue and cap elements to meet building code and fit within designated chase space.

1.4 SUBMITTALS

A. Product Data: Material data for each product specified.

B. Shop Drawings: Full-scale details to indicate special joint or termination conditions and conditions of interface with other materials.

C. Quality Control Submittals.
1. Manufacturer's Instructions: Inspection, preparation and installation instructions.

D. Contract Closeout Submittals.
1. Operation and Maintenance Data.
2. Warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and or mixing with other components.

B. Storage:
1. Store materials in weather protected environment clear of ground and moisture.

C. Protection:

1. Protect materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
2. Handle and store materials and place equipment in a manner to avoid damage to installed work.

1.6 PROJECT/SITE CONDITIONS.

A. Environmental Requirements: Do not deliver or install materials or components until temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard.

B. Field measurements.
1. Field Verify locations and dimensions of items critical to the design, fit or assembly of the work of this section. Complete field dimensioning prior to fabrication of components.
2. Verify that field measurements are as indicated on shop drawings.

1.7 WARRANTY

A. General Warranty:
1. Provide written 12-month warranty against all material and labor defects in the installed system and components.
2. Warranty period shall commence on the date of substantial completion.
3. Submit under the provisions of Section 01 77 10 "Warranties".

PART 2 - PRODUCTS.

2.1 MANUFACTURED FIREPLACE

A. Town and Country Fireplaces
1. TC36ST See-Thru Series C
2. Liner: Coffee Bean Brown Porcelain Panels
3. Maestro Control System with wall plate and remote control.

2.2 POWER VENT SYSTEM

A. Town and Country power vent unit
1. Flush mount horizontal wall termination box

2.3 MANUFACTURED FLUE

1. Rigid Pipe Venting Systems
   a. As recommended by the fireplace manufacturer
2. Vent Sizing
   a. Inner diameter: 5 inches, Outer diameter: 8 inches.

PART 3 - EXECUTION

3.1 EXAMINATION.

A. Verify dimensions of openings and clearances are as needed to meet manufacture's requirements and recommendations.

B. Verify that adjacent construction meets manufacture's requirements and recommendations.

3.2 INSTALLATION.

A. Install in accordance with manufacturer's latest requirements and recommendations.

B. Coordinate installation of gas supply and CO sensor with other building trades.

C. Coordinate connections to flue cap with Section 04 20 00 "Unit masonry".

D. Test system operation and correct deficiencies.

3.3 CLEANING

A. Repair damaged and defective work, where possible, to eliminate functional and visual defects; where not possible to repair, replace work. Adjust for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean work on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

D. Protect installed work from subsequent operations.

3.4 DEMONSTRATION

A. Provide instruction on proper operation of unit to owner's designated personnel.

3.5 PROTECTION

A. Protect installed work from subsequent operations.

END OF SECTION 103100

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SECTION 104400 FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Fire extinguishers, fire extinguisher cabinets and mounting brackets

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
   1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, and cabinet type, trim style, and panel style.
   2. Fire Extinguishers Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.

B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

B. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers those fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION CABINET

A. Cabinet Type: Suitable for fire extinguisher.
   1. Basis-of-Design Product:

Code	Manufacturer	Number	Description
FEC-1	J. L. Industries, Inc	"Panorama" 2032 Q-53	Semi-recessed, with acrylic door and saf-t-lok lock.

B. Cabinet Construction: Nonrated.

C. Cabinet Material: Cold-rolled steel sheet.

D. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).

   1. Rolled-Edge Trim: 4-inch backbend depth.

E. Door Material: Stainless-steel sheet. With acrylic door and saf-t-lok lock.

F. Door Style: Solid opaque panel with frame.

G. Door Glazing: Acrylic sheet.

   1. Acrylic Sheet Color: Clear transparent acrylic sheet painted white on unexposed side.

H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated, and as follows:
   1. Recessed door pull.
   2. Continuous Hinge: Same material and finish as trim, permitting door to open 180 degrees.

I. Accessories:
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to security fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2.2 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run grain of directional finishes with long dimension of each piece.
   2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.3 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
   1. Basis-of-Design Product:

	Manufacturer	Number	Description
	J. L. Industries, Inc	"Saturn" 15	Class K 1.8 gal capacity

2.4 MATERIALS:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

   a. Finish: Baked enamel or powder coat].
   b. Color: As selected by Architect from full range of industry colors and color densities.

2. Stainless Steel: ASTM A 666, Type 304.

   a. Finish: No. 4 directional satin finish.

3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet) with Finish 2 (patterned, textured).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

A. General: Install fire protection cabinets in locations and at mounting heights indicated.
   1. Fire Protection Cabinets: 54 inches (1372 mm) above finished floor to top of cabinet.

B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire protection cabinets.
   2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturers written installation instructions.

B. Adjust fire protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.

E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

3.5 EXTINGUISHERS

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

END OF SECTION 104400

SECTION 105113 - METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Standard metal lockers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Regulatory Requirements: Where metal lockers are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities" and ICC/ANSI A117.1.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures.
      b. Faulty operation of latches and other door hardware.
   2. Damage from deliberate destruction and vandalism is excluded.
   3. Warranty Period for Knocked-Down Metal Lockers: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 STANDARD METAL LOCKERS (ML-1)

A. Basis-of-Design Product: Subject to compliance with requirements, provide products comparable to:
   1. Lyon Metal Products
   2. Republic Storage Systems

B. Locker Arrangement: 2- tier.

C. Locker Arrangement: 3- tier.

D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet as follows:
   1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch (0.61-mm) nominal thickness, with single bend at sides.
   2. Backs and Sides: 0.024-inch (0.61-mm) nominal thickness, with full-height, double-flanged connections.
   3. Shelves: 0.024-inch (0.61-mm) nominal thickness, with double bend at front and single bend at sides and back.

E. Frames: Channel formed; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral door strike full height on vertical main frames.
   1. Frame Vents: Fabricate face frames with vents.

F. Doors: One piece; fabricated from 0.060-inch (1.52-mm) nominal-thickness steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
   1. Doors less than 12 inches (305 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
   2. Doors for box lockers less than 15 inches (381 mm) wide may be fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet.
   3. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches (381 mm) wide; welded to inner face of doors.

4. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 0.048-inch (1.21-mm) nominal-thickness steel sheet; welded to inner face of doors.

G. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees, self-closing.
1. Continuous Hinges: Manufacturer's standard, steel, full height.

H. Projecting Door Handle and Latch: Finger-lift latch control designed for use with either built-in combination locks or padlocks; positive automatic latching, chromium plated; pry and vandal resistant.
1. Latch Hooks: Equip doors 48 inches (1219 mm) and higher with three latch hooks and doors less than 48 inches (1219 mm) high with two latch hooks; fabricated from 0.105-inch (2.66-mm) nominal-thickness steel sheet; welded or riveted to full-height door strikes; with resilient silencer on each latch hook.
2. Latching Mechanism: Manufacturer's standard, rattle-free latching mechanism and moving components isolated to prevent metal-to-metal contact, and incorporating a prelocking device that allows locker door to be locked while door is open and then closed without unlocking or damaging lock or latching mechanism.

I. Equipment: Equip each metal locker with identification plate and the following unless otherwise indicated:
1. Two single-prong wall hooks bolted to locker back.

J. Accessories:
1. Filler Panels: Fabricated from manufacturer's standard thickness, but not less than 0.036-inch (0.91-mm) nominal-thickness steel sheet.
2. Finished End Panels: Fabricated from 0.024-inch (0.61-mm) nominal-thickness steel sheet.

K. Finish: Baked enamel.
1. Color(s): As selected by Architect from manufacturer's full range.

2.2 FABRICATION

A. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.

C. Identification Plates: Manufacturer's standard, etched, embossed, or stamped aluminum plates, with numbers and letters at least 3/8 inch (9 mm) high. Contact Architect for numbering sequence.

D. Continuous Base: Formed into channel or zee profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.

E. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

F. Finished End Panels: Designed for concealing unused penetrations and fasteners, except for perimeter fasteners, at exposed ends of nonrecessed metal lockers; finished to match lockers.
   1. Provide one-piece panels for double-row (back-to-back) locker ends.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.
   1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
   2. Anchor single rows of metal lockers to walls near top and bottom of lockers.
   3. Anchor back-to-back metal lockers to floor.

B. Knocked-Down Metal Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
   1. Attach door locks on doors using security-type fasteners.
   2. Identification Plates: Identify metal lockers with identification indicated on Drawings.
      a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
      b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.
   3. Attach filler panels with concealed fasteners. Locate filler panels where indicated on Drawings.
   4. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 11 40 00 - FOODSERVICE EQUIPMENT

PART ONE - GENERAL

1.1 DESCRIPTION

A. The work shall be in accordance with all Contract Documents and shall include miscellaneous work and material which is reasonably inferred and necessary for completion. Make minor changes in equipment location as directed by the Owner or his representative.

B. Provide a knowledgeable and competent jobsite foreman to coordinate with applicable trades for all plumbing, electrical and HVAC rough-ins, wall openings, floor depressions, floor pitches, and equipment curbs and pads.

C. Verify available utility services and provide equipment accordingly. Verify rough-in locations and advise Owner's representative of any discrepancies prior to pouring of floors or closing of walls. Verify all plumbing, electrical and HVAC requirements of new, existing and purveyor-furnished foodservice equipment. Verify all field dimensions and existing equipment dimensions.

1.2 RELATED WORK BY OTHER CONTRACTORS

A. GENERAL CONTRACTOR (GC)

1. Provide transit-level recesses for walk-in cooler/freezer floors and other depressions as indicated on the Drawings. Provide quarry tile or other flooring material and base inside and outside walk-in coolers and freezers as shown on the Section 11 40 00 Drawings. Provide slab insulation, concrete wearing floors and setting beds.

2. Provide core drilling and sleeves in floors, wall sleeves, concrete equipment pads and roof curbs with pitch pockets for refrigeration system components.

3. Provide concealed wall backing of size and type and at locations indicated on shop drawings submitted by the Food Service Contractor (FSC).

B. PLUMBING CONTRACTOR (PC)

1. Provide rough-in and final connections of all plumbing services. Flush all lines of foreign matter before connecting fixtures.

2. Provide all water supply and drain lines, drain fittings, floor drains, valves, traps, tailpieces and pressure reducing valves back flow prevention valves; grease traps; and PVC conduit for refrigeration lines, unless indicated in the Plumbing Schedule as furnished by the FSC.

3. Install all faucets, spray units, lever drains, vacuum breakers, check valves, flow control valves, water inlets, traps, filters, strainers, PRV valves, T/P gauges, gas valves, gas hoses, gas pressure regulators, etc., furnished by the FSC. Exposed piping and fixtures shall not show tool marks. Horizontal piping shall be a minimum of 6" AFF.

4. Provide walk-in cooler and freezer copper condensate line piping, trapped outside the cold rooms and installed per prevailing codes.

5. Make connections between sections of modular equipment such as exhaust hoods, and warewashing machines.

C. ELECTRICAL CONTRACTOR (EC)

1. Provide rough-in and final connections of all electrical services. Install electrical devices furnished by FSC and indicated on Electrical Schedule. Wet areas such as sinks, disposers or dishwashers shall be wired in Sealtite Type EF conduit or equal, thru water-proof boxes.

2. Provide receptacles, conduit, contactors, controllers, switches, disconnects, starters, etc., unless indicated in the Electrical Schedule as furnished by the FSC.

3. Where shunt trips are indicated on the Electrical Schedule provide shunt trips and/or contactors with 120V coils with contact ratings matching the electrical appliance or device. Wire from the micro switch relay on the fire control system head to the contactors/shunt trips.

4. Make electrical connections between sections of modular equipment such as utility distribution systems, exhaust hoods, refrigeration systems or walk-in coolers and freezers.

D. HVAC CONTRACTOR (HC)

1. Provide rough-in and final connections of all HVAC services.

2. Provide ducts, fans, dampers, starters, etc., necessary for operation of grease extracting exhaust hoods, condensate hoods, and ventilator stacks.

3. Provide looped gas supply lines, gas pressure reducing and regulating valves for pressure above 14" W.C., gas shut-off valves (except for gas fire/fuel shut-off solenoid valves)

1.3 QUALITY ASSURANCE

A. Comply with all federal, state and local laws and regulations governing materials, installation, health, safety, fire, HVAC and electrical requirements within the applicable jurisdiction.

B. Comply with Standards of ADA, AGA, ASHRAE, ASME, NEMA, NEC, NFPA #17A, 54, 70, and 96, NSF, OSHA and UL.

C. All principal items of equipment shall bear the NSF seal.

D. Use UL Listed electrical components and include UL labels.

E. When the Contract Documents call for higher standards or larger sizes than the regulations, the Contract Documents shall govern. When the regulations require higher standards or larger sizes than the Contract Documents, the regulations shall govern. Rulings and interpretations of the enforcing agencies shall be considered a part of the regulations. No additional amounts shall be paid for such compliance.

F. If, because of jurisdictional trade agreements or other conditions, any work specified in the Contract Documents must be done by others, sublet such work only to those who are qualified to do such work or make other arrangements at the expense of the FSC, subject to approval by the Architect.

1.4 GUARANTEE

A. Equipment provided under this Contract shall be guaranteed for parts and labor for a period of one (1) calendar year from date of acceptance by the Owner as determined by the Owner and Architect. Any parts requiring replacement due to defective material or workmanship during this period shall be promptly replaced with new parts and installed at no cost to Owner.

B. Equipment shall be serviced within a reasonable time by a competent and factory-trained local service agency. When an equipment breakdown occurs, service shall be performed within 24 hours of the request. If the necessary repairs or replacements are not made promptly, the Owner may have the necessary repairs and replacements made and charge the costs to the FSC.

C. Condensing units shall be further warranted on a pro rata basis for an additional four years, exclusive of labor. Refrigeration warranties shall include replacement of refrigerant caused by a fault or leak in the system.

1.5 SUBMITTALS

A. Submit shop and rough-in drawings, schedules and six buy-out brochure manuals within 30 days of award of contract or as required by the Architect. Submit each page for review in quantities required by the Architect.

B. Electronic shop drawings and rough-in drawings, when required by the Architect shall be in AutoCAD or AutoCAD compatible format and buy-out books shall be in Word or PDF format. Architect or GC shall forward to the Foodservice Consultant all buy-out manuals and all drawings for review. Drawings shall be sent rolled up and in a tube. Buy-out manuals shall be assembled in hard-cover three-ring binders. Corrected brochure manuals and drawings will be returned by the Foodservice Consultant for revisions by the FSC. Repeat until all corrections are satisfactorily made.

C. When drawings are approved, submit assembled sets of prints in quantity required by the Architect.

D. When manuals are approved submit assembled brochures in quantity required by the Architect. Provide a numbered cover sheet for each Item that includes a copy of the Specification for that Item. Manuals are to indicate accessories and components used with each Item. Cross out models or accessories shown on catalog sheets but not required by the Specifications.

E. Drawings shall include:

1. Itemized plumbing, electrical and HVAC requirement schedules showing quantities, all required services, sizes and all accessories furnished by the FSC for installation by the applicable trades.

2. Plumbing, electrical and HVAC rough-in plans in 1/4" scale. Rough-in Drawings included with the Contract Documents may be used only with the written permission of the Foodservice Consultant. When such drawings are used it shall be the responsibility of the FSC to verify all dimensions and plumbing, electrical and HVAC services and prevailing codes as they relate to this Project and to show any required changes on the documents submitted for approval. Rough-in plans may be combined on one sheet only with permission of the Foodservice Consultant. Plans are to show location, elevation, size and type of water supplies, drains, gas lines, floor drains, site drains, electrical supplies, outlets, switches, etc. Rough-in dimensions shall be located from readily identifiable column centers and finished walls as drawn by the Architect. Include on each drawing page a legend of commonly used symbols and abbreviations.

3. Floor recesses, trenches, refrigeration lines, refrigeration conduit, concealed wall blocking, pass-thru openings, etc., in 1/4" to 3/4" scale.

4. Owner's existing equipment, Owner-furnished equipment, future equipment and purveyor-furnished equipment such as beverage machines, when indicated in the Contract Documents.

5. Plans, elevations, sections and details for all custom fabricated items, exhaust hoods, walk-in coolers and freezers, etc.

6. Submit shop drawings showing plans, elevations and details for all custom fabricated items in minimum 3/4" scale. Detailed sections shall be 1 1/2" scale or larger. Shop drawing paper size shall be a minimum of 24" x 36".

F. When approved drawings and buy-out brochures are received by the Owner and Architect, fabrication may begin. The approvals shall not relieve the FSC of responsibility for conformance with the Contract Documents unless written approval of change is obtained from the Owner or the Owner's representative.

G. Prior to demonstration and final inspection submit three copies of operation and maintenance manuals to Architect or GC for approval. Manuals shall be in hard cover three-ring binders and shall include replacement parts lists and a typewritten sheet listing names, addresses and phone numbers of all service agencies to be involved, with reference to the names and item numbers of the pieces of equipment each services. Provide a typewritten index sheet showing, in numerical order, the item numbers and corresponding model and serial number for each piece of equipment. Provide a cover sheet listing the name, address and phone number of the Architect, FSC and the Food Service Consultant.

H. Should the contract for foodservice equipment be awarded after the plumbing, electrical and HVAC services have been roughed-in, verify the locations of all such services, sleeves, depressions, etc., and incorporate them in the drawings. If the inspection reveals that the existing conditions seriously interfere with the execution of the Work, report these conditions to the Architect and await instructions before proceeding with that portion of the drawings.

1.6 PRODUCT STORAGE, DELIVERY AND HANDLING

A. All shipping, storage and delivery costs for equipment furnished by the FSC shall accrue to the FSC.

B. Do not deliver equipment until authorized by the GC. Verify storage areas with the GC prior to delivery. Verify delivery route and building access prior to fabrication or installation.

C. Equipment shall be wrapped and crated at the factory and shall be delivered in undamaged condition. FSC shall be responsible for loss or damage to equipment until final inspection and acceptance by the Owner. Store all equipment and materials in such a manner as to prevent damage due to moisture, foreign material and impact.

PART TWO - PRODUCTS

2.0 GENERAL

A. All equipment shall be manufacturer's latest model. An item of equipment specified by model number shall include all accessories the manufacturer includes as standard with the equipment as well as specified optional accessories.

B. The manufacturing facilities used for custom fabricated equipment shall at all times be accessible for the Architect and Consultant to inspect the materials and general construction and progress of the Work.

2.1 CUSTOM FABRICATION

A. All custom fabricated equipment as described in the Item Specifications shall be of uniform design and finish and shall be fabricated by one manufacturer.

B. Stainless steel shall be 18-8 Type 304, ASTM Specification A167, #4 finish, ASTM Specification A480. Sheets shall be free of warps, buckles, pits and scratches. Galvanized steel shall meet ASTM Standard A446. All edges, corners and welds shall be ground and polished smooth. Unless specified otherwise the following metal gauges shall be used:

10 gauge:	Gusset plates.
12 gauge:	Hardware reinforcement, channels.
14 gauge:	Table tops, sinks, splash shields, drainboards, slanting rackshelves and shelf brackets.
16 gauge:	Undershelves, overshelves, wall shelves, drawer fronts and access panels, double pan doors.
18 gauge:	Cabinet bodies, drawer pans, skirts, closure panels, trim strips, exhaust hoods.

C. Standard table top edges shall be turned down square 1 1/4" with 1/4" turn back angled downward 15 degrees.

D. Reinforce tops with welded galvanized or S/S U-channels, closed welded hat channels or painted angle iron, lengthwise and with crossbraces 30" O.C. minimum and at each pair of legs. Intersections of channels shall be fully welded. Tack welding of channel intersections will not be accepted.

E. Standard backsplashes shall be 10" high with 2" return to wall on 45 degree and then down 1/2" at rear. Ends shall be closed and welded. Cove the intersections of all back and endsplashes and raised rolled rims on tables, dishtables and drainboards a minimum of 3/4", horizontally and vertically.

F. Fasten tops to bases with studs welded to underside and capped with locking chrome acorn nuts. No exposed bolt or stud threads will be permitted on fabricated equipment.

G. Enclosed and semi-enclosed cabinet bases shall have flush fully welded mullion facings. Vertical partition dividers shall have #4 finish on both sides. Concealed partitions to be galvanized. Sections and framework behind cabinet doors shall be S/S.

H. Pipe stands and frames shall be fabricated of 1 5/8" O.D. 16 ga. Type 304 S/S tubing with continuously fillet welded cross bracing. Welds shall be ground and polished smooth. Legs to have S/S adjustable feet and S/S enclosed gussets welded to galvanized or S/S channel. Gussets shall be Component Hardware #A18-0206 or equal. Adjustable flanged feet are to be S/S, anchored with S/S fasteners.

I. Doors shall be of welded double pan construction, 3/4" thick, with sound deadening core and channel bracing.

J. Equip hinged doors with Component Hardware #P63-1012 recessed S/S handles and #M21-2580 mechanical catches with spring action nylon rollers. Hinged doors are to have heavy duty S/S lift-off hinges and are to be mounted flush with cabinet body.

K. Equip sliding doors with Component Hardware #62-1010 recessed handles. Sliding doors shall be hung from 14 ga. S/S overhead tracks and shall have bottom guides and nylon rollers. Provide limit device to prevent sliding doors from telescoping.

L. Drawers shall be provided with Component Hardware Series S52 heavy duty slides, 200# load capacity per pair. Install on angle of 1/2" in 12" to provide self-closing operation. Mount slides to an 18 ga. S/S channel-type three-sided housing having an open bottom with two welded S/S channel cross braces. Drawer housings are not to be considered as crossbracing for table tops. Drawer front shall be of 18 ga.

S/S double pan construction with fiberboard insulation between. Each drawer shall have continuous top pull as shown on the Drawings. Drawer pan holder shall be 16 ga. S/S and shall be tack welded to back of drawer front and sealed with silicone. Drawer pans shall be stamped 18 ga. S/S, 20" x 20" x 5" or other sizes as specified and shall be easily removable without the use of tools. Include drawer stops and Component Hardware #Q20-2081 rubber cushion bumpers.

M. Undershelves on open base tables shall be fully welded or removable, as specified. Welded type shall have edges turned down to match table tops. Undershelves of 20" or more in width shall be reinforced with welded S/S or galvanized U-channels or angles, lengthwise and with crossbraces 30" O.C. minimum and at each pair of legs. Intersections of bracing shall be welded as described for table top bracing. Removable shelves shall be sectional with no section larger than 27"x 33" and with edges rolled to conform to the crossbracing and stretchers. Grind and polish all edges and corners of removable shelves.

N. Undershelves in cabinet bodies shall be 16 ga. S/S, formed with the back and ends turned up 1 1/2", coved, welded and sealed to the cabinet body, with front edge and reinforcement as described for open base tables.

O. Table overshelves shall have edges matching that described for table tops. Supports shall be 1 1/4" diameter S/S tubing with nuts welded in bottom of tube and bolted from below. Provide channel under table surface where bolts penetrate. Table overshelves over 12" wide shall have enclosed S/S longitudinal inverted hat channel bracing. Cantilever supports (flags) shall be 14 ga. S/S, welded. Standards passing through an angled backsplash shall be thru close-fitting oval holes. Bolt cantilevered standards to heavy gauge flanges welded to the underside of the table. Standards for splash-mounted overshelves shall be not more than 60" O.C.

P. Wall-mounted shelves shall be similar in construction to table overshelves, supported on 14 ga. S/S brackets.

Q. Sinks shall be 14 ga. S/S with intersections and corners coved a minimum of 3/4". No soldered filleted corners will be accepted. Sinks with two or more compartments shall have fully welded double wall partitions. No evidence of welding shall appear. Trim bands will not be permitted. Provide an 18 ga. S/S apron covering the front of multiple bowl sinks. Crease bottom of sink four ways to recessed drain cup. Backsplash shall be 10" high, of same description as table splashes. Grain of splash shall match grain of rear of bowls. Sink legs, rails, gussets, feet, underbracing and shelves shall be to same specification as tables.

R. Provide brackets for rotary drain handles, attached with welded studs and acorn nuts. Brackets for disposer control switches, control panels and mixing valves shall be fully welded to sink or table or shall be welded to a full depth U-channel which is attached to the sink or table by not less than six spot-welded studs.

S. Drainboards shall be 14 gauge S/S, integrally welded with straight rolled rim at front. Pitch drainboards toward sinks.

T. Hardware and buy-out accessories shall be identified on the shop drawings on a bill of material, subject to approval.

U. Prewiring of electrical items to junction boxes or circuit breaker panels shall comply with UL, NEMA, NEC and prevailing codes.

V. Where U.L. Listed equipment assemblies with electrical circuit breaker panels are specified for custom fabricated equipment, the equipment shall be fabricated in a U.L. Listed shop.

W. Field wiring and U.L. field certification shall not be acceptable. Identify all circuits by typewritten index. Provide all panel spaces with breakers or dummies.

X. Internal wiring specified for custom fabricated equipment shall be identified with tags indicating item number and electrical characteristics. Furnish wiring diagrams. Wiring shall run in rigid conduit, zinc coated where concealed and chrome or S/S where exposed. Wire wet areas in Sealtite Type EF conduit or equal. Provide conduit raceways where possible. NEMA #4 standards shall apply to all splash areas. Final connections by EC.

Y. Exposed junction boxes for switches and receptacles shall be S/S or cast aluminum Bell boxes and shall be furnished with S/S cover plates. Provide NEMA #4 water-proof boxes for wet areas.

2.2 REFRIGERATION SYSTEMS – NONE REQUIRED

2.3 COLD STORAGE ROOMS – NONE REQUIRED

2.4 ARCHITECTURAL WOODWORK – MUST MEET ARCHITECTURAL SPECIFICATION SECTION 06 40 23 REQUIREMENTS

2.5 EQUIPMENT SCHEDULE

Meadowood Neighborhood Center
Madison, Wisconsin

NOTE 1: Rough-in drawings for this project have been prepared by Stewart Design Associates, Inc. It shall be the responsibility of the Food Service Contractor (FSC) to verify all dimensions, plumbing and electrical services and prevailing codes as they relate to this Project and to show any required changes on the documents submitted for approval.

NOTE 2: Where model numbers or multiple names of equipment manufacturers are given in this Specification the equipment manufactured by the first-named manufacturer shall provide the design, material and performance standards upon which acceptance of the equipment shall be based. Please add SYS ID #S115 to each model number as consultant contact reference for manufacturerer.

NOTE 3: Approved fabricators of custom fabricated S/S equipment for this Project are:

BEST-WAY FABRICATING, INC.
603 19th Avenue NE
P.O. Box 187
St. Joseph, MN 56374
320-363-4600 (Phone)
1-800-896-5564

NATIONWIDE FABRICATION, INC.
5311 Niagara St.
Commerce City, CO 80022
303-853-0107 (Phone)
303-853-0114 (Fax)

EMJAC INDUSTRIES, INC.
1075 Hialeah, Florida 33010
888-767-8339 (Phone)
305-883-2319 (Fax)

INSTITUTIONAL EQUIPMENT, INC.

704 Veterans Parkway, Unit B
Bolingbrook, IL 60440-5094
630-771-0990 (Phone)
630-771-0994 (Fax)

TWO RIVERS ENTERPRISES
490 River Street West
Holding, MN 56340
(320) 746-3156 (phone)
(320) 746-3158 (fax)

SERVCO
3189 Jamieson Avenue
St. Louis, MO 63139-2519
(314) 781-3189 (phone)
(314) 645-700

AMERICAN CREATIVE SOLUTIONS
435 East Main Street
Savannah, TN, 38372
(877) 925-4406 (phone)
(731)-925-3209 (fax)

ITEM SPECIFICATIONS

ITEM 1 WORKTABLE WITH PREPARATION SINKS
Designed by architect and provided by millwork contractor.

ITEM 2 RANGE WITH CONVECTION OVEN
One required
Vulcan
One Endurance model 36C-6B-N with fully mig welded chassis, lift off burner heads, stainless steel high riser with lift off shelf and with the following accessories:

A. Heavy duty locking casters
B. One each T&S model HG-4D-48-SK flexible gas hose with quick disconnect and swivels on each end.

ITEM 3 EXHAUST HOOD
One required
Halton or approved equal model;
One Model KVE Capture Jet exhaust hood, 4'-6" x 4'-0" x 2'-0" high, with S/S grease extractor filters as shown in the drawings. Include heat sensor mounted in hood to meet IMC 507.2.1.1. Filters shall be removable by use of a S/S tool with S/S handle. No fastening devices permitted for the filters. Ventilator shall be all S/S, not less than 18 gauge type 304 with #3 finish on exposed surfaces. Unit to include Capture Jet fans with transitions and speed controls. No galvanized metal will be permitted. Provide two U.L. Listed LED vapor-proof lights, factory pre-wired to a single connection point. "J" box located in the hood. Hood fan control and light switch location shall be located as shown in the foodservice electrical rough-in drawings. Trim the area between the top of the hood and the finished ceiling with matching S/S. No exposed fasteners permitted. Bottom of hood to be 80" AFF and hood must include S/S trim or off-set 18" from combustibles or 3" from limited combustibles.

NOTE: Approvals shall include NSF seal, U.L. Listing and stamped/sealed engineering and calculations drawings for all exhaust hoods. The drawings must be stamped/sealed by licensed mechanical engineer with-in the state of the installation.

The ventilator shall conform to the requirements of NFPA-96 and prevailing code.

Provide testing and balancing of hood by authorized factory-trained personnel after all other HVAC systems and cooking equipment are operational. A written report is to be completed by the technician and the Owner and submitted to the Architect with copies to Foodservice Consultant.

ITEM 4 FIRE SUPPRESSION SYSTEM
One required
Ansul
One Model R-102 wet chemical system with stainless steel mounting enclosure, hood, duct and surface protection for Items 2 and 3. Provide gas fire/fuel mechanical shut-off valve to PC for installation. Shunt trip breakers for Items shall be furnished and installed by the EC.

ITEM 5 WORKTABLE
Designed by architect and provided by millwork contractor.

ITEM 6 RESIDENTIAL REFRIGERATOR
Provided by owner.

ITEM 7 MOBILE CART
One required
Lakeside or Focus Foodservice equal
One Model 422.

ITEM 8 MOBILE WORKTABLES
Two required
Fabricate
Two counters with base structure constructed of 2" square welded S/S tubing with full undershelf as shown on the Drawings. All countertop materials and decorative panels shall match Architects interiors selection and design style. The top shall be in Architect approved solid surface material with 3/4" Type D3 exterior grade plywood substrate and backer sheet. Front panels to be plastic laminate on Type D3 exterior grade plywood substrate with matching laminated edges and with backer sheet. No exposed anchors for the face panels shall be accepted. All laminate panels are to be attached from inside the counter and easily detachable for service work or future modification. Provide S/S flanges welded to the support structure to which the panels mount. Provide four Colson #22.0567.95 TotalLock swivel stem casters, or Jarvis equal. The caster locking device shall lock both the swivel action and the caster rotation with a single thermoplastic brake lever. Include two drawers and three 115/1 20 amp duplex receptacles enclosed in a S/S or cast aluminum Bell box, mounted to a S/S bracket below the table surface and provided with a S/S cover plate. Include plug and cordset of adequate length to reach outlet locations as shown in the rough-in drawings. FEC to coordinate cordset and plug with EC.

ITEM 9 OPEN NUMBER

ITEM 10 HAND SINK, BY PC
Provided by PC.

ITEM 11 DRY STORAGE SHELVING
One unit required
InterMetro, Focus or Eagle approved equal
One unit, consisting of the following:
A. Five each 2136BR shelves.
B. Four each 63UP posts.
C. Four each 5MP casters.

ITEM 12 REACH-IN COOLER
One required
True or approved equal model
One Model T-49 with the following accessories:
A. Full-doors hinged as shown on Drawings.
B. A total of four shelves per section.
C. Locking casters

ITEM 13 REACH-IN FREEZER
One required
True or approved equal model
One Model T-23F with the following accessories:
A. Full doors hinged as shown on Drawings.
B. A total of four shelves per section.
C. Locking casters.

ITEM 14 OPEN NUMBER

ITEM 15 POT AND PAN SINKS
One required
Fabricate
One utensil sink as shown on the Drawings. Include the following:
A. Welded disposer collar and disposer control bracket.
B. Partial undershelf, as shown on the Drawings.
C. 10" high backsplash and endsplash.
D. Four 20" x 28" x 12" deep sinks.
E. Three 2" rotary lever drains.
F. Two T&S B-290 faucet with aerator.
G. Pre-cut holes for faucets, pre-rinse spray and vacuum breaker.
H. One S/S 12" X 60" wall shelf.
I. One S/S pot and pan rack as shown in the drawings.

ITEM 16 PRE-RINSE SPRAY ASSEMBLY
One required
T&S Brass & Bronze
One T&S Model B-0287-109 Big Flo pre-rinse spray assembly with faucet with 12" spout.

ITEM 17 DISPOSER
One required
In-Sink-Erator or Salvajor approved equal model:
One Model SS-150-7 short-body disposer with solenoid valve, manual reversing switch and flow control valve. Include T&S Model B-455 chrome vacuum breaker assembly for mounting on the slope of the backsplash. Provide a cast iron waste outlet in lieu of the standard PVC outlet.

ITEM 18 UNDERCOUNTER DISHWASHER
One required
Hobart
One Model LXe-R hi-temperature undercounter dishwasher, include the following:
A. Detergent and rinse aid pumps.
B. 70 deg. rise booster heater with only cold water connection.
C. Power cord kit.
D. Drain water tempering kit.
E. Energy recovery system.

F. Steam elimination system.
G. Adjustable wash cycles.
H. ADA compliant.

PART THREE - EXECUTION

3.1 GENERAL

A. Furnish to appropriate trades at a sufficiently early date all floor troughs or other equipment and accessories to be installed by that trade.

B. All plumbing and electrical and HVAC components scheduled to be installed by separate trades shall be tagged with item numbers and given to those trades. Obtain a receipt for same.

C. Any existing equipment scheduled to be re-used or disposed of shall be disconnected by the appropriate trade. Relocate and install those items according to instructions given for new equipment and in accordance with instructions given in the Equipment Schedule.

D. Remove crating and rubbish on a daily basis. Verify with GC on availability of on-site trash disposal area.

E. Protect all new and relocated foodservice equipment from damage until final acceptance by the Owner.

3.2 INSTALLATION

A. Provide a competent foreman to direct the Work and to advise counsel other trades regarding proper installation and connection of the equipment, per manufacturer's instructions. Assist trades in temporary relocation of equipment as required to make connections. Instruct trades on equipment manufacturer's connection details. Align and level equipment as connections are completed.

B. Set and level all non-mobile equipment to the correct height and anchor where indicated and/or required for secure installation. Use concealed anchors wherever possible. Anchors are to be noncorrosive and of adequate size for the Work. Align adjoining pieces of equipment for flush fit wherever applicable.

C. Cut holes in foodservice equipment for fixtures, conduit, receptacles, cords, pipes and ducts. Provide sleeves or ferrules, etc.

D. All permanent equipment installed against walls, floors, ceilings or other equipment shall be sealed to same with clear food-grade silicone sealant. Sealant is to be applied smoothly and in a concave shape, forming an air-tight and waterproof barrier.

E. Install trim strips with mastic. Use S/S machine screws or other noncorrosive fasteners when the use of mastic is not adequate. Trim strips at the top of backsplashes will not be permitted. Equipment must fit walls to within 1/4". Equipment installed in or through walls shall be trimmed to same with trim of same material and finish as the equipment. Rivets may not be used as fasteners on custom fabricated equipment.

F. Field joints in S/S shall be made by welding. Welding shall be by electric method and shall be made with a welding rod of the same composition as the sheets or parts being welded. Welds shall be complete welds, strong and ductile, with excess metal ground off and joints finished smooth to match adjoining surfaces. Welds shall be free of mechanical imperfections, such as gas holes, depressions, pits, runs and cracks, and shall have the same color as adjoining sheet surfaces. Joints shall be continuously welded so that the fixtures appear as one-piece construction. Butt welds made by spot welding straps under seams, filling in the void with solder and finishing by grinding are not acceptable.

G. Spot welds shall have a maximum spacing between welds of 3". Tack welds shall have at least 1/4" length of welding material at a maximum spacing of 4". Welds at the ends of channel battens shall not exceed 2" centers. Recoat galvanized members that have been cut, welded or damaged.

H. Wherever break bends occur, they shall be free of undue extrudence and any marks shall be removed by grinding and polishing. Sheared edges shall be free of burrs or irregular projections and shall be finished to eliminate danger of cutting or laceration.

I. Grain of polishing shall run in the same direction on all horizontal and on all vertical surfaces of each item of fabricated equipment. Where table or sink tops join at right angles, the finish shall terminate in a mitered edge.

3.2 ELECTRICAL REQUIREMENTS

A. Comply with standards of NEC, UL and NEMA and with the requirements of the prevailing code authority.

B. Provide attached cordsets where cords are indicated on the foodservice Electrical Schedule. Cordsets are to be neoprene, of adequate length. EC to match receptacle to cap.

3.3 PLUMBING REQUIREMENTS

A. All plumbing work shall be in accordance with prevailing codes and regulations.

B. Furnish to the PC for installation all control valves, valve-type wastes, vacuum breakers, pressure reducing valves, check valves, solenoid valves, water filters, etc., as indicated in the Section 11 40 00 Contract Documents. Furnish gas pressure regulators for all foodservice equipment requiring pressures below 14" W.C.

C. Furnish chrome piping and chrome angled flanged fittings where vacuum breakers extend above backsplash. Installation by PC.

D. Flexible gas lines shall have a detachable S/S restraining cable, securely attached to the wall or floor and the equipment, of such length as to prevent undue stress on the flexible gas line or connection.

3.4 HVAC REQUIREMENTS

A. All HVAC work shall be in accordance with prevailing codes and regulations.

B. Cut exhaust duct openings in ventilators in coordination with the HC.

3.5 REFRIGERATION REQUIREMENTS – NONE REQUIRED

3.5 FIRE SYSTEMS

A. Fire systems shall conform to NFPA Pamphlets 17A and 96, U.L. 300 and rulings of authorities having local jurisdiction.

B. Systems shall provide hood, duct and surface protection. Piping shall be concealed wherever possible. Exposed piping shall be Type 304 18-8 S/S or chrome plated.

C. Furnish required size gas fire/fuel shut-off valve to PC for installation. Furnish control head microswitch for electrical equipment requiring surface protection. Shunt trip breakers shall be provided by the EC.

D. Include first year semi-annual checkout.

3.6 CLEANING

A. When installation is complete, remove all tape from the equipment and all debris from the work areas and leave the facility broom clean. Equipment shall be left with scratches buffed out and any painted surface damage touched-up. Replace work that cannot be properly restored. Equipment is to be left free of dirt and reasonably free of dust. Final cleaning and sanitizing is to be done by Owner.

PART FOUR - UTILIZATION

4.1 COMMISSIONING

A. Equipment shall be started and tested by factory-authorized service agencies.

B. Lubricate, start-up, test and adjust equipment prior to Owner's inspection and demonstration. Repair or replace equipment that is not fully operational or is noisy or vibrating. When cleaning and testing and adjusting is complete, notify Architect in writing.

4.2 OPERATION AND USE

A. When cleaning, testing and adjusting have been completed and operation and maintenance manuals approved, arrange for demonstration times at Owner's convenience but during normal working hours. Demonstrations shall be done by competent, trained personnel, thoroughly familiar with the operation, techniques of usage, capacities and maintenance of the equipment.

B. The FSC contract representative for this Project shall be present at all equipment demonstrations.

C. Furnish all warranty cards and advise Owner to complete and file the registrations. Demonstration and instruction may take up to two full days.

END OF SECTION 11 40 00

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SECTION 115116 - LIBRARY SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY OF WORK.

A. Section Includes:
   1. Book Depositories - Interior and Exterior.

1.3 SUBMITTALS

A. Product Data: Material data for each product specified.

B. Shop Drawings: Full-scale details to indicate special joint or termination conditions and conditions of interface with other materials.

C. Quality Control Submittals.
   1. Manufacturer's Instructions: Inspection, preparation and installation instructions.

D. Contract Closeout Submittals.
   1. Operation and Maintenance Data. Provide schedule of and instructions for inspection and routine maintenance procedures.
   2. Warranty.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and or mixing with other components.

1.5 PROJECT/SITE CONDITIONS.

A. Field measurements.
   1. Field verify locations and dimensions of items critical to the design, fit or assembly of the work of this section. Complete field dimensioning prior to fabrication of components.
   2. Verify that field measurements are as indicated on shop drawings.

1.6 WARRANTY

A. General Warranty: Warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. General Warranty:
   1. Provide written 12-month warranty against all material and labor defects in the installed system and components.
   2. Warranty period shall commence on the date of Substantial Completion.

PART 2 - PRODUCTS.

2.1 MANUFACTURERS.

A. Book Depositories:
   1. Products of Kingsley Equipment Company, Pomona, CA are used as a reference.
   2. Stainless Steel type 304 with silk screen letters.

Code	Manufacturer	Product	Options	Wording
EBD-1	Kingsley	10-8800	Provide thick wall kit	Books
EBD-2	Kingsley	10-8800	Provide thick wall kit	Media
IBD-1	Kingsley	10-8100	Provide thick wall kit	Books
IBD-2	Kingsley	10-8100	Provide thick wall kit	Media

PART 3 - EXECUTION

3.1 INSTALLATION.

A. Install in accordance with manufacturer's instructions.

B. Install equipment plumb and true.

C. Conceal fastenings where exposed to view.

D. Fit trim cover pieces accurately and tight to adjacent construction.

3.2 CLEANING

A. Repair damaged and defective work, where possible, to eliminate functional and visual defects; where not possible to repair, replace work. Adjust for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Protect installed work from subsequent operations.

END OF SECTION 115116

SECTION 122113 - HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Horizontal louver blinds with aluminum slats.
   2. Locations: As shown on drawings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for horizontal louver blinds.

C. Samples: For each exposed product and for each color and texture specified.

PART 2 - PRODUCTS

2.1 HORIZONTAL LOUVER BLINDS

A. Subject to compliance with requirements, provide comparable product by one of the following:
   1. Hunter Douglas Contract.
   2. Levolor Contract; a Newell Rubbermaid company.
   3. Springs Window Fashions.

B. Aluminum Slats:
   1. 1 inch (25 mm) wide and not less than 0.006 inch thick.

C. Headrail:
   1. Manual Lift Mechanism:
      a. Lift-Cord Lock: Variable; stops lift cord at user-selected position within blind full operating range
      b. Operator: Extension of lift cord(s) through lift-cord lock mechanism to form cord pull.
   2. Manual Tilt Mechanism: Enclosed worm-gear mechanism and linkage rod that adjusts ladders.
      a. Tilt: Full, one direction, positive stop or lockout limited at an angle of 80 degrees from horizontal.
      b. Operator: Clear-plastic wand.
   3. Manual Lift-Operator and Tilt-Operator Lengths: Manufacturer's standard.

D. Bottom Rail: Matching slats.
   1. Type: Manufacturer's standard.

E. Ladders: Braided cord.

F. Valance: Manufacturer's standard.

G. Mounting Brackets: With spacers and shims required for blind placement and alignment indicated.
   1. Type: Overhead
   2. Intermediate Support: Provide intermediate support brackets to produce support spacing recommended by blind manufacturer for weight and size of blind.

H. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard.

I. Colors, Textures, Patterns, and Gloss:
   1. Slats: As selected by Architect from manufacturer's full range.
   2. Components: Provide rails, cords, ladders, and materials exposed to view matching or coordinating with slat color.

2.2 HORIZONTAL LOUVER BLIND FABRICATION

A. Product Safety Standard: Fabricate horizontal louver blinds to comply with WCMA A 100.1 including requirements for corded, flexible, looped devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F (23 deg C):
   1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which blind is installed less 1/4 inch (6 mm) per side or 1/2 inch (13 mm) total, plus or minus 1/8 inch (3.1 mm). Length equal to head-to-sill dimension of opening in which blind is installed less 1/4 inch (6 mm), plus or minus 1/8 inch (3.1 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Install horizontal louver blinds level and plumb, aligned and centered on openings, and aligned with adjacent units according to manufacturer's written instructions.
   1. Locate so exterior slat edges are not closer than 1 inch (25 mm)] from interior faces of glass and not closer than 1/2 inch (13 mm) from interior faces of glazing frames through full operating ranges of blinds.
   2. Install mounting and intermediate brackets to prevent deflection of headrails.
   3. Install with clearances that prevent interference with adjacent blinds, adjacent construction, and operating hardware of glazed openings, other window treatments, and similar building components and furnishings.

C. Adjust horizontal louver blinds to operate free of binding or malfunction through full operating ranges.

D. Clean horizontal louver blind surfaces after installation according to manufacturer's written instructions.

E. END OF SECTION 122113

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SECTION 124813 - ENTRANCE FLOOR MATS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Resilient-tile entrance mats (WM-1).

1.3 COORDINATION

A. Coordinate size and location of mats.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for floor mats and frames.

B. Shop Drawings:

1. Items penetrating floor mats and frames, including door control devices.

C. Samples: For the following products, in manufacturer's standard sizes:

1. Floor Mat: Assembled sections of floor mat.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For floor mats and frames to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient-Tile Entrance Mats: Full-size tile units equal to 2 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 ENTRANCE FLOOR MATS AND FRAMES, GENERAL

A. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1.

2.2 TILE ENTRANCE MATS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Bolyu; Access Floor Tile or comparable product by one of the following:

1. American Floor Products Company, Inc.
2. American Mat & Rubber Company.
3. Cactus Mat Mfg. Co.
4. Consolidated Plastics Company, Inc.
5. Durable Corporation.
6. Flexco.
7. Mats Inc.
8. Musson Rubber Company.
9. Pawling Corporation; Architectural Products Division.
10. Tennessee Mat Company, Inc.
11. Turtle Plastics.

B. Carpet-Type Tiles: Textured loop, solution, dyed, nylon carpet bonded to 1/8- to 1/4-inch-thick, flexible non-woven backing to form mats 3/8 or 7/16 inch thick with nonraveling edges.

1. Colors, Textures, and Patterns: As selected by Architect from full range of industry colors.
2. Tile Size: 24-inches x 24-inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, sizes, and other conditions affecting installation of floor mats and frames.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install surface-type units to comply with manufacturer's written instructions at locations indicated; coordinate with entrance locations and traffic patterns.

END OF SECTION 124813

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SECTION 210500 – COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. It is the intent of these specifications to provide complete and workable fire suppression systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable fire protection systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment specification may not deal individually with minute items required, such as components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.2 SECTION INCLUDES

A. This section includes information common to two or more technical fire suppression specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Design Criteria
5. Guarantee
6. Operation And Maintenance Instructions
7. Record Documents
8. Protection Of Finished Surfaces
9. Sealing And Firestopping
10. Off Site Storage
11. Regulatory Requirements
12. Certificates And Inspections
13. Coordination
14. Request And Certification For Payment
15. Sleeves And Openings
16. Omissions
17. Definitions
18. Project/Site Conditions
19. Work Sequence And Scheduling
20. Training
21. Access Panels And Doors
22. Identification
23. Sleeves And Openings
24. Sealing And Firestopping
25. Concrete Work
26. Cutting And Patching
27. Building Access
28. Equipment Access
29. Coordination
30. Identification
31. Housekeeping And Clean Up

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 21 sections of fire suppression.

1.4 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review.

G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies.

H. Not more than two weeks after award of contract but before any product submittals or shop drawings are submitted, contractor to submit the following fire protection system data sheet. List piping material types, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer and model number. The approved fire suppression system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.

I. Fire Suppression System Data Sheet:

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Hangers & Supports			
Sprinklers			
Valves			
Specialties			
Equipment			

1. Product submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.
2. Submit one (1) sample of each proposed sprinkler type to Architect/Engineer for approval.

3. Submit working plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type occupancy classes hydraulic reference points, design areas and discharge densities per NFPA 13.
4. Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet, detailed work sheets and a graphic representation of the complete hydraulic calculation plotted on semi-exponential graph paper per NFPA 13
5. Submit working plans and hydraulic calculations for automatic sprinkler systems to the Architect/Engineer for approval prior to submittal to the local Fire Department.
6. Submit plan approval application, working plans and hydraulic calculation for automatic sprinkler systems to the owner's insurance underwriter or local AHJ for approval. Submit copy of approval letter from local Fire Department to Architect/Engineer.
7. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:
   a. Operating and Maintenance Manuals — 2 copies
   b. Architect/Engineer — 1 copy
   c. Local Fire Chief or Marshal — 1 copy

1.5 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1.	ANSI	American National Standards Institute
2.	ASME	American Society of Mechanical Engineers
3.	ASTM	American Society for Testing and Materials
4.	AWWA	American Water Works Association
5.	AWS	American Welding Society
6.	EPA	Environmental Protection Agency
7.	FM	FM Global (Factory Mutual Insurance Company)
8.	FS	Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
9.	IEEE	Institute of Electrical and Electronics Engineers
10.	ISA	Instrument Society of America
11.	DSPS	State of Wisconsin, Department of Safety & Professional Services
12.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
13.	NBS	National Bureau of Standards
14.	NEC	National Electric Code
15.	NEMA	National Electrical Manufacturers Association
16.	NFPA	National Fire Protection Association
17.	UL	Underwriters Laboratories Inc.

1.6 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.

3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

1.7 DESIGN CRITERIA

A. Design fire protection systems in accordance with codes, standards and regulations noted above.

B. The fire protection systems consist of:
1. Automatic wet pipe sprinkler systems.
2. Dry upright heads within combustible wood roof truss space due to them being exposed to freezing conditions.

C. Water Demand Requirements:
1. Hydraulically design automatic sprinkler systems for the hydraulically most remote area based on the following:

Occupancy Classification	Area (Sq. Ft.)	Density (GPM/Sq. Ft.)
Overall:		
Ordinary Hazard (Group 1)		
Light Hazard:		
Lobbies, Offices, Toilets, Break Room, etc.	1,500	0.10
Ordinary Hazard (Group 1):		
Collection Areas, Storage Rooms,		

Janitor Closet, Mechanical Rooms	1,500	0.15

Hose Allowance 250 gpm

D. Available water supply data for system design is as follows:
1. Test Date and Time: N/A
2. Performed By: Madison Water Utility

Hydrant Location	Outlet Elevation	Flow GPM	Static Pressure	Residual Pressure
5802 Russett Rd	N/A	1000	50.2	39.4

E. Water test data is preliminary for bidding purposes. Obtain a new flow test for design purposes. Tests shall be representative of high water use periods.

1.8 GUARANTEE

A. Refer to Division 1 for guarantees and warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.9 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for operating and maintenance instructions.

B. In addition to the general content specified under Division 1 supply the following additional documentation:
1. Copies of all approved submittals along with approval letters.
2. Manufacturer's wiring diagrams for electrically powered equipment.
3. Records of tests performed to certify compliance with system requirements.
4. Certificates of inspection by regulatory agencies.
5. Parts lists for equipment and specialties.
6. Manufacturer's installation, operation and maintenance recommendations for equipment and specialties.
7. Valve schedules
8. Lubrication instructions, including list/frequency of lubrication
9. Warranties

10. Copy of NFPA 25 – Standard for Inspection, Testing & Maintenance of Water-Based Fire Protection, latest edition
11. Additional information as indicated in the technical specification sections

1.10 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division, follow the following procedures.
1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
5. Select one of the following two paragraphs depending on who is responsible for final electronic record drawings. This may be decided in our contract with the client.
6. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
7. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

C. In addition to the data indicated in Division 1, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

1.11 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished surfaces.

1.12 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Architect/Owner.

1.13 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Offsite Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.14 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code, Department of Safety & Professional Services, Department of Health Services, NFPA Standards and local Authority Having Jurisdiction (AHJ) regarding design, materials and installation.

1.15 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the authority having jurisdiction over the site.

1.16 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
1. Structure
2. Recessed light fixtures
3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
4. Ductwork and appurtenances
5. Electrical and low voltage cable tray
6. Plumbing vent piping
7. Fire protection (sprinkler system)
8. HVAC piping
9. Gas piping, process piping and domestic water
10. Electrical conduit and low voltage conduit
11. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.

1.17 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.18 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.19 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.20 DEFINITIONS

A. Wherever the words "the Contractor", "this Contractor" or "Fire Protection Contractor" appear in this division, they refer to the Contractor for Fire Protection work.

B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.21 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.22 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.23 TRAINING

A. The contractor shall have the following responsibilities:
   1. Provide a training plan sixty days before the planned training covering the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered (description, duration of discussion, special methods, etc.)
      f. Duration of training on each subject
      g. Instructor for each subject
      h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).
   2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems.
   3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
   4. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
   5. Training shall include:
      a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
      b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions.
      c. Discussion of relevant health and safety issues and concerns.
      d. Discussion of warranties and guarantees.
      e. Common troubleshooting problems and solutions.
      f. Explanatory information included in the O&M manuals.
      g. Discussion of any peculiarities of equipment installation or operation.
      h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.

B. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

C. Provide a minimum of 2 hours of instruction.

D. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings: Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 09 are sufficient; no additional access provisions are required unless specifically indicated.

B. Plaster Walls and Ceilings: 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. Adhesive Labels: Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards.

B. Snap-Around Markers: One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, ¾" min. size for lettering. Provide nylon ties on each end of pipe marker.

C. Signs: Permanently marked weatherproof metal or rigid plastic sign conforming to NFPA 13, secured with corrosion-resistant wire, chain, or other means.
   1. Engraved Name Plates: White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting.

D. Valve Tags: Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1¼" minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem.

2.3 SLEEVES AND OPENINGS

A. General:
   1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping. The entire assembly shall be hot-dip galvanized after fabrication.
   2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

2.4 SEALING AND FIRESTOPPING

A. Fire And/Or Smoke Rated Penetrations:
   1. Manufacturers: 3M, Hilti, STI/SpecSeal, Tremco.
   2. All firestopping systems shall be provided by the same manufacturer.
   3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Authority Having Jurisdiction (AHJ).
   4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
   5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
   6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
   7. All sealants shall meet the intent of VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
   1. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade use urethane caulk in annular space between pipe and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 – EXECUTION

3.1 CONCRETE WORK

A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of piping, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

3.2 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.3 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.4 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Fire Protection Contractor and installed by the General Contractor.

3.5 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.6 IDENTIFICATION

A. Identify interior piping mains 2½" and larger not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location.

B. Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to system risers. Information to include location of the design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

3.7 SLEEVES AND OPENINGS

A. General:
1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
5. Refer to Division 1 for additional information on sleeves and openings.

3.8 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire And/Or Smoke Rated Penetrations:
1. Install approved product in accordance with the manufacturer's instructions where a pipe penetrates a fire/smoke rated surface.
2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support substantial weight.

C. Non-Rated Partitions:
1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe is completely blocked.

3.9 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION 210500

SECTION 210529 - HANGERS AND SUPPORTS FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes specifications for supports of all fire suppression equipment and materials.
   1. Pipe Hangers And Supports
   2. Pipe Hanger Rods
   3. Beam Clamps
   4. Corrosive Atmosphere Coatings

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 210500 – Common Work Results for Fire Suppression

C. Section 211000 – Water-Based Fire-Suppression Systems

D. Division 3 - Concrete

1.3 SUBMITTALS

A. Refer Section 210500 – Common Work Results for Fire Suppression, Submittals. In addition to the general content specified under Section 210500 – Common Work Results for Fire Suppression, supply the following submittals:
   1. Pipe Hangers And Supports
   2. Pipe Hanger Rods
   3. Beam Clamps
   4. Corrosive Atmosphere Coatings

B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service. Provide details on the working drawings submitted for approval with all pertinent information listed.

1.4 REFERENCE STANDARDS

A. MSS SP-58

B. MSS SP-69

C. NFPA 13 Installation of Sprinkler Systems (Latest edition)

D. UL Underwriters' Laboratories Listed.

E. FM FM Global

1.5 QUALITY ASSURANCE

A. Substitution of Materials Refer to Division 1 for equals and substitutions.

1.6 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Materials and application of pipe hangers and supports shall be in accordance with NFPA and be UL/FM listed and approved.

1.7 DESCRIPTION

A. Provide all supporting devices as required for the installation of equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any fire suppression item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring explosive powder actuation will not be accepted.

D. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

PART 2 – PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Cooper/B-Line, Anvil, Pate, Piping Technology, Roof Products & Systems.

B. Hangers for Pipe Sizes 1/2" through 4":
   1. Carbon steel, adjustable swivel ring with 3/8" min. UL/FM approved hanger rods.
   2. Carbon steel, adjustable clevis, standard, with UL/FM approved size hanger rods.

C. Wall Support:
   1. Carbon steel welded bracket with hanger.
   2. Steel channels with pipe clamps.

D. Floor Support:
1. Carbon steel pipe saddle, stand and bolted floor flange.

2.2 PIPE HANGER RODS

A. Steel Hanger Rods:
1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

B. Size rods for individual hangers and trapeze support as indicated in the following schedule.

Pipe Size	Diameter of Rod
4" and Smaller	3/8" or 9.5mm min.
5", 6" and 8"	½" or 12.7mm min.
10" and 12"	5/8" or 15.9mm min.

2.3 BEAM CLAMPS

A. MSS SP-69 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter.

2.4 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:
1. Food service/kitchen areas

PART 3 – EXECUTION

3.1 INSTALLATION

A. Size, apply and install supports in compliance with manufacturer's recommendations.

B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Perform welding in accordance with standards of the American Welding Society.

3.2 HANGER AND SUPPORT SPACING

A. Use hangers with minimum vertical adjustment.

B. Support riser piping independently of connected horizontal piping.

C. Adjust hangers to obtain the slope specified in the piping section of these specifications.

D. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Steel	1" through 1-1/4"	12'-0"	15'-0"
Steel	1-1/2" through 8"	15'-0"	15'-0"

E. Unsupported length from the last hanger and an end sprinkler shall be as follows:
1. 1" piping Not greater than 36"
2. 1-1/4" piping Not greater than 48"
3. 1-1/2" piping or larger Not greater than 60"

END OF SECTION 210529

SECTION 211000 - WATER-BASED FIRE-SUPPRESSION SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section contains specifications for fire suppression pipe, pipe fittings, sprinklers, valves, switches and related items for automatic sprinkler systems in this project.
   1. Fire Protection Piping
   2. Unions and Flanges
   3. Mechanical Grooved Pipe Connections
   4. Sprinklers
   5. Flexible Sprinkler Connections
   6. Switches
   7. Local Alarm Horn/Strobe
   8. Pressure Gauges
   9. Valves
   10. Double Check Backflow Prevention Assembly
   11. Fire Department Connection

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 210500 - Common Work Results for Fire Suppression

C. Section 210529 - Hangers and Supports for Fire-Suppression Piping and Equipment

1.3 SUBMITTALS

A. Refer Section 210500 – Common Work Results For Fire Suppression, Submittals. In addition to the general content specified under Section 210500 – Common Work Results For Fire Suppression, supply the following submittals:
   1. Fire Protection Piping
   2. Unions and Flanges
   3. Mechanical Grooved Pipe Connections
   4. Sprinklers
   5. Flexible Sprinkler Connections
   6. Switches
   7. Local Alarm Horn/Strobe
   8. Pressure Gauges
   9. Valves
   10. Double Check Backflow Prevention Assembly
   11. Alarm Check Valves
   12. Fire Department Connection

B. Schedule from the contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

1.4 REFERENCE STANDARDS

A. ANSI A21.4

B. ANSI A21.11

C. ANSI A21.51

D. ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings

E. ANSI B16.3 Malleable Iron Threaded Fittings

F. ANSI B16.4 Cast Iron Threaded Fittings

G. ANSI B16.5 Pipe Flanges and Flanged Fittings

H. ANSI B16.9 Factory Made Wrought Steel Buttweld Fittings

I. ANSI B16.11 Forged Steel Fittings, Socket Welded and Threaded

J. ANSI B16.18 Cast Bronze Solder Joint Pressure Fittings

K. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

L. ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings-DWV

M. ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

N. ASTM A105 Forgings, Carbon Steel, for Piping Components

O. ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings

P. ASTM A135 Electric Resistance Welded Steel Pipe

Q. ASTM A181 Forgings, Carbon Steel for General Purpose Piping

R. ASTM A234 Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

S. ASTM A536 Ductile Iron Castings

T. ASTM A795 Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use

U. ASTM B88 Seamless Copper Water Tube

V. AWS A5.8 Brazing Filler Metal

W. AWS D10.9 Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3

X. NFPA 13 Installation of Sprinkler Systems. (Latest edition)

Y. UL Underwriters' Laboratories

Z. FM FM Global

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.6 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

C. Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.7 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Storage and protection methods must allow inspection to verify products.

1.8 WELDER QUALIFICATIONS

A. Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

B. The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

PART 2 – PRODUCTS

2.1 FIRE PROTECTION PIPING

A. Steel Pipe:
1. Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.
2. Unscheduled specialty steel pipe is not acceptable.
3. Pipe Wall Thickness: Schedule 40 for welded, rolled groove, cut groove and threaded. Schedule 30 for welded, rolled groove, 8" and larger cut groove and 8" and larger threaded piping. Schedule 10 up to and including 6" for rolled groove and welded.
4. Fittings: 2" and Under - Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless carbon steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ASTM A47 malleable iron or ASTM A53 fabricated steel.
5. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
6. Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used for piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

2.2 UNIONS AND FLANGES

A. 2" and Smaller Steel: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

B. 2-1/2" and Larger: ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

2.3 MECHANICAL GROOVED PIPE CONNECTIONS

A. Manufacturers: Victaulic, Anvil, Star Fittings.

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

C. Couplings and fittings to be malleable iron, ASTM A47 or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

D. Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

E. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

2.4 SPRINKLERS

A. Manufacturers: Grinnell, Reliable, Tyco, Viking

B. Fusible link or glass bulb type, cast brass or bronze construction. Provide sprinklers with minimum nominal ½" discharge orifice.
1. Quick Response Concealed Pendant: White cover plate
2. Quick Response Upright: Brass finish
3. Quick Response Dry Upright: Brass finish

2.5 FLEXIBLE SPRINKLER CONNECTORS

A. Manufacturers: Aqua Flex, Flex Head, Sprinkflex, Viking

B. UL/FM Type 304 stainless steel flexible sprinkler connection, 175 psi rated, braided flexible stainless steel tubing with 1" diameter internal corrugated hose, stainless steel hose nipples, and galvanized steel attachment brackets for use in either suspended or hard ceilings.

2.6 SWITCHES

A. Manufacturers: Potter Electric Signal, System Sensor, Notifier

B. Flow Switches: Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

C. Supervisory Switches for O S & Y gate valve installations: UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

2.7 LOCAL ALARM HORN/STROBE

A. Manufacturers: Potter Electric Signal, Gentex, System Sensor, Simplex, Siemens, Wheelock

B. UL listed multi-tone electric horn and strobe for outdoor use, with red finished housing, white lettering, weatherproof backbox, 12/24 VDC, and electrical characteristics compatible with building alarm system. Potter SASH-24.

2.8 PRESSURE GAUGES

A. Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

B. Cast aluminum, stainless steel or brass case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

2.9 VALVES

A. Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Viking, Watts

B. Gate Valves
1. 2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge.
2. 2½" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge.

C. Butterfly Valves
1. 2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.
2. 2½" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open supervisory/tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached.

D. Check Valves

1. 2" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.
2. 2½" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.
3. Provide ½" automatic drip drain on inlet of fire department connection check valve.

E. Drain valves
1. ¾" min. two or three piece bronze body ball valve with threaded ends, chrome plated bronze ball, glass filled Teflon seat, Teflon packing and threaded packing nut, blowout-proof stem, 400 psig WOG, and capped hose thread outlet.

2.10 DOUBLE CHECK BACKFLOW PREVENTION ASSEMBLY

A. Manufacturers: Conbraco, Febco, Watts, Wilkins

B. ASSE 1015 double check valve assembly with 2 independent spring loaded check valves, 2 isolation ball or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Body constructed of epoxy coated cast iron or stainless steel with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

2.11 FIRE DEPARTMENT CONNECTION

A. Manufacturer: Croker, Elkhart Brass, Potter-Roemer

B. Flush:
1. Cast brass or ductile iron flush fire department inlet, inlet body, swing clappers, pin-lug swivels and caps with chains, 2-1/2" National Standard female hose thread inlets, 4" outlet, polished brass lettered identification backplate.
2. Storz fire department inlet connection with hard coated aluminum body, 5" large diameter hose inlet, 4" (6") NPT outlet and cast brass lettered identification plate.

PART 3 – EXECUTION

3.1 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

B. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of fire protection piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, ceiling grid layout, light fixtures and grilles before installing piping.

C. Where piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

D. Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

E. Maintain piping in clean condition internally during construction.

F. Provide clearance for access to valves and piping specialties.

G. Install piping so that system can be drained. Where possible, slope to main drain valve. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

H. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

I. Do not route piping within exterior walls.

J. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

K. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.2 WELDED PIPE JOINTS

A. Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used only for connections up to one-half (1/2) the diameter of the immediate upstream piping.

3.3 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.4 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

3.5 UNIONS AND FLANGES

A. Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve. Concealed unions, flanges or couplings are not acceptable.

3.6 INSTALLATION OF FIRE SUPPRESSION SYSTEM COMPONENTS

A. Install fire suppression system components in accordance with NFPA, product listings and manufacturer's recommendations. Locate where accessible for servicing and replacement.

B. Sprinkler Heads: Locate sprinklers as indicated on fire protection drawings and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinklers level in locations not subject to spray pattern interference. Provide sprinkler installations below ductwork, soffits, etc.

C. Select sprinkler temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (nominally 165 degrees F.) sprinkler except at skylights, adjacent to diffusers, unit heaters, un-insulated heating pipes or ducts, within electrical rooms, elevator equipment rooms, top of elevator hoistways, mechanical rooms, storage rooms, or where otherwise indicated.

D. Spare Sprinklers: Provide quantity of spare sprinklers as noted below and 1 wrench for each type and temperature range installed. Provide 6 spares per 300 or less installed sprinklers, 12 per 1000 or less and 24 for more than 1000. Provide steel cabinet for storage of sprinklers and wrenches.

E. Pipe riser drains, test connections and auxiliary drains, where required, to building exterior or as indicated on drawings. Discharge to plumbing fixtures is not allowed.

F. Gauges: Provide a valved pressure gauge in main system riser at inlet and outlet of pump and elsewhere as indicated.

G. Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide capped hose thread drain valves to allow draining of each trapped portion of piping.

H. Fire Department Connections: Mount on wall where indicated. Support from structure independent of piping. Locate between 2' to 3' above grade. Fill wall penetration with insulation and caulk exterior and interior face of wall opening weathertight.

3.7 PIPING SYSTEM LEAK TESTS

A. Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

B. Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the owner's project representative.

C. Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

D. Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

E. All pressure tests are to be documented on NFPA contractor's material and test certificate forms.

3.8 CONSTRUCTION VERIFICATION CHECKLISTS

A. Contractor is responsible for utilizing the construction verification checklists supplied under these specifications in accordance with the procedures defined for construction verification checklists.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. It is the intent of these specifications to provide complete and workable plumbing systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, drayage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable plumbing systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.2 SECTION INCLUDES

A. This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Lead Free Requirements
5. Guarantee
6. Operation And Maintenance Instructions
7. Record Documents
8. Protection Of Finished Surfaces
9. Sealing And Firestopping
10. Off Site Storage
11. Regulatory Requirements
12. Certificates And Inspections
13. Coordination
14. Demolition And Existing Requirements
15. Request And Certification For Payment
16. Sleeves And Openings
17. Omissions
18. Definitions
19. Project/Site Conditions
20. Work Sequence And Scheduling
21. Salvage Materials
22. Training
23. Access Panels And Doors
24. Identification
25. Bedding And Backfill
26. Demolition
27. Excavation And Backfill
28. Concrete Work
29. Cutting And Patching
30. Building Access
31. Equipment Access
32. Lubrication
33. Housekeeping And Clean Up
34. Sheeting, Shoring And Bracing
35. Dewatering
36. Rock Excavation
37. Surface Restoration

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 22 sections of plumbing.

1.4 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review.

G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies.

H. Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer and model number. The approved plumbing system data sheet(s) will be made available to the owner's project representative for their use on this project.

I. Plumbing System Data Sheet:

J.

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Unions			
Valves:			
Pipe Specialties			
Hangers & Supports			
Insulation			
Plumbing Specialties			

Plumbing Fixtures
Plumbing Equipment

1. Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.
2. Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

a.	Operating and Maintenance Manuals	2 copies
b.	Owner	1 copy
c.	Architect/Engineer	2 copies

1.5 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1. ABMA American Boiler Manufacturers Association
2. ACPA American Concrete Pipe Association
3. AGA American Gas Association
4. ANSI American National Standards Institute
5. ARI Air Conditioning and Refrigeration Institute
6. ASME American Society of Mechanical Engineers
7. ASPE American Society of Plumbing Engineers
8. ASSE American Society of Sanitary Engineering
9. ASTM American Society for Testing and Materials
10. AWWA American Water Works Association
11. AWS American Welding Society
12. CISPI Cast Iron Soil Pipe Institute
13. CGA Compressed Gas Association
14. CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
15. EPA Environmental Protection Agency
16. FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
17. GAMA Gas Appliance Manufacturers Association
18. IAPMO International Association of Plumbing & Mechanical Officials
19. IEEE Institute of Electrical and Electronics Engineers
20. ISA Instrument Society of America
21. MICA Midwest Insulation Contractors Association
22. MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
23. NBS National Bureau of Standards
24. NEC National Electric Code
25. NEMA National Electrical Manufacturers Association
26. NFPA National Fire Protection Association
27. NSF National Sanitation Foundation
28. PDI Plumbing and Drainage Institute
29. STI Steel Tank Institute

30. UL Underwriters Laboratories Inc.

B. Standards referenced in this section:
1. ACI 614 Recommended Practice for Measuring, Mixing and Placing of Concrete
2. ASTM D1557 Standard Test Method for Moisture-Density Relations of Soils
3. ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
4. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
5. UL1479 Fire Tests of Through-Penetration Firestops
6. UL723 Surface Burning Characteristics of Building Materials

1.6 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

1.7 LEAD FREE RQUIREMENTS

A. All materials that contact potable water shall be lead free. Lead free refers to the wetted surface of pipe, fittings and fixtures in potable water systems that have a weighted average lead content ≤0.25% per the Federal Safe Drinking Water Act as amended January 4th 2011 Section 1417.

B. This requirement applies to all of the subsequent Plumbing Specification Sections and Plumbing Drawings and supersedes any part or model number that may conflict with this requirement.

1.8 GUARANTEE

A. Refer to Division 1 for guarantees and warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.9 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.

B. In addition to the general content specified under Division 1 supply the following additional documentation:
1. Copies of all approved submittals along with approval letters
2. Records of tests performed a to certify compliance with system requirements
3. Manufacturer's wiring diagrams for electrically powered equipment
4. Certificates of inspection by regulatory agencies
5. Valve schedules
6. Lubrication instructions, including list/frequency of lubrication
7. Parts lists for fixtures, equipment, valves and specialties.
8. Manufacturers' installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
9. Additional information as indicated in the technical specification sections

1.10 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division, follow the following procedures.
1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.

1.11 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1.

1.12 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from Architect/Owner.

1.13 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Offsite Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.14 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.15 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required local or State installation inspections except those provided by the Architect/Engineer in accordance with State code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

1.16 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
   1. Structure
   2. Recessed light fixtures
   3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
   4. Ductwork and appurtenances
   5. Electrical and low voltage cable tray
   6. Plumbing vent piping
   7. Fire protection (sprinkler system)
   8. HVAC piping
   9. Gas piping, process piping and domestic water
   10. Electrical conduit and low voltage conduit
   11. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.

1.17 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.18 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.19 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.20 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.21 DEFINITIONS

A. Wherever the words "the Contractor", "this Contractor" or "Plumbing Contractor" appear in this division, they refer to the Contractor for Plumbing work.

B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.22 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.23 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.24 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.25 TRAINING

A. The contractor shall have the following responsibilities:
   1. Provide a training plan sixty days before the planned training covering the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered (description, duration of discussion, special methods, etc.)
      f. Duration of training on each subject
      g. Instructor for each subject
      h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).
   2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
   3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
   4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
   5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

6. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
7. Training shall include:
   a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the O&M manuals.
   g. Discussion of any peculiarities of equipment installation or operation.
   h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

B. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

C. Provide a minimum of 8 hours of instruction.

D. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. Manufacturers: EMED Company, W.H. Brady, Seton Nameplate Company, Thor Enterprises, Carlton, MSI Marking Services.

B. Engraved Name Plates:
1. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting.

C. Snap-Around Pipe Markers:
1. One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, ¾" min. size for lettering. Provide nylon ties on each end of pipe markers.

D. Valve Tags:
1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem.

E. Underground Warning Tape:
1. Detectable underground warning tape, 5.0 mil overall thickness, 6" width, .0035" thick aluminum foil core with polyethylene jacket bonded to both sides. Color code tape and print caution along with name of buried service in bold letters on face of tape.
2. Underground Tracer Wire:
3. All underground non-metallic sewers/mains and water services/mains shall be provided with tracer wire installations. Tracer wire shall be continuous solid copper or steel plastic coated with split bolt or compression-type connectors.

2.3 BEDDING AND BACKFILL

A. Bedding up to a point 12" inches above the top of the pipe shall be thoroughly compacted sand or crushed stone chips meeting the following gradations:

Gradation for Bedding Sand		Gradation for Crushed Stone Chip Bedding	
Sieve Size	% Passing (by Wt.)	Sieve Size	% Passing (by Wt.)
1 inch	100	1/2 inch	100
No. 16	45 - 80	No. 4	75 - 100
No. 200	2 - 10	No. 100	10 - 25

B. Backfill above the bedding in lawn areas shall be thoroughly compacted excavated material free of large stones, organic, perishable, and frozen materials.

C. Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic, perishable and frozen materials.

2.4 SLEEVES AND OPENINGS

A. General:
1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

B. Sleeves Through Below Grade Walls:
1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.
   a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
   b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
   c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
   d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.

2.5 SEALING AND FIRESTOPPING

A. Fire and/or Smoke Rated Penetrations:
1. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco.
2. All firestopping systems shall be provided by the same manufacturer.
3. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
4. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
5. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
6. Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
7. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
   1. Pipe Penetrations Through Below Grade Walls: In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.
   2. Pipe Penetrations: At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

PART 3 – EXECUTION

3.1 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.2 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

B. Tunnel or remove sidewalk and curb in areas of excavation to the nearest joint. Remove pavements, curbs and gutters to neat and straight lines to the limits of removal. Make sawcut lines parallel to existing joints, or parallel or perpendicular to pavement edges to form a neat patch. Carefully remove remaining pavement within the sawcut area. Leave existing base materials between the area disturbed by the work and the sawcut line undisturbed by the sawcutting, pavement removal, or pavement replacement processes.

C. Strip topsoil from area to be excavated, free from subsoil and debris, and store for later respreading.

D. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

E. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

F. Remove surplus excavated materials from site.

G. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

H. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

I. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

J. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

K. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

L. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

3.3 CONCRETE WORK

A. Cast-in-place concrete within the building will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support or installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment, pipe penetrations in wet areas, etc. with the Division 3 Contractor.

B. Plumbing related cast-in-place concrete on the exterior of the building to be provided by this Contractor in conformance with requirements of Division 3. This includes piping thrust restraints, pipe supports, hydrant supports, manholes, catch basins, grease traps, septic tanks, distribution boxes, valve pits, meter pits, cleanout cover pads, yard hydrant pads, etc.

3.4 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.5 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.6 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.7 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

3.8 IDENTIFICATION

A. Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where accessible piping passes through walls or floors. Place flow directional arrows at each pipe identification location.

B. Identify all exterior buried piping for entire length with underground warning tape except for sewer piping which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves. Where existing underground warning tape is broken during excavation, replace with new tape identifying appropriate service and securely spliced to ends of existing tape.

C. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in

mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

3.9 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.10 SLEEVES AND OPENINGS

A. General:
   1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
   2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
   3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
   4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
   5. Refer to Division 1, General Requirements for additional information on sleeves and openings.

B. Sleeves Through Floors/Ceilings:
   1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.
   2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
      a. Wet Locations:
         1) Mechanical Rooms
         2) Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.11 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire And/Or Smoke Rated Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Partitions:
   1. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the pipe and tighten in place, in accordance with manufacturer's instructions.
   2. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

3.12 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

3.13 SHEETING, SHORING AND BRACING

A. Provide shoring, sheet piling and bracing in conformance with the Building Code to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

3.14 DEWATERING

A. Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances. Obtain general permit from the Wisconsin Department of Natural Resources district office for discharge of construction dewatering effluent. Obtain well permit from the Wisconsin Department of Natural Resources district office for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

3.15 ROCK EXCAVATION

A. Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe. Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; which material is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and remove same with a power shovel except after thorough and continuous drilling and blasting. Rock excavation includes rock boulders of 1/2 cubic yard or more in volume.

B. Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2) feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6" pipe and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

3.16 SURFACE RESTORATION

A. Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work. Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary deposit of excavated earth. Remove all surplus material, tools and equipment.

B. Lawns: Topsoil with 4" of clean, friable, fertile topsoil, free from debris, lumps, rocks, roots, plants and seeds. Grade surfaces to match adjacent elevations. Rake smooth, free of lumps and debris. Sod with good quality nursery sod, uniform, dense, free from weeds and consisting of approximately 60% Kentucky blue grass and the balance perennial rye, fescue and white clover. Place sod with joints staggered and abutting. Maintain lawn areas for one month after installation. will be responsible for necessary watering and mowing. Do necessary weeding, repair, reseeding or resodding until uniform catch is obtained.

C. Curb and Gutter: Concrete curb and gutter conforming to local requirements.

D. Sidewalk and Walkways: Non-reinforced concrete conforming to local requirements, thickness to match existing, cross slope of one-fourth inch per foot, scored into squares approximately equal to width.

E. Bituminous Concrete Pavements: 4" thick crushed stone base course and two pass bituminous concrete pavement, first course 1-1/2" binder, second course 1-1/2" surface.

END OF SECTION 220500

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SECTION 220513 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes requirements for single phase motors that are used with equipment specified in other sections.
   1. Single Phase, Single Speed Motors

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 223000 – Plumbing Equipment for equipment requiring motors.

C. Section 224200 – Commercial Plumbing Fixtures.

D. Division 26 – Electrical – Electrical for power wiring, starters, and other electrical devices

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Single Phase, Single Speed Motors

B. Include with the equipment which the motor drives the following motor information: motor manufacturer, voltage, phase, hertz, rpm, full load efficiency, full load power factor, service factor, NEMA design designation, insulation class, and frame type.

1.4 REFERENCE STANDARDS

A. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators

B. ANSI/NEMA MG-1 Motors and Generators

C. ANSI/NFPA 70 National Electrical Code

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 220500 – Common Work Results for Plumbing.

1.6 ELECTRICAL COORDINATION

A. All starters, disconnects, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are provided by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

B. Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be made to any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor.

C. The A/E must coordinate specified voltages with the Electrical Consultant for the project. The Electrical Contractor will provide all power wiring and the Plumbing Contractor will provide all control wiring. Control wiring shall conform to Division 16 requirements for Control Wiring.

D. Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

1.7 PRODUCT CRITERIA

A. Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

B. Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

C. Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

PART 2 – PRODUCTS

2.1 SINGLE PHASE, SINGLE SPEED MOTORS

A. Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

B. Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

PART 3 – EXECUTION

3.1 INSTALLATION

A. When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002 inch.

B. Lubricate all motors requiring lubrication.

END OF SECTION 220513

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SECTION 220514 - PLUMBING SPECIALTIES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes specifications for floor drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.
   1. Floor Drains
   2. Hub Drains
   3. Cleanouts
   4. Water Hammer Arrestors
   5. Backflow Preventers
   6. Fire Hydrants
   7. Valve Boxes
   8. Thermostatic Mixing Valves
   9. Safings
   10. Interior Grease Interceptors

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 220523 – General-Duty Valves for Plumbing Piping

C. Section 221100 – Facility Water Distribution

D. Section 221300 – Facility Sanitary Sewerage

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.4 REFERENCE STANDARDS

A. ANSI A112.21.1 - Floor Drains.

B. ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.

C. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.

D. ASSE 1010 - Water Hammer Arrestors.

E. ASSE 1011 - Hose Connection Vacuum Breakers.

F. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 220500 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.1 FLOOR DRAINS

A. Manufacturer: Josam, J.R. Smith, Wade, Zurn.

B. FD-1: Enameled cast iron two piece body with bottom outlet, double drainage flange, weep holes, reversible membrane clamp and adjustable 6" diameter strainer. Outlet size as indicated on drawings. Zurn ZN-415-6B-P. Architect to select from manufacturer's standard finishes.

C. FD-2: Enameled medium duty cast iron two piece body with bottom outlet, double drainage flange, weep holes, adjustable 7" round coated cast iron tractor grate strainer. Outlet size as indicated on drawings. Zurn Z-507.

2.2 HUB DRAINS

A. HD-1: 3" minimum cast iron hub section up 2" minimum above floor level with full-sized deep seal P-trap.

2.3 CLEANOUTS

A. Manufacturers: Josam, J.R. Smith, Wade, Zurn.

B. Interior Concrete Floor Areas: Enameled cast iron body with round adjustable scoriated heavy-duty cast iron cover, tapered threaded ABS closure plug. Zurn Z-1400-HD.

C. Interior Vinyl or Ceramic Tile Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400.

D. Interior Carpeted Floor Areas: Enameled cast iron body with round adjustable scoriated nickel bronze cover and secured carpet marker, tapered threaded ABS closure plug. Zurn Z-1400-CM.

E. Interior Finished Wall Areas: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Screw shall not pass completely through ABS plug. Zurn Z-1446.

F. Interior Horizontal Lines: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

2.4 WATER HAMMER ARRESTORS

A. Manufacturers: Precision Plumbing Products, Sioux Chief, Watts.

B. ANSI A112.26.1, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure 1500 psig surge pressure.

2.5 BACKFLOW PREVENTERS

A. Manufacturers: Ames, Beeco, Cash-Acme, Cla-Val, Conbraco, Febco, Watts, Wilkins.

B. Hose Connection Vacuum Breakers: ASSE 1011, brass or bronze construction EPDM diaphragm and seat, rated for 125 psig and 180° F. Watts 8AC.

2.6 FIRE HYDRANTS

A. Manufacturers: Clow, Kennedy, Mueller, Waterous.

B. FHY: AWWA C502 dry barrel hydrant with cast or ductile iron body and standpipe, two field replaceable 2 ½" hose nozzles and chained caps, one field replaceable pumper nozzle and chained cap, 5 ¼" compression valve, O-ring seals, sealed oil reservoir, breakaway safety flange and stem coupling, automatic bronze drain valve, red finish 6'-0" minimum bury depth. Verify thread requirements with the local fire department or authority having jurisdiction.

2.7 VALVE BOXES

A. Manufacturers: C.P. Test Service, Mueller, Tyler.

B. Two-piece cast iron adjustable height casing with cast iron frame, cast iron cover and bottom bearing flange. Size for full burial depth of valve. 2" minimum internal diameter for valves sizes through 2", 4" minimum internal diameter for valve sizes 2 ½" through 3" and 5 ¼"

minimum diameter for 4" and larger valves. Cast name of service on cover top. On plastic pipelines, provide cast iron foot piece matched to valve box bottom or concrete bearing pad for support of valve.

2.8 THERMOSTATIC MIXING VALVES

A. Manufacturers: Holby, Leonard, Lawler, Powers, Symmons.

B. TMV-1: ASSE 1016 thermostatic mixing valve, 4 gpm flow rate at 8 psi pressure drop, with bronze body, ¾" NPT inlets and outlet, 125 psi rated and adjustable set point. Lawler Model 516.

2.9 SAFING

A. Manufacturers: Noble, Oatey.

B. Chlorinated polyethylene sheeting, 40 mil thickness, ASTM D4068, with CPE solvent; or 3 lb./sq. ft. sheet lead.

2.10 INTERIOR GREASE INTERCEPTOR

A. GI-1: Equal to Schier Great Basin grease interceptor Mode No. GB-35 shall be lifetime guaranteed and made in USA of seamless High Density Polyethylene. Interceptor shall be furnished for below grade installation. Interceptor shall be certified to ASME A12.14.3 (type C), with field adjustable riser system, built-in flow control, built-in test caps and three outlet options. Interceptor flow rate shall be 35 GPM. Interceptor grease capacity shall be 142 lbs. Cover shall provide water/gas-tight seal.

PART 3 – EXECUTION

3.1 GENERAL

A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturer's recommendations.

3.2 DRAINS AND CLEANOUTS

A. Set floor drains level and plumb, adjusted to finished floor elevation. Set hub drains level and plumb with rim 3" above finished floor elevation. Provide deep seal traps on floor drains and hub drains.

B. Set cleanouts level and plumb adjusted to finished floor elevation or finished wall location. Maintain a minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, Teflon tape or waterproof grease.

3.3 WATER HAMMER ARRESTORS

A. Install water hammer arrestors where indicated and at quick closing valve installations.

3.4 FIRE HYDRANT

A. Set fire hydrants level and plumb. Secure hydrant base and back with poured concrete thrust blocking providing thrust restraint and support of hydrant independent of piping. Provide 1 cu. Yd. of granular backfill material around drain valve openings for free drainage. Provide isolation valve and valve box at each hydrant. Where hydrant is located in paved area or near traffic, provide 6" diameter by 8' long Schedule 40 painted steel pipe bollards filled with concrete around hydrant.

3.5 VALVE BOXES

A. Set valve boxes level and plumb centered over valve. Set bottom flange on undisturbed soil or compacted granular backfill. Where plastic piping is used, provide cast iron or concrete bearing pad below valve. Adjust top section o finished grade level.

3.6 THERMOSTATIC MIXING VALVES

A. TMV-1: Install thermostatic mixing valve as indicated on drawings and per valve manufacturer's recommendations. Furnish and install check valves on supply inlets. Furnish and install spring loaded check valves on supply inlets. Adjust outlet temperature to deliver maximum 115°F.

3.7 SAFING

A. Install safing at floor drains above grade. Extend 12" beyond drains in all directions. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test.

3.8 INTERIOR GRASE INTERCEPTOR

A. Install grease interceptors as close to fixture(s) as possible, maintaining clearance above the interceptor for cleaning and maintenance. Set interceptors on compacted granular backfill adjusting for plumb and level. Adjust cover to finished floor elevation. Do not support interceptor from piping.

END OF SECTION 220514

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SECTION 220515 - PIPING SPECIALTIES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section contains specifications for plumbing piping specialties for all piping systems.
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. Test Plugs
   5. Pressure Gauges
   6. Strainers
   7. Water Flow Meters

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 220523 – General-Duty Valves for Plumbing Piping

C. Section 220700 – Plumbing Insulation

D. Section 221100 – Facility Water Distribution

E. Section 223000 – Plumbing Equipment

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Thermometers
   2. Thermometer Sockets
   3. Test Wells
   4. Test Plugs
   5. Pressure Gauges
   6. Strainers
   7. Water Flow Meters

B. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

1.4 REFERENCE STANDARDS

A. ASTM B650 Electrodeposited Engineering Chromium Coatings on Ferrous Substrates

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Division 1.

1.6 DESIGN CRITERIA

A. All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 220500 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.1 THERMOMETERS

A. Ashcroft, Marsh, Taylor, H. O. Trerice, Ametek/U. S. Gauge, Weiss, Wika, Weksler.

B. Stem Type: Cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Hot Water
Scale Range, °F	30 - 180
Increment, °F	2

2.2 THERMOMETER SOCKETS

A. Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

2.3 TEST WELLS

A. Similar to thermometer sockets except with a brass cap that threads into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

2.4 TEST PLUGS

A. Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

2.5 PRESSURE GAUGES

A. Ametek/U. S. Gauge, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Wika, Weksler.

B. Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

C. Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4" size.

D. Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

2.6 STRAINERS

A. Armstrong, Illinois, Keckley, Metraflex, Mueller Steam, Sarco, Watts.

B. Y type; cast bronze body, ASTM B62; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; sweat, threaded or flanged body rated at not less than 150 psi WOG.

C. Y type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG.

2.7 WATER FLOW METERS

A. Manufacturers: Hedland, Omega.

B. Direct reading water flow meter for potable water use with polysulfone plastic body, piston and cone, stainless steel spring, Buna N flow indicator ring and pressure seals, polycarbonate limit indicators, NPT or sweat brass fittings, 5% +/- accuracy over full scale and rated for 325 psi and 250° F maximum temperature. Flow meter shall be full line size.

PART 3 – EXECUTION

3.1 THERMOMETERS

A. Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

3.2 THERMOMETER SOCKETS

A. Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

3.3 TEST WELLS

A. Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

3.4 TEST PLUGS

A. Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for short-term measurement of pressure or temperature.

3.5 PRESSURE GAUGES

A. Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

B. Pressure Snubbers: Install in gauge piping for all gauges used on water services.

C. Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

3.6 STRAINERS

A. Install all strainers where indicated allowing sufficient space for the screens to be removed. Install a ball valve in the tapped screen retainer.

3.7 WATER FLOW METERS

A. Install in hot water return piping as indicated on the drawings. Install in accordance with manufacturer's recommendations. Inlet and outlet piping must be properly aligned to minimize structural stress on the meter body.

B. Install meter body so scale can be conveniently read.

C. Minimum flow through individual hot water return branch lines is 0.5 gpm.

END OF SECTION 220515

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SECTION 220523 - GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes valve specifications for all Plumbing systems except where indicated under Related Work.
   1. Water System Valves
      a. Ball Valves
      b. Swing Check Valves
      c. Balancing Valves
      d. Drain Valves
      e. Spring Loaded Check Valves
      f. Corporation/Curb Stop Valves
   2. Specialty Valves And Valve Accessories
      a. Gauge Valves
      b. Safety Relief Valves

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 220514 – Plumbing Specialties

C. Section 221100 – Facility Water Distribution

D. Section 221300 – Facility Sanitary Sewerage

E. Section 223000 – Plumbing Equipment

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Water System Valves
      a. Ball Valves
      b. Swing Check Valves
      c. Balancing Valves
      d. Drain Valves
      e. Spring Loaded Check Valves
      f. Corporation/Curb Stop Valves
      g. Valve Boxes

2. Specialty Valves And Valve Accessories
   a. Gauge Valves
   b. Safety Relief Valves

B. Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

1.4 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

1.5 DESIGN CRITERIA

A. ANSI Z21.22 - Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems.

B. ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

C. Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

D. Valves to be line size unless specifically noted otherwise.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 22 05 00 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.1 WATER SYSTEM VALVES

A. Manufacturers: Apollo, Asco, Conbraco, Crane, Hammond, Jomar, Lunkenheimer, Milwaukee Valve, Nibco, Stockham, Watts

B. All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.

C. Ball Valves:
   1. Two or three piece bronze body; sweat ends, stainless steel ball; glass filled Teflon seat; Teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation.
   2. 2" and smaller: Nibco, S-585-70-66
   3. 3": Nibco G-590-Y-66

D. Swing Check Valves:
1. 3" and smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Hammond IB941, Nibco S413B, Watts CVYS

E. Balancing Valves:
1. 2" and smaller: Two or three piece bronze body ball valve, sweat or threaded ends, chrome plated brass ball, glass filled teflon seat, threaded packing nut, with adjustable memory stop position indicator and extended handle stem, suitable for 400 psig water working pressure at 240 degrees F. Watts B-6000/B-6001 BS

F. Drain Valves:
1. ¾" ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Watts B-6000-CC/B-6001-CC series.

G. Spring Loaded Check Valves:
1. 2" and smaller: Bronze body, sweat or threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, Class 125, Teflon seat unless only bronze available. ConBraCo 61 series, Mueller 203BP, Nibco S480Y, Val-Matic S1400 series, Watts equal.

H. Corporation/Curb Stop Valves:
1. 2" and smaller: Bronze body ground key valve, bronze plug, AWWA taper thread inlet and copper flare outlet nut connections or compression type, AWWA C800.
2. 2" and smaller: Bronze body plug valve, bronze plug, quarter turn check, O-ring seals, copper flare nut connections or compression type, AWWA C800.

2.2 SPECIALTY VALVES AND VALVE ACCESSORIES

A. Gauge Valves: Use 1/4" ball valves. Needle valves and gauge cocks will not be accepted.

B. Safety Relief Valves:
1. Manufacturers: Bell & Gossett, A. W. Cash, Conbraco, Watts, Wilkins
2. Bronze body, temperature and pressure actuated stainless steel stem and spring, thermostat with non-metallic coating, test lever, suitable for 125 psig water working pressure at 240 degrees F, sized for full BTUH input and operating pressure of equipment, with valve capacity on metal label. For equipment less than or equal to 200,000 BTUH input, provide AGA, UL or ASME listed and labeled valve. Provide ASME listed and labeled valve for larger equipment. Temperature and pressure relief valve shall be sized using the AGA steam temperature rating per SPS 382.40(5)(d).

PART 3 – EXECUTION

3.1 GENERAL

A. Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

B. Mount valves in locations which allow access for operation, servicing and replacement.

C. Provide valve handle extensions for all valves installed in insulated piping.

D. Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

E. Prior to flushing of piping systems, place all valves in the full-open position.

3.2 SHUT OFF VALVES

A. Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

3.3 BALANCING VALVES

A. Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

B. Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

3.4 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

3.5 SPRING LOADED CHECK VALVES

A. Install a spring loaded check valve in each circulating pump discharge line, each clearwater sump pump discharge line and elsewhere as indicated.

3.6 SAFETY RELIEF VALVES

A. Install relief valves on all pressure vessels and elsewhere as indicated. Inlet and outlet piping connecting to valves must be the same size as valve connections or larger. Pipe discharge to drain where indicated or to floor.

END OF SECTION 220523

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors.
   1. Structural Supports
   2. Pipe Hangers And Supports
   3. Pipe Hanger Rods
   4. Beam Clamps
   5. Anchors
   6. Corrosive Atmosphere Coatings

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 031000 – Concrete Formwork for equipment pads

C. Section 033000 – Cast-in-Place Concrete for equipment pads

D. Section 220700 – Plumbing Insulation for insulation protection at support devices

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Structural Supports
   2. Pipe Hangers And Supports
   3. Pipe Hanger Rods
   4. Beam Clamps
   5. Anchors
   6. Corrosive Atmosphere Coatings

B. Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

C. All submittals are to comply with submission and content requirements specified within Section 220500 – Common Work Results for Plumbing.

1.4 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture

B. MSS SP-69 Pipe Hangers and Supports - Selection and Application

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

1.6 DESCRIPTION

A. Provide all supporting devices as required for the installation of plumbing equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

B. Do not hang any plumbing item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

C. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

D. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

E. Protect insulation at all hanger points; see Related Work above.

1.7 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

PART 2 – PRODUCTS

2.1 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of plumbing equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

2.2 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Anvil, B-Line, Grinnell, Pate, Piping Technology, Roof Products & Systems.

B. Hangers for Pipe Sizes 1/2" through 2":
   1. Carbon steel, adjustable swivel ring.
   2. Carbon steel, adjustable clevis, standard.

C. Hangers for Pipe Sizes 2" and Larger:
   1. Carbon steel, adjustable clevis, standard.

D. Multiple or Trapeze Hangers:
   1. Steel channels with welded spacers and hanger rods.

E. Wall Support:
   1. Carbon steel welded bracket with hanger.
   2. Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp.

F. Vertical Support:
   1. Carbon steel riser clamp for above floor use.

G. Floor Support:
   1. Carbon steel pipe saddle, stand and bolted floor flange.

H. Copper Pipe Supports:
   1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

2.3 PIPE HANGER RODS

A. Steel Hanger Rods:
   1. Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.
   2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
   3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

2.4 BEAM CLAMPS

A. MSS SP-69 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter.

2.5 ANCHORS

A. Use welding steel shapes, plates, and bars to secure piping to the structure.

2.6 CORROSIVE ATMOSPHERE COATINGS

A. Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication, ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of comparable thickness to factory coating.

B. Corrosive atmospheres include the following locations:
   1. Food service/kitchen areas

PART 3 – EXECUTION

3.1 INSTALLATION

A. Size, apply and install supports and anchors in compliance with manufacturers recommendations.

B. Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

C. Coordinate hanger and support installation to properly group piping of all trades.

D. Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel.

E. Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

F. Perform welding in accordance with standards of the American Welding Society.

3.2 HANGER AND SUPPORT SPACING

A. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

B. Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

C. Use hangers with 1-1/2 inch minimum vertical adjustment.

D. Support riser piping independently of connected horizontal piping.

E. Adjust hangers to obtain the slope specified in the piping section of these specifications.

F. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Copper	4" and larger	12'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Steel	8" through 12"	14'-0"	20'-0"
Steel	14" and over	20'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"
Plastic	1-1/4" and over	4'-0"	6'-0"

3.3 RISER CLAMPS

A. Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

3.4 ANCHORS

A. Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION 220529

SECTION 220700 – PLUMBING INSULATION

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes insulation specifications for plumbing piping and equipment.
   1. Insulation
      a. Rigid Fiberglass Insulation
      b. Elastomeric Insulation
      c. Phenolic Insulation
   2. Covers and Jackets
      a. PVC Fitting Covers and Jackets
   3. Insulation Inserts And Pipe Shields
   4. Accessories

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 220500 – Common Work Results for Plumbing

C. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment

D. Section 221300 – Facility Sanitary Sewerage

E. Section 223000 – Plumbing Equipment

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Insulation
      a. Rigid Fiberglass Insulation
      b. Elastomeric Insulation
      c. Phenolic Insulation
   2. Covers and Jackets
      a. PVC Fitting Covers and Jackets
   3. Insulation Inserts And Pipe Shields
   4. Accessories

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.4 REFERENCE STANDARDS

A.	ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
B.	ASTM C165	Test Method for Compressive Properties of Thermal Insulations
C.	ASTM C177	Heat Flux and Thermal Transmission Properties
D.	ASTM C195	Mineral Fiber Thermal Insulation Cement
E.	ASTM C302	Density of Preformed Pipe Insulation
F.	ASTM C303	Density of Preformed Block Insulation
G.	ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
H.	ASTM C518	Heat Flux and Thermal Transmission Properties
I.	ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
J.	ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
K.	ASTM C547	Mineral Fiber Preformed Pipe Insulation
L.	ASTM C553	Mineral Fiber Blanket and Felt Insulation
M.	ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
N.	ASTM C591	Preformed Rigid Cellular Polyurethane Thermal Insulation
O.	ASTM C610	Expanded Perlite Block and Thermal Pipe Insulation
P.	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
Q.	ASTM C921	Properties of Jacketing Materials for Thermal Insulation
R.	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
S.	ASTM E84	Surface Burning Characteristics of Building Materials
T.	MICA	National Commercial & Industrial Insulation Standards
U.	NFPA 225	Surface Burning Characteristics of Building Materials
V.	UL 723	Surface Burning Characteristics of Building Materials

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 220500 – Common Work Results for Plumbing.

1.7 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
1. Pipe Insulation
2. Equipment Insulation

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Owner's Project Representative.

1.8 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials or accessories containing asbestos will not be accepted.

B. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:
1. Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

2.2 INSULATION AND JACKETS

A. Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

B. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

C. Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
2. White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

D. Elastomeric Insulation:
1. Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor transmission of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

E. Phenolic Insulation:
1. Rigid closed cell, minimum nominal density of 2.2 lbs. per cu. ft., thermal conductivity of not more than 0.13 at 75 degrees F, minimum compressive strength of 31 psi parallel and 18 psi perpendicular, maximum water vapor transmission 0.117 perm inch, maximum water absorption of .5% by volume, rated for service range of -290 degrees F to 250 degrees F.
2. Kraft reinforced foil vapor barrier laminate all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

F. PVC Fitting Covers and Jackets:
1. White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20 mil).

2.3 INSULATION INSERTS AND PIPE SHIELDS

A. Manufacturers: B-Line, Pipe Shields, Value Engineered Products

B. Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

C. Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

D. Precompressed 20# density molded fiberglass blocks, Hamfab, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

E. Wood blocks will not be accepted.

2.4 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

K. Fungicidal water base coating (Foster 40-20) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install insulation, jackets and accessories in accordance with manufacturer's instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

B. Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

G. Provide a complete vapor barrier for insulation on the following systems:
   1. Cold water (potable and non-potable)
   2. Storm Water
   3. Equipment piping with a surface temperature below 65 degrees F

3.2 PIPING, VALVE AND FITTING INSULATION

A. General:
   1. Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.
   2. Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.
   3. Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

B. Insulation Inserts and Pipe Shields:
   1. Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

C. Fittings and Valves:
   1. Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

D. Elastomeric:
1. Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight installation. Apply full bed of adhesive to both surfaces.

E. Protective Jackets:
1. Provide a protective PVC jacket for the following insulated piping: water piping in kitchen area.
2. Lap seams and joints a minimum of 2 inches and continuously seal with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor barrier is not required and jacket requires routine removal, tack fasteners may be used.

F. Pipe Insulation Schedule:
1. Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	Insulation Types	Insulation Thickness by Pipe Size				
		1" and smaller	1-1/4" to 2"	2-1/2" to 4"	5" to 6"	8" and larger
Hot Water Supply	Rigid Fiberglass	1"	1"	1.5"	1.5"	1.5"
Hot Water Return	Rigid Fiberglass	1"	1"	1.5"		
Cold Water	Rigid Fiberglass	0.5"	0.5"	1"	1"	1"
Tempered Water	Rigid Fiberglass	0.5"	0.5"	1"		
Non-Potable Cold Water	Rigid Fiberglass*	0.5"	0.5"	1"		
Non-Potable Hot Water	Rigid Fiberglass*	1"	1"	1.5"		
All Storm Piping & Roof Drain bodies	Rigid Fiberglass	0.5"	0.5"	0.5"	0.5"	0.5"
Clearwater Waste	Rigid Fiberglass*	0.5"	0.5"	0.5"	0.5"	0.5"

* Elastomeric & Phenolic types are acceptable

2. The following piping and fittings are not to be insulated:
a. Chrome plated exposed supplies and stops (except where specifically noted).
b. Water hammer arrestors.
c. Piping unions and flanges for systems not requiring a vapor barrier.

3.3 EQUIPMENT INSULATION

A. Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

B. Elastomeric:
1. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

C. Equipment Insulation Schedule:
1. Provide equipment insulation as follows:

Equipment	Insulation Type	Thickness	Remarks
Water Meter	Elastomeric	½"	Sheet type, fabricated for ease of removal and replacement when service is required.
Water Softener	Elastomeric	½"	Sheet type, fabricated for ease of removal and replacement when service is required.

END OF SECTION 220700

SECTION 221100 - FACILITY WATER DISTRIBUTION

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section contains specifications for plumbing pipe and pipe fittings for this project.
   1. Domestic Water
   2. Dielectric Unions And Flanges
   3. Unions And Flanges
   4. Press Fitting Pipe Connections
   5. Mechanical Grooved Pipe Connections
   6. Piping System Leak Tests

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 220514 – Plumbing Specialties

C. Section 220515 – Piping Specialties

D. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Domestic Water
   2. Dielectric Unions And Flanges
   3. Unions And Flanges
   4. Press Fitting Pipe Connections
   5. Mechanical Grooved Pipe Connections
   6. Piping System Leak Tests

B. Schedule from the contractor indicating the ASTM or AWWA specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

C. Statement from manufacturer on letterhead that pipe furnished meets the ASTM or AWWA specification contained in this section.

1.4 REFERENCE STANDARDS

A.	ANSI A21.4	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
B.	ANSI A21.11	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
C.	ANSI A21.51	Ductile-Iron Pipe, Centrifugally Cast
D.	ANSI B16.3	Malleable Iron Threaded Fittings
E.	ANSI B16.4	Cast Iron Threaded Fittings
F.	ANSI B16.5	Pipe Flanges and Flanged Fittings
G.	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
H.	ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
I.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
J.	ASTM A105	Forgings, Carbon Steel, for Piping Components
K.	ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
L.	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
M.	ASTM B32	Solder Metal
N.	ASTM B88	Seamless Copper Water Tube
O.	ASTM B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
P.	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
Q.	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
R.	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
S.	ASTM D2464	Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
T.	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
U.	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
V.	ASTM D2657	Heat Fusion Joining of Polyolefin Pipe and Fittings

W. ASTM D2774 Recommended Practice for Underground Installation of Thermoplastic Pressure Piping

X. ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings

Y. ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

Z. ASTM D3222 Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials

AA. ASTM D4101 Propylene Plastic Injection and Extrusion Materials

BB. ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 80

CC. ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Schedule 40

DD. ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80

EE. ASTM F493 Solvent Cements for Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe and Fittings

FF. ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

GG. AWS A5.8 Brazing Filler Metal

HH. AWWA C104 Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water

II. AWWA C105 Polyethylene Encasement for Ductile Iron Piping for Water

JJ. AWWA C110 Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids

KK. AWWA C111 Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings

LL. AWWA C151 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids

MM. AWWA C153 Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids

NN. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances

OO. AWWA C651 Disinfecting Water Mains

PP. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the owner.

1.6 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM or AWWA specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.7 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.1 DOMESTIC WATER

A. Above Ground:
1. Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.
2. Ductile iron pipe, thickness Class 53, AWWA C151/C115; with standard thickness cement mortar lining, AWWA C104; ductile iron mechanical grooved cement mortar lined fittings and couplings on cut grooved pipe, Class 350 12" and below, Class 250 above 12", AWWA C606; ductile iron or gray iron flanged cement mortar lined fittings, Class 250, AWWA C110; rubber gasket joints with non-toxic gasket lubricant, AWWA C111.

B. Below Ground 3" and Larger:
1. Ductile iron pipe, mechanical or push on joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.
2. PVC pressure pipe, DR 18, Class 150, AWWA C900 and C905; with integral bell and elastomeric gaskets, ASTM D3139. Fittings and fitting polyethylene encasement to be same as noted above for ductile iron.

C. Underground to Interior Building Entrance Piping 3" and larger:
1. Ductile iron as specified above with factory threaded and machined flanges.

D. Hydrant Leads:
1. Ductile iron pipe, restrained mechanical joint, thickness Class 52, AWWA C151; with standard thickness cement mortar lining, AWWA C104; ductile iron or gray iron restrained mechanical joint cement mortar lined fittings, Class 250, AWWA C110; ductile iron restrained mechanical joint compact fittings, Class 350, AWWA C153; rubber gasket joints with non-toxic gasket lubricant, AWWA C111. Provide 8 mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.

E. Thrust Restraints for Underground Piping:
1. Asphaltic or epoxy coated ductile iron follower gland mechanical joint restraint with gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference, low alloy steel T-bolts and UL listing or Factory Mutual approval. For PVC pipe joint bells, use epoxy or primer coated ductile iron bell and serrated ring restraints or gripping wedge restraints and torque limiting twist-off nuts around the pipe circumference with low alloy steel tie bolts. Restraint to have minimum pressure rating

and safety factor equal to or greater than pressure rating and safety factor of pipe and be designed specifically for the pipe material it's applied on.

2.2 DIELECTRIC UNIONS AND FLANGES

A. Manufacturers: Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc.

B. Dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

2.3 UNIONS AND FLANGES

A. Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be Teflon type. Treated paper gaskets are not acceptable.

B. 2" and Smaller Steel:
   1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

C. 2" and Smaller Copper:
   1. ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

D. 2-1/2" and Larger Steel:
   1. ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face Teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be Teflon type.

E. 2-1/2" and Larger Copper:
   1. ANSI B15.24 Class 150 cast bronze flanges with full face Teflon gaskets.

2.4 MECHANICAL GROOVED PIPE CONNECTIONS

A. Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruvlok or Gustin-Bacon may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

B. All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.

C. Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

D. Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.

E. Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

F. Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

PART 3 – EXECUTION

3.1 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.2 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.3 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Provide clearance for installation of insulation, access to valves and piping specialties.

F. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

G. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment.

H. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.4 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.5 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.6 MECHANICAL JOINT PIPE CONNECTIONS

A. Comply with AWWA C600/C605 installation requirements. Clean pipe end and socket. Clean and lubricate pipe end, socket and gasket with soapy water or gasket lubricant. Place gland and gasket, properly oriented, on pipe end. Insert pipe end fully into socket and press gasket evenly into recess keeping joint straight. Press gland evenly against gasket, insert bolts and hand tighten nuts. Make joint deflection prior to tightening bolts. Evenly tighten bolts in sequence to recommended torque.

3.7 PUSH-ON GASKETED PIPE CONNECTIONS

A. Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.8 MECHANICAL GROOVED PIPE CONNECTIONS

A. Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

3.9 DOMESTIC WATER

A. Maintain piping system in clean condition during installation. Remove dirt and debris from assembly of piping as work progresses. Cap open pipe ends where left unattended or subject to contamination.

B. Install exterior water piping below predicted frost level, but in no case less than 6' bury depth to top of pipe. Maintain minimum of 8' horizontal distance between 2-1/2" and larger water piping and sanitary sewer piping. Maintain minimum of 30" horizontal and 12" vertical distance, water on top, between 2" and smaller water piping and sanitary sewer piping. Where water piping crosses a sanitary sewer, provide minimum 18" vertical clearance and waterproof PVC water pipe sleeve (reference sanitary sewer materials) sealed at both ends for distance of 10' from sewer in both directions.

C. Provide thrust restraints for 3" and larger exterior water piping joints, hydrants, caps, plugs, fittings and bends of 22-1/2 degrees or more. Field apply continuous anti-corrosion coating to rodded restraint components. Protect mechanical joints, nuts and bolts from concrete cover. Cover with 8 mil sheet or tube polyethylene material sleeve.

D. Install interior water piping with drain valves where indicated and at low points of system to allow complete drainage. Install shutoff valves where indicated and at the base of risers to allow isolation of portions of system for repair. Do not install water piping within exterior walls.

E. Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears clear. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

F. Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

3.10 UNDERGROUND PIPE WRAP

A. Use for ductile iron piping encased in concrete or underground which is not in a conduit. Remove all dirt and other foreign material from exterior of pipe. Apply primer as recommended by the manufacturer. Use a spiral wrap process for applying tape to the pipe. Repair any breaks in the tape coating caused by the installation process.

3.11 DIELECTRIC UNIONS AND FLANGES

A. Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

3.12 UNIONS AND FLANGES

A. Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

3.13 PIPING SYSTEM LEAK TESTS

A. Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

B. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested. Measure and record test pressure at the high point in the system.

D. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

E. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented on form included in specification.

Test System	Medium	Initial Test Pressure Duration	Final Test Pressure	Duration
*Below Ground Domestic Water	Water	N/A	200 psig	2 hr.
Above Ground Domestic Water	Water	N/A	100 psig	8 hr.
Above Ground Non-potable Water	Water	N/A	100 psig	8 hr.
Below Ground Non-potable Water	Water	N/A	100 psig	8 hr.

*Flush and hydrostatically test underground water service piping in accordance with NFPA 13 – Installation of Sprinkler Systems, latest edition. All pressure tests shall be documented on NFPA Contractor's Material and Test Certificate for Underground Piping forms. These forms are to be included in the O&M manual.

END OF SECTION 221100

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

□ Plumbing □ Fire Sprinkler

Test Medium: □ Air □ Water □ Other__

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ Initial Pressure: _____ PSIG

Stop Test Time: _____ Final Pressure: _____ PSIG

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

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SECTION 221300 - FACILITY SANITARY SEWERAGE

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section contains specifications for plumbing pipe and pipe fittings for this project.
   1. Sanitary Waste And Vent
   2. Piping System Leak Tests

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 220514 – Plumbing Specialties

C. Section 220529 – Hangers and Supports for Plumbing Piping and Equipment

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Sanitary Waste And Vent
   2. Piping System Leak Tests

B. Schedule from the contractor indicating the ASTM or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

C. Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, or CISPI specification contained in this section.

1.4 REFERENCE STANDARDS

A.	ANSI B16.3	Malleable Iron Threaded Fittings
B.	ANSI B16.4	Cast Iron Threaded Fittings
C.	ANSI B16.5	Pipe Flanges and Flanged Fittings
D.	ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

E.	ANSI B16.29	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
F.	ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
G.	ASTM A74	Cast Iron Soil Pipe and Fittings
H.	ASTM A105	Forgings, Carbon Steel, for Piping Components
I.	ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
J.	ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
K.	ASTM A888	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
L.	ASTM B32	Solder Metal
M.	ASTM B306	Copper Drainage Tube (DWV)
N.	ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
O.	ASTM C76	Reinforced Concrete Culvert, Storm Drain and Sanitary Pipe
P.	ASTM C564	Standard Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
Q.	ASTM C1540	Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
R.	ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe
S.	ASTM D2241	Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
T.	ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
U.	ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
V.	ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
W.	ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
X.	ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
Y.	ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
Z.	ASTM D3212	Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

AA.	ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
BB.	CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications
CC.	CISPI 310	Couplings For Use In Connection With Hubless Cast Iron Soil Pipe And Fittings For Sanitary And Storm Drain, Waste And Vent Piping Applications

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the owner.

1.6 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system.

C. Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

D. Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

E. Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

1.7 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.1 SANITARY WASTE AND VENT

A. Interior Above Ground:
1. Hubless cast iron soil pipe and fittings, ASTM A888; with no-hub couplings, CISPI 301, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the Engineer.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DWV), ANSI B16.23; wrought copper drainage fittings (DWV), ANSI B16.29; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorous brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for vent branch takeoffs up to one-half (1/2) the diameter of the main.
3. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
4. Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

B. Interior Below Ground:
1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301, and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

C. Exterior Below Ground 15" and Smaller:
1. Cast iron soil pipe and fittings, CISPI 301, ASTM A74 or ASTM A888 with neoprene rubber compression gaskets, ASTM C564 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.
   a. Manufacturers: A B & I Foundry, Charlotte Pipe and Foundry, Tyler Pipe
2. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
3. Type PSM PVC sewer pipe and socket fittings, SDR 35, Class 12454-B (PVC 1120), ASTM D3034; primer, ASTM F656; solvent cement, ASTM 2564; or integral bell and flexible elastomeric seal, ASTM D3212.

PART 3 – EXECUTION

3.1 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.2 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.3 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

C. Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

D. Maintain piping in clean condition internally during construction.

E. Do not route piping through transformer vaults or above transformers, panelboards or switchboards, including the required service space for this equipment.

F. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

3.4 COPPER PIPE JOINTS

A. Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

3.5 THREADED PIPE JOINTS

A. Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.6 SOLVENT WELDED PIPE JOINTS

A. Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove dust, drips, moisture, grease and other superfluous materials from pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

B. Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer's recommendations for initial set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner's Project Representative.

3.7 MECHANICAL HUBLESS PIPE CONNECTIONS

A. Place the gasket on the end of one pipe or fitting and the clamp assembly on the end of the other pipe or fitting. Firmly seat the pipe or fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturers recommended torque.

3.8 SANITARY WASTE AND VENT

A. Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.

B. Install exterior piping below predicted frost level and not less than 5' bury depth to top of pipe wherever possible. Where piping is located above predicted frost level, provide frost protection.

C. Flush piping inlets (floor drains, hub drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impeded.

3.9 PIPING SYSTEM LEAK TESTS

A. For hydrostatic tests, use clean water and remove all air from the piping being tested. Measure and record test pressure at the high point in the system.

B. Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

C. Entire test must be witnessed by the Owner's representative. All pressure tests are to be documented.

		Initial Test		Final Test	
System	Test Medium	Pressure	Duration	Pressure	Duration
Sanitary Waste and Vent	Water	N/A		10' water	2 hr.

END OF SECTION 221300

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SECTION 223000 - PLUMBING EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes specifications for water heaters, water softeners, pumps and other equipment used for plumbing applications.
   1. High Efficiency Commercial Gas Fired Water Heater
   2. Water Softeners
   3. In-Line Centrifugal Pumps
   4. Expansion Tanks

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 220513 - Common Motor Requirements for Plumbing

C. Section 220515 - Piping Specialties

D. Section 220523 - General-Duty Valves for Plumbing Piping

E. Section 220700 - Plumbing Insulation

F. Division 26 - Electrical

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. High Efficiency Commercial Gas Fired Water Heater
   2. Water Softeners
   3. In-Line Centrifugal Pumps
   4. Expansion Tanks

B. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.4 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under in Section 220500 – Common Work Results for Plumbing.

PART 2 – PRODUCTS

2.1 HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATER (GWH-1)

A. Manufacturers: A.O. Smith, Bradford White, Bock, Lochinvar, State.

B. Type: Gas fired sealed combustion condensing commercial storage water heater, minimum 92% thermal efficiency. Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.

C. Tank: Steel glass lined tank rated for 150 psig complete with multiple removable magnesium anode rods or single impressed current anode rod, submerged combustion chamber, 4" tank access hand hole, foam insulation, painted steel jacket, brass drain valve and temperature and pressure relief valve.

D. Burner: Top mounted down fired premix low NOx power burner.

E. Controls: 120 volt, 1 phase, 60 Hz electronic controls, intermittent spark or hot surface ignition, operating thermostat with 110°-180° F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

F. Vent: 3" or 4" PVC, CPVC or ABS combustion air intake and flue gas outlet with DWV solvent weld fittings.

G. Equal to AO Smith Model BTH-300, 130 gallon tank, 300 MBH, 75 ½" high x 33 1/8" diameter.

2.2 INSTANTANEOUS WATER HEATERS (EWH-1)

A. Manufacturers: Stiebel-Eltron, Eemax, Chronomite

B. Equal to Stiebel-Eltron DCH-E 10.

C. Tankless instantaneous electric water heater with flow switch, copper sheathed heating element, anti-scald thermostat, high limit switch with manual reset, and ¾" NPT inlet/outlet connections.

D. Ratings: 33° F temperature rise at 1.5 gpm flow, 7.200 watt heating element, 208/60/3 electrical.

2.3 WATER SOFTENERS (WS-1)

A. Manufacturers: Amtrol, Capital, Custom-Care, Hellenbrand, Water Right.

B. Tanks: Fiberglass reinforced mineral tank constructed of molded high density polyethylene inner shell reinforced by exterior fiberglass winding and epoxy resin. NSF approved and rated for 150 psig. Mount slotted or lateral hub PVC distributor in tank with underbedding gravel.

C. Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum 50% resin bed freeboard.

D. Valve: Top mount brass valve with motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity and regeneration settings. Provide bypass ball valve arrangement.

E. Controls: Factory wired and tested controls with transformer and labeled terminal block for consisting of the following:
   1. Mechanical Demand Meter Delayed Regeneration

F. Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.

G. Ratings: Maximum 10 MG/L hardness leakage, 110° F maximum operating temperature, 30-100 psig operating pressure, 120/60/1 electrical.

H. Accessories:
   1. Flexible braided stainless steel pipe connectors for tanks over 24" in diameter.
   2. Inlet and outlet sampling valves, inlet and outlet pressure gauges with shutoff valve.
   3. Resin defoulant system with chemical metering pump, tubing and 4 month supply of chemical cleaner for iron and bacteria fouling.

I. Equal to Hellenbrand model H150-150 ED with 5 cu. Ft. mineral, flow rate at 15 psi, 40 gpm. Capacity at medium salt set 140,000 grains/50 lbs. of salt.

2.4 IN-LINE CENTRIFUGAL PUMPS (CP-1)

A. Manufacturer: Bell and Gossett, Gould, Grundfos, Taco.

B. Type: Horizontal single stage oil lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225° F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

C. Casing: Bronze or stainless steel; flanged suction and discharge connection.

D. Impeller: Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

E. Bearings: Oil lubricated bronze sleeve or ball bearings.

F. Shaft: Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

G. Seal: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

H. Drive: Flexible coupling.

I. Motor: Provide pump with open dripproof motor with built-in thermal overload protection sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

J. Equal to Bell and Gossett Model number NBF-8S/LW, 7 feet of head with 1.5 gpm flow.

2.5 EXPANSION TANKS

A. Manufacturer: Amtrol, Bell and Gossett, Wessels.

B. Vertical steel precharged hydro-pneumatic expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service.

C. Equal to Amtrol Model ST-12 with 4.4 gallon of total volume.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

B. Set commercial water heaters, commercial water softeners, storage tanks and booster pumps on concrete housekeeping pads. Adjust and level equipment.

C. Connect equipment to water and drain piping using unions or flanges and isolation valves.

D. Size temperature and relief valves per CSA ratings. Pipe temperature and pressure relief valves to floor drain or floor as indicated.

E. Startup and test equipment adjusting operating and safety controls for proper operation.

F. Set water heater temperature at 145°F on GWH-1.

G. Set water heater temperature at 115°F on EWH-1.

H. Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

I. Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

J. Hot Water Circulating Pump: Pump:
   1. Pump to operate on signal from aquastat in hot water return line (5 feet from water heater) to start on water temperature drop below 140°F and stop when temperature reaches 145°F, adjustable.
   2. Furnish and mount aquastat. 24 hour time clock provided and installed by Electrical Contractor. Time clock to override aquastat control and allow pump to operate under control of aquastat during daytime and shut-off pump at night. Day-night schedule set per Owner's direction. (Aquatat-Honeywell No. L4006A1678 or L6006A114).
   3. Pump, aquastat and time clock wiring under Division 16, Electrical.
   4. Balance hot water return system flow.

K. Adjust compression tank precharge to scheduled minimum operating pressure prior to connecting to system.

3.2 TRAINING

A. See Section 220500 – Common Work Results for Plumbing for general training requirements.

B. In addition to the training provided in Section 220500 – Common Work Results for Plumbing, provide an additional 2 hours of training for each type of plumbing equipment provided on the project.

END OF SECTION 223000

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SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes specifications for plumbing fixtures, faucets and trim.
   1. Plumbing Fixtures
      a. Electric Water Coolers
      b. Hose Bibbs
      c. Lavatories
      d. Mop Basins
      e. Sinks
      f. Urinals
      g. Wall Hydrants
      h. Water Closets

1.2 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 220514 – Plumbing Specialties

C. Section 221100 – Facility Water Distribution

D. Section 221300 – Facility Sanitary Sewerage

1.3 SUBMITTALS

A. Refer to Section 220500 – Common Work Results for Plumbing, Submittals. In addition to the general content specified under Section 220500 – Common Work Results for Plumbing, supply the following submittals:
   1. Electric Water Coolers
   2. Hose Bibbs
   3. Lavatories
   4. Mop Basins
   5. Sinks
   6. Urinals
   7. Wall Hydrants
   8. Water Closets

B. Include data concerning sizes, rough in-dimensions, capacities, materials of construction, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.4 REFERENCE STANDARDS

A.	ANSI A112.6.1M	Supports for Off-the Floor Plumbing Fixtures for Public Use
B.	ANSI A112.18.1	Finished and Rough Brass Plumbing Fixture Fittings
C.	ANSI A112.19.2M	Vitreous China Plumbing Fixtures
D.	ANSI A112.19.5	Trim for Water Closet Bowls and Urinals
E.	ARI-1010	Self-Contained Mechanically Refrigerated Drinking Water Coolers
F.	ASSE 1011	Hose Connection Vacuum Breakers
G.	ASSE 1016	Individual Thermostatic, Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings

1.5 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1.

B. Plumbing products requiring approval by the State of Wisconsin Dept. of Safety & Professional Services must be approved or have pending approval at the time of shop drawing submission.

1.6 ENERGY EFFICIENCY REQUIREMENTS

A. Plumbing fixtures must meet the following maximum water usage requirements:
   1. Lavatory Faucets: flow of 0.5 gallons per minute
   2. Sink Faucets: flow of 1.6 gallons per minute
   3. Urinal Flush Valves: 0.13 gallons per flush
   4. Water Closet Flush Valves: 1.28 gallons per flush

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES

A. Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted. Architect to select from manufacturer's standard finish colors.
   1. Vitreous China Fixtures: American Standard, Kohler, Sloan, Toto, Zurn
   2. Water Closet Seats: Bemis, Beneke, Centoco, Olsonite Sperzel
   3. Faucets: Chicago Faucet, Sloan, Zurn
   4. Stops and Supplies: Chicago Faucet, McGuire, Zurn
   5. Flush Valves: Sloan, Zurn

6. Drains and Traps: Kohler, McGuire, Dearborn, Zurn
7. Carriers and Supports: Josam, J.R. Smith, Wade, Watts, Zurn
8. Electric Water Coolers: Elkay, Halsey Taylor, Haws, Oasis, Sunroc
9. Molded Stone Fixtures: Fiat, Mustee
10. Stainless Steel Sinks: American Standard, Elkay, Just, Kohler
11. Hose Bibbs and Wall Hydrants: Chicago Faucet, Josam, J.R. Smith, Wade, Woodford, Zurn
12. Thermostatic Mixing Valves: Bradley, Lawler, Leonard, Powers

B. Electric Water Coolers:
1. EWC-1: GreenSpec® listed dual height electric water cooler with remote refrigeration system, steel wall frame, stainless steel wall grille, two stainless steel bowls, self-closing front push buttons, and two 1¼" tailpieces. Rated for 8 GPH at 80 degree inlet water, 90 degree ambient and 50 degree leaving water, 370 watts, 120/60/, 1/5 HP, 4 amps.
   a. Fixture: Elkay EDFPBM117RAC
   b. Supply: 1/2" ball valve
   c. Trap: 1½" x 1½" PVC P- trap
   d. Remote Chiller: Elkay ECH8
2. EWC-2: Wall hung dual height electric water cooler with integral bottle filling station, inlet water filter, self-closing front and side push bars on water cooler basins, sensor operated controls on filling station, stainless steel cabinet, wall hanger, 1 ¼" tailpiece, rated for 8.0 GPH at 80 degree inlet water, 90 degree ambient temperature and 50 degree leaving water, 370 watt, 120/60/1. Provide with lower drink unit and bottle filler on the left.
   a. Fixture: Elkay LZSTLR8WSLK
   b. Stop/Supply: ½" ball valve with ½" riser
   c. Traps: 1 ¼" x ½" PVC P-trap

C. Hose Bibbs:
1. HB-1: Bronze or brass body hose faucet, ¾" inlet, ¾" outlet, with polished chrome finish, ASSE 1011 hose connection vacuum breaker and metal wheel handle.
   a. Faucet: Woodford Model 24PC

D. Lavatories:
1. L-1: Solid surface material counter with integral bowl. Sensor operated faucet with cast brass spout, 0.5 gpm vandal resistant spray outlet, 4" C-C trim plate, and thermostatic mixing valve with checkstops and wall mounting bracket. 120 VAC/24 VAC transformer.
   a. Fixture: Furnished and installed by G.C.
   b. Faucet: Chicago Faucet 116.121.AB.1
   c. Cover Plate: Chicago Faucet 240.627.21.1
   d. Drain: Kohler K-13885 strainer and 1 ¼" offset tailpiece
   e. Trap: 1 ¼" x 1 ½" 17 gauge cast brass p-trap
2. L-2: Wall mounted white vitreous china lavatory, 21 ¼" x 18 1/8" with drillings for concealed arm carrier, faucet holes on 4" centers. Sensor operated faucet with cast brass spout, 0.5 gpm vandal resistant spray outlet, 4" C-C trim plate, and thermostatic mixing valve with checkstops and wall mounting bracket. 120 VAC/24VAC transformer.
   a. Fixture: Kohler "Kingston" K-2005
   b. Faucet: Chicago Faucet 116.121.AB.1
   c. Cover Plate: Chicago Faucet 240.627.21.1
   d. Drain: Kohler K-13885 strainer and 1 ¼: offset tailpiece

e. Trap: 1 ¼" x 1 ½" 17 gauge cast brass p-trap
f. Carrier: Zurn commercial carrier with concealed arms, adjusted for 34" rim height

E. Mop Basins:
1. MB-1: Floor mounted molded stone mop basin, 24" x 36" x 10" with 3" drain, stainless steel strainer, stainless steel wall guards for corner installation, faucet with integral stops and lever handles, and ASSE 1011 hose connection vacuum breaker.
a. Fixture: Mustee 65M
b. Wall Guards: Mustee 67.2436
c. Faucet: Chicago Faucet 305-R
d. Vacuum Breaker: Watts 8A
e. Hose: Mustee 65.700

F. Sinks
1. S-1: Counter mounted, self-rimming 18 gauge type 302 stainless steel single compartment sink, 19 1/2" x 19" x 6 1/2" with 3 faucet holes and basket strainer. Faucet with gooseneck spout, ceramic disc cartridges, lever handles and 1.5 gpm flow control aerator.
a. Fixture: Elkay LRAD 1919-3
b. Faucet: Chicago Faucet 1100-GN8AE35-XKCP
c. Supplies: McGuire H2165LK
d. Drain: Elkay LKAD-35
e. Trap: 1 ½" x 1 ½" 17 gauge cast brass p-trap
2. S-2: Counter undermount mounted, self-rimming 18 gauge type 302 stainless steel double compartment sink, 14" x 14" x 5" each compartment with 3 faucet holes and basket strainer. Faucet with gooseneck spout, ceramic disc cartridges, lever handles, and 1.5 gpm flow control aerator.
a. Fixture: Elkay ELUHAD 3216-5-3
b. Faucet: Chicago Faucet 1100-GN10AE35-XKCP
c. Supplies: McGuire H2165LK
d. Drain: Elkay LKAD-35
e. Trap: 1 ½" x 1 ½" 17 gauge cast brass p-trap

G. Urinals:
1. U-1: Wall mounted white vitreous china high efficiency 0.125 gallon per flush urinal with ¾" top inlet spud, 2" outlet spud, removable strainer, and concealed hard wired sensor operated 0.13 gpf flush valve with override button, wall box, stainless steel access panel, elbow adaptor for top spud fixtures, and 120VAC/24VAC transformer.
a. Fixture: Kohler 'Bardon' K-4904-ET
b. Flush Valve: Sloan 197-0.13 ES-S TMO SWB
c. Transformer: Sloan EL-154
d. Carrier: Zurn Commercial Grade

H. Wall Hydrants:
1. WH-1: Freeze proof automatic draining wall hydrant, exposed, ¾" inlet, ¾" hose thread ASSE 1019-B hose connection vacuum breaker, loose key operator, and chrome finish.
a. Faucet: Woodford Model 65CH

I. Water Closets:
   1. WC-1 (Floor Mount with Electronic Flushometer):
      a. Fixture: ANSI A117.1; floor mounted, siphon jet action, vitreous china, 14 ¾" high close-coupled closet combination with elongated rim, top spud and boltcaps. Model K-4349-0 manufactured by Kohler.
      b. Flush Valve: New ANSI A112.18.1; exposed chrome plated sensor operated, escutcheon integral screwdriver stop and vacuum breaker, 120 VAC/24 VAC transformer. Sloan Royal Model 111-ES-S manufactured by Sloan Valve Company.
      c. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, stainless steel bolts, without cover. Model 1955SSC manufactured by Bemis.
   2. WC-2 (Floor Mount – ADA with Electronic Flushometer):
      a. Fixture: ANSI A117.1; floor mounted, siphon jet action, vitreous china, 17 ½" high close-coupled closet combination with elongated rim, top spud and boltcaps. Model K-4368-0 manufactured by Kohler.
      b. Flush Valve: New ANSI A112.18.1; exposed chrome plated sensor operated, escutcheon integral screwdriver stop and vacuum breaker, 120 VAC/24 VAC transformer. Sloan Royal Model 111-ES-S manufactured by Sloan Valve Company.
      c. Seat: Solid white plastic, open front, extended back, self-sustaining hinge, stainless steel bolts, without cover. Model 1955SSC manufactured by Bemis.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures in accordance with manufacturer's instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.

B. Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

C. Install barrier free fixtures in compliance with the Wisconsin Building Code and Federal ADA Accessibility Guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to avoid contact by wheelchair users.

D. Install two-station electric water coolers so the bubbler orifice of lower unit is 36" above finished floor. Provide unions at water connections to electric water coolers.

E. Where individual toilet rooms contain one or more wall mounted urinals, install one urinal with the lip 17" above finished floor. Install all additional urinals within the same room with the lip 24" above finished floor.

F. Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

G. Cover pipe wall penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, unless otherwise indicated.

H. Set floor mounted plumbing fixtures, counter mounted sinks, lavatory and sink faucets and drains with full setting bed of flexible non-staining plumber's putty.

I. Seal wall mounted plumbing fixtures to wall with silicone sealant. Seal mop basins to floor and wall with grout or silicone sealant.

J. Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

K. Mount wall hydrants in exterior wall construction with valve extended beyond interior side of building insulation. Slope to drain to building exterior. Install 24" minimum above finished grade. Set wall hydrant in grout or caulk and fill exterior wall penetration with insulation.

L. Adjust lavatory mixing valve outlet water temperature to maximum 105°F.

M. Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust flush valves for intended water flow rate to fixtures without splashing, noise or overflow.

N. Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

END OF SECTION 224200

SECTION 230500 - COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. It is the intent of these specifications to provide complete and workable mechanical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, dryage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable mechanical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

E. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

F. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

G. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.2 SECTION INCLUDES

A. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Guarantee
5. Work By Owner
6. Operation And Maintenance Instructions
7. Record Documents
8. Continuity Of Existing Services
9. Protection Of Finished Surfaces
10. Sealing And Firestopping
11. Off Site Storage
12. Regulatory Requirements
13. Certificates And Inspections
14. Coordination
15. Demolition And Existing Requirements
16. Request And Certification For Payment
17. Sleeves And Openings
18. Omissions
19. Definitions
20. Project/Site Conditions
21. Work Sequence And Scheduling
22. Salvage Materials
23. Training
24. Access Panels And Doors
25. Identification
26. Demolition
27. Cutting And Patching
28. Building Access
29. Equipment Access
30. Lubrication
31. Housekeeping And Clean Up

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. This section applies to all Division 23 sections.

1.4 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review.

G. Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedule is in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

1.5 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in other sections are as follows:

1.	AABC	Associated Air Balance Council
2.	ABMA	American Boiler Manufacturers Association
3.	ADC	Air Diffusion Council
4.	AGA	American Gas Association
5.	AMCA	Air Movement and Control Association
6.	ANSI	American National Standards Institute
7.	AHRI	Air-Conditioning, Heating and Refrigeration Institute
8.	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
9.	ASME	American Society of Mechanical Engineers
10.	ASTM	American Society for Testing and Materials
11.	AWWA	American Water Works Association
12.	AWS	American Welding Society
13.	EJMA	Expansion Joint Manufacturers Association
14.	EPA	Environmental Protection Agency
15.	ETL	Edison Testing Laboratories
16.	FM	Factory Mutual Insurance Company
17.	GAMA	Gas Appliance Manufacturers Association
18.	HI	Hydraulic Institute
19.	ICC	International Code Council
20.	IEEE	Institute of Electrical and Electronics Engineers

21.	IRI	Industrial Risk Insurers
22.	ISA	Instrument Society of America
23.	ISO	International Organization for Standardization
24.	MCAA	Mechanical Contractors Association of America
25.	MICA	Midwest Insulation Contractors Association
26.	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
27.	NBS	National Bureau of Standards
28.	NEBB	National Environmental Balancing Bureau
29.	NEC	National Electric Code
30.	NEMA	National Electrical Manufacturers Association
31.	NFPA	National Fire Protection Association
32.	OSHA	Occupational Safety and Health Administration
33.	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
34.	TABB	Testing, Adjusting and Balancing Bureau
35.	UL	Underwriters Laboratories Inc.
36.	ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
37.	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
38.	UL1479	Fire Tests of Through-Penetration Firestops
39.	UL723	Surface Burning Characteristics of Building Materials

1.6 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
   1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment/electrical or accessories into the system, including but not limited to, coordination with other trades and any required changes by other trades and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

1.7 GUARANTEE

A. Refer to Division 1 for Guarantees and Warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.8 WORK BY OWNER

A. Asbestos abatement will be performed by the Owner under separate contract.

1.9 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.

1.10 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division 1, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be

Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.

2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
5. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

C. In addition to the data indicated in the Division 1, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

1.11 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.12 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished surfaces.

B. Furnish one aerosol spray can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" per Division 1.

1.13 SEALING AND FIRESTOPPING

A. Sealing, fireproofing patching, fire caulking and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from Architect/Owner.

1.14 OFF SITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.15 REGULATORY REQUIREMENTS

A. Comply with requirements of Wisconsin Administrative Code and local Authority Having Jurisdiction (AHJ) regarding materials and installation.

1.16 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

D. Where applications are required for procuring services to the Building, prepare and file such application with the utility company. Furnish all information required in connection with the application in the form required by the utility company.

1.17 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services, or providing temporary service. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
1. Structure
2. Recessed light fixtures
3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
4. Ductwork and appurtenances
5. Electrical and low voltage cable tray
6. Plumbing vent piping
7. Fire protection (sprinkler system)
8. HVAC piping
9. Gas piping, process piping and domestic water
10. Electrical conduit and low voltage conduit
11. Control conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.

I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

J. At the initial Coordination Meeting, the Mechanical Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Contractor to be reflected on the Drawings. The Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
1. Structure
2. Existing roof drain leaders
3. Sprinkler mains
4. Significant conduit runs
5. Cable trays
6. Contract ceiling heights
7. Soffits
8. Access points
9. Fire wall penetrations
10. Gas piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne

by the Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.18 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.19 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project Representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the owner, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.20 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.21 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.22 DEFINITIONS

A. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.23 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.24 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.25 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.26 TRAINING

A. The contractor shall have the following responsibilities:
   1. Provide a training plan sixty days before the planned training covering the following elements:
      a. Equipment
      b. Intended audience
      c. Location of training
      d. Objectives
      e. Subjects covered (description, duration of discussion, special methods, etc.)

f. Duration of training on each subject
g. Instructor for each subject
h. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).

2. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.
3. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.
4. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.
5. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.
6. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.
7. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.
8. Training shall include:
   a. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   b. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   c. Discussion of relevant health and safety issues and concerns.
   d. Discussion of warranties and guarantees.
   e. Common troubleshooting problems and solutions.
   f. Explanatory information included in the O&M manuals.
   g. Discussion of any peculiarities of equipment installation or operation.
   h. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   i. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.
9. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

B. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

C. Provide a minimum of 8 hours of instruction.

PART 2 – PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-In Ceilings:
1. Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Plaster Walls And Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. Stencils:
1. Not less than 1 inch high letters/numbers for marking pipe and equipment.

B. Snap-On Pipe Markers:
1. Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services.

C. Engraved Name Plates:
1. White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

D. Valve Tags:
1. Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

2.3 SLEEVES AND OPENINGS

A. General:
1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.

2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

2.4 SEALING AND FIRESTOPPING

A. Fire And/Or Smoke Rated Penetrations:
   1. Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco.
   2. All firestopping systems shall be provided by the same manufacturer.
   3. Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
   4. Product:
      a. Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
      b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
      c. Contractor shall use firestop putty, caulk sealant, intumescent wrap strips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
      d. All sealants shall meet the intent of LEED® VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
   1. Pipe Penetrations: At pipe penetrations of non-rated interior partitions and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
   2. Duct Penetrations:
      a. Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.
      b. Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 – EXECUTION

3.1 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area,

construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the owner to minimize disruption to the existing building occupants.

B. All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the owner. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.2 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.3 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.4 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

B. Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

3.5 COORDINATION

A. Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

B. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

C. Cooperate with the test and balance agency in ensuring compliance with Section 23 05 93 - Testing, Adjusting and Balancing for HVAC. Verify system completion to the test and balance agency (pressure testing, proper pressurization, clean filters, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

3.6 IDENTIFICATION

A. Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

B. Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

C. Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 - Products.

D. Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

E. Use engraved name plates to identify control equipment.

F. Label fire dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "FIRE DAMPER". Smoke and combination fire smoke dampers shall also include a second line listing the individual damper tag. The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.7 LUBRICATION

A. Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

3.8 SLEEVES AND OPENINGS

A. General:
1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
5. Refer to Division 1 for additional information on sleeves and openings.

3.9 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire And/Or Smoke Rated Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Partitions:
   1. At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.
   2. Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

3.10 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION 230500

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes general requirements for single-phase and poly-phase general purpose squirrel-cage induction motors for use on AC powers systems up to 600 Volts. Included are the following sections:
   1. Single Phase Motors
   2. Polyphase Motors

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 233400 – HVAC Fans

C. Section 235500 – Fuel-Fired Heaters

D. Section 237413 – Roof Top Air Handling Units

E. Section 238200 – Heating and Cooling Terminal Units

1.3 REFERENCE STANDARDS

A. The following Standards are referenced herein. Utilize the current edition of the referenced Standards unless otherwise noted:
   1. ANSI/IEEE 112 Test Procedure for Polyphase Induction Motors and Generators.
   2. ANSI/IEEE 841 Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors-Up to and Including 500 hp.
   3. ANSI/NEMA MG-1Motors and Generators
   4. ANSI/NFPA 70National Electric Code

1.4 COORDINATION

A. Coordinate features of motors, installed units and accessory devices to be compatible with:
   1. Motor controllers.
   2. Torque, speed and horsepower requirements of the load.
   3. Rating and characteristics of the supply circuit and required control sequence.
   4. Ambient and environmental conditions of the installation location.

B. All starters, overload relay heater coils, disconnect switches, fuses, relays, power wiring, power wiring conduit, push buttons, pilot lights and other devices for the control of motors or electrical equipment are furnished and installed by the Division 26 Contractor unless otherwise noted elsewhere in this Division of Specifications.

PART 2 – PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with the requirements of this Section unless stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with ANSI/NEMA MG-1 requirements unless otherwise noted.

C. Comply with ANSI/IEEE 841 requirements for all severe-duty motors unless otherwise noted.

2.2 MOTOR CHARACTERISTICS

A. Motors shall be continuous duty at ambient temperature of 40°C and an altitude of 3,300 feet above sea level.

B. Capacity and torque characteristics shall be suitable to start, accelerate and operate the connected loads at the designated speeds, as the installed altitude and environment with the indicated operating sequence without exceeding the nameplate ratings or considering the service factor of the motor.

C. Perform dynamic balancing and test motors after manufacture. Self-excited vibration velocity of motors shall not exceed limits set forth in NEMA MG-1, Part 7.

2.3 SINGLE PHASE MOTORS

A. Motors 1/20 horsepower and smaller shall be shaded-pole type.

B. Motors larger than 1/20 horsepower through 1/3 horsepower shall be one of the following to suit the starting torque and other requirements of the specific motor application:
   1. Permanent-split capacitor.
   2. Capacitor start, capacitor run.

C. Bearings shall be pre-lubricated, anti-friction ball bearing or sleeve bearing type suitable for radial and thrust loading.

D. Thermal protection shall be internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to the temperature rating of the motor insulation. Thermal-protection device shall automatically reset when the motor temperature returns to a normal range.

2.4 POLYPHASE MOTORS

A. Motors ½ horsepower and larger shall be NEMA MG-1, Design B medium induction polyphase motors unless otherwise noted. Motors shall random wound squirrel cage copper bar rotors.

B. Motors shall be 208 volt motors unless otherwise noted.

C. Motors shall be premium efficiency, meeting the requirements of NEMA MG-1.

D. Motors shall be 4-pole (nominal 1800 rpm).

E. Service factor of motor shall be 1.15 unless otherwise noted.

F. Motors windings and leads shall be copper.

G. Motor insulation shall be Class F unless otherwise noted. Motor temperature rise shall match the motor insulation.

H. Motors smaller than 15 horsepower shall utilize the manufacturer's starting characteristics.

I. Motor enclosures shall be open drip-proof.

J. Motor enclosures for motor frame sizes 324T and larger shall be cast iron.

K. Motor enclosures for motor frame sizes smaller than 324T shall be rolled steel or cast iron.

L. Bearings shall be regreasable, shielded, anti-friction ball bearing type suitable for radial and thrust loading. Bearings shall be rated for a minimum AFBMA 9, L10 life of 80,000 hours. Stamp the bearing sizes on the motor nameplate.

M. Bearings on motors serving belt driven equipment shall utilize a bearing load calculated with NEMA minimum v-belt pulley with centerline at the end of the NEMA standard shaft extension.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Mount motors on a rigid base designed to accept a motor, using metal shims as required under each mounting foot to obtain a secure installation.

B. Inspect and align each motor when direct coupled to the driven device. Alignment shall be within HVAC equipment manufacturer's limits.

C. Perform dynamic balancing and test motors for vibration after manufacture. Self-excited vibration velocity of motors shall not exceed 0.157/0.06 inches per second at bearing caps.

D. Inspect and align each motor when connected to the driven device by means of a belt drive. Mount motor sheaves on the appropriate shafts as recommended by the equipment and motor manufacturers. Use a straight edge to check alignment of the sheaves. Reposition the sheaves as required to obtain the proper alignment. After the sheaves are aligned, adjust the motor base as required so that the belt(s) can be added and then tighten the motor base so that the belt tension is in accordance with the drive manufacturers recommendations. Frequently check the belt tension during the first 24 hours of operation and again after 80 hours of operation for proper belt tension. Adjust belt tension as required.

3.2 START-UP

A. Test start each motor to verify proper rotation prior to operating system.

B. Lubricate all motors as recommended by motor manufacturer. Record lubrication material used and frequency of use. Include this lubrication log in the Operation and Maintenance manuals.

END OF SECTION 230513

SECTION 230523 – GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This section includes valve specifications for all HVAC systems except where indicated under Related Work. Included are the following topics:
   1. Natural Gas Systems
      a. Shut-off Valves (Gas)
      b. Gas Pressure Regulators (Gas)

1.2 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230515 – Piping Specialties

D. Section 230914 – Electric Instrumentation and Control Devices for HVAC

1.3 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Natural Gas Systems
      a. Shut-off Valves (Gas)
      b. Gas Pressure Regulators (Gas)

B. Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation

1.4 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.5 DESIGN CRITERIA

A. Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer unless prior written approval is obtained from owner.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 - Common Work Results for HVAC.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. DeZurik, Homestead, Rockwell, Walworth.

B. All valves shall be designed for operation with not less than 150 lbs. working pressure and of a type permitting repacking while under pressure. Provide valves to allow isolation shut-off of all major branches.

2.2 NATURAL GAS SYSTEMS

A. SHUT OFF VALVES:
   1. 2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.
   2. DeZurik, Homestead, Rockwell, Walworth.

B. GAS PRESSURE REGULATORS:
   1. 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

PART 3 – EXECUTION

3.1 GENERAL

A. Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

B. Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

C. Install all valves with the stem in the upright position. Valves installed with the stems down, will not be accepted.

D. Install stem extensions when shipped loose from valve.

E. Prior to flushing of piping systems, place all valves in the full-open position.

3.2 SHUT-OFF VALVES

A. Install shut-off valves on both sides of all equipment, on major piping loops, and at each branch for isolation or repair. All shut-off valves shall be located to allow proper access for operation for servicing.

3.3 DRAIN VALVES

A. Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, equipment locations specified.

3.4 GAS PRESSURE REGULATORS

A. When the gas pressure regulator is equipped with a vent connection, run a connection size vent to the exterior of the building in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION 230523

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SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:
1. Pipe Hanger and Support Manufacturers
2. Structural Supports
3. Pipe Hangers and Supports
4. Wood Structure Supports
5. Beam Clamps
6. Equipment Curbs
7. Pipe Penetrations through Roof

1.3 RELATED WORK

A. Applicable provisions of Division 1 shall govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230548 – Vibration Controls for HVAC Piping and Equipment

D. Section 230700 – HVAC Insulation

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
1. Pipe Hanger and Support Manufacturers
2. Structural Supports
3. Pipe Hangers and Supports
4. Wood Structure Supports
5. Beam Clamps
6. Equipment Curbs
7. Pipe Penetrations through Roof

B. Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service.

C. All submittals are to comply with submission and content requirements specified in this specification.

1.5 REFERENCE STANDARDS

A. MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.

B. MSS SP-69 Pipe Hangers and Supports - Selection and Application.

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

B. Piping connected to rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

C. Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

D. Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

E. Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

1.8 DESCRIPTION

A. Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

B. Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

C. Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

D. Protect insulation at all hanger points; see Related Work above.

PART 2 – PRODUCTS

2.1 PIPE HANGER AND SUPPORT MANUFACTURERS

A. Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

2.2 STRUCTURAL SUPPORTS

A. Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend equipment.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers For Steel Pipe Sizes 1/2" Through 2":
1. Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

B. Multiple Or Trapeze Hangers:
1. Steel channels with welded spacers and hanger rods if calculations are submitted.

C. Wall Support:
1. Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
2. Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

D. Steel Hanger Rods:
1. Threaded both ends, threaded one end, or continuous threaded, black finish.
2. Size rods for individual hangers and trapeze support as indicated in the following schedule.
3. Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4

4. Provide rods complete with adjusting and lock nuts.

2.4 WOOD STRUCTURE SUPPORTS

A. Carbon steel pipe short strap for piping ½" through 2". Fastened with two No. 24 x 2 (minimum size) wood screws. Anvil Figure 262.

B. Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter. Anvil Figure 142.

2.5 BEAM CLAMPS

A. MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

B. MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

2.6 EQUIPMENT CURBS

A. Prefabricated Metal Curb:
1. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

B. Wood Build Sleeper Curb:
1. Constructed of wood blocking and anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

2.7 PIPE PENETRATIONS THROUGH ROOF

A. Single Pipe Penetrations:
1. A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. .
2. A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using beam clamps, ceiling plates, or wall brackets. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

B. Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

3.2 HANGER AND SUPPORT SPACING

A. Place a hanger within 12 inches of each horizontal elbow, valve, or similar piping specialty item.

B. Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

C. Support riser piping independently of connected horizontal piping.

D. Adjust hangers to obtain the slope specified in the piping section of this specification.

E. Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"

3.3 EQUIPMENT CURBS

A. Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment manufacturer's instructions. Flashing and counter flashing by the General Contractor.

B. Fill the entire void space with compressible fiberglass insulation.

3.4 PIPE PENETRATION THROUGH ROOF

A. Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the General Contractor.

END OF SECTION 230529

SECTION 230548 - VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

1. Contractor provide vibration isolators and flexible connections for the following equipment specified and indicated on the drawings:
   a. Rooftop Unit Fans
   b. Fans

1.2 SECTION INCLUDES

A. This section includes specifications for vibration isolation material for equipment, piping systems, and duct systems. Included are the following topics:
   1. Type C: Unhoused Spring with Neoprene
   2. Type E: Spring Hanger with Neoprene
   3. Type T: Horizontal Thrust Restraint
   4. Flexible Piping Connections
   5. Curb Mounted Spring Rail

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

D. Section 231100 – Facility Fuel Piping

E. Section 233300 – Air Duct Accessories

F. Section 233400 – HVAC Fans

G. Section 237413 - Roof Top Air Handling Units

1.4 SUBMITTALS

A. Refer to Division 1, General Conditions, Submittals. At a minimum, provide submittals for the following items:
   1. Type C: Unhoused Spring with Neoprene
   2. Type E: Spring Hanger with Neoprene
   3. Type T: Horizontal Thrust Restraint
   4. Flexible Piping Connections
   5. Curb Mounted Spring Rail

B. Include isolator type, materials of construction, isolator free and operating heights, and isolation efficiency based on the lowest operating speed of the equipment supported.

1.5 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.6 DESIGN CRITERIA

A. Isolate all motor driven mechanical equipment from the building structure and from the systems which they serve to prevent equipment vibrations from being transmitted to the structure. Consider equipment weight distribution to provide uniform isolator deflections.

B. For equipment with variable speed capability, select vibration isolation devices based on the lowest speed.

C. Coordinate the selection of devices with the isolator and equipment manufacturers. All isolation material used by contractor shall be supplied by one manufacturer.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Use materials that will retain their isolation characteristics for the life of the equipment served. Use industrial grade neoprene for elastomeric materials.

B. Treat all isolators to resist corrosion. For isolation devices exposed to the weather or used in high humidity areas, hot dip galvanize steel parts, apply a neoprene coating on all steel parts, or use stainless steel parts; include limit stops to resist wind.

C. Use isolators with a ratio of lateral to vertical stiffness not less than 1.0 or greater than 2.0.

2.2 VIBRATION ISOLATOR MANUFACTURERS

A. Mason Industries, Amber/Booth Co., Vibration Mounting & Controls, Peabody Noise Control.

2.3 TYPE C: UNHOUSED SPRING WITH NEOPRENE

A. Combination freestanding, unhoused spring and neoprene with rib molded antifriction base. Include leveling bolts for securing to the equipment. Springs to be laterally stable under load and selected so they have an additional travel to solid equal to 50% of the rated deflection. Use height saving brackets when appropriate to the application.

2.4 TYPE E: SPRING HANGER WITH NEOPRENE

A. Vibration hanger with a steel spring and 0.3" deflection neoprene element in series. Use neoprene element molded with a rod isolation bushing that passes through the hanger box. Select spring diameters and size hanger box lower holes large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. Select springs so they have a minimum additional travel to solid equal to 50% of the rated deflection.

2.5 TYPE T: HORIZONTAL THRUST RESTRAINT

A. Spring element in series with a neoprene pad as described for Type C mount with the same deflection as specified for the mounting or hanger. Design the assembly so the spring element is contained within a steel frame, so it can be preset for thrust at the factory, and adjusted in the field for a maximum of 1/4" movement at start and stop. Include threaded rod and angle brackets for attachment to both equipment and ductwork or equipment and structure.

2.6 FLEXIBLE PIPING CONNECTIONS

A. Natural Gas:
   1. Do not use flexible pipe connections on gas systems.

2.7 CURB MOUNTED SPRING RAIL

A. Full-perimeter rail type isolator, spring components shall be 2" (51 mm) deflection, free-standing, un-housed, laterally stable steel springs. Springs shall have a lateral stiffness greater than 1.0 times the rated vertical stiffness and shall be designed for 50% overload to solid. Springs shall be color coded to indicate load capacity. Rails shall provide continuous support for the rooftop equipment and shall be designed to provide isolation against casing-radiated vibration in the rooftop equipment housing and structure-borne vibration from rotating and mechanical equipment in the rooftop package. Rail assembly shall consist of extruded aluminum top and bottom members connected by spring isolators and a continuous air- and water-tight seal. The seal shall be a beaded elastomeric material retained in a keyway along the top extrusion. The weather strip shall be sealed along the bottom with an aluminum fascia strip. Rail assemblies shall incorporate means for attachment to the building and the supported equipment and shall incorporate additional stiffening members if necessary to assure stability. Rails shall be fitted with wind restraint devices suitable for prevailing wind conditions that will not impose loads on the curb walls at 90 degrees to their long axis.

2.8 PERFORMANCE

A. Select vibration isolation devices as indicated below or to provide not less than 95% isolation efficiency, whichever is greater.

	Floor Span or Column Spacing							
	--On Grade--		---20 Feet---		---30 Feet---		---40 Feet---	
TYPE OF EQUIPMENT	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.	Iso. Type	Min. Static Defl. In.
ROOFTOP UNITS:								
Thru 5 hp	C	0.35	C	0.75	C	0.75	C	0.75

Piping Connected To Rotating Or Reciprocating Equipment:

Flexible piping connections and Type E or F hangers for a distance of 100 pipe diameters or a distance of three hangers away from the equipment, whichever is greater. Type F hangers shall be utilized for the first two upstream and downstream hangers. The Type E and/or Type F hangers must have the same deflection as the hangers supporting the rotating or reciprocating equipment.

2.9 BLOWER MINIMUM DEFLECTION GUIDE

		Required Deflection (Inches)			
		On	20'	30'	40'
A.	Fan Speed (RPM)	Grade	Floor Span	Floor Span	Floor Span
1.	175-224	0.35	3.50	4.50	4.50
2.	225-299	0.35	3.50	3.50	3.50
3.	300-374	0.35	2.50	2.50	3.50
4.	375-499	0.35	1.50	2.50	3.50
5.	500 and over	0.35	0.75	1.50	2.50

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install vibration isolation devices in accordance with the manufacturer's installation instructions. The isolation manufacturer and/or the manufacturer's authorized representative shall be responsible for:
   1. Selection of the proper size and type of isolation materials.
   2. Preparation of the submittal material required.

B. Unless otherwise noted on the equipment schedule, all mechanical equipment shall be mounted on vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accord with weight distribution of the isolated equipment to provide reasonably uniform deflection. Deflections shall be provided by the equipment manufacturer.

C. Bolt isolators to equipment and to supporting structure where isolator bolt holes are supplied.

D. Shim or adjust leveling screws to level equipment. Shims shall not interfere with isolator action.

E. Verify actual deflected height with design operating height and replace the isolator when they differ by 25% or more.

F. Correct interferences with the isolator action or report to the General Contractor when interference is caused by another contractor.

G. Do not allow installation practices to short circuit any isolation device.

3.2 ROOFTOP UNITS, AND CENTRIFUGAL FANS

A. Attach horizontal thrust restraints at the centerline of thrust and symmetrically on either side of the unit. Thrust restraints are not required when the fan section in not isolated from the remainder of the rooftop unit by means of duct flexible connections.

END OF SECTION 230548

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SECTION 230593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Contractor provide:
1. Personnel to accompany and assist Architect/Engineer and air balancer during test, adjust and balancing of system(s).
2. Have the temperature control manufacturer's representative set and adjust automatically operated devices to achieve specified sequence of operations.
3. Have the temperature control manufacturer's representative accompany and assist Architect/Engineer and Air Balancer during test, adjust and balancing of system(s).
4. The balancing will be performed by a subcontractor retained by the Mechanical Contractor.

1.2 SECTION INCLUDES

A. This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:
1. Performing Testing, Adjusting and Balancing
2. VAV Supply Duct System Static Pressure Setpoint
3. Bypass Duct System Setpoint

1.3 RELATED WORK

A. Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230523 – General Duty Valves for HVAC Piping

D. Section 230700 – HVAC Insulation

E. Section 230914 –Electric Instrumentation and Control Devices for HVAC

F. Refer to Division 1 for submittals. At a minimum, provide submittals for the following items:
1. Testing, Adjusting and Balancing Report

G. Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

H. Submission: Distribute electronic copies of the Report to the General Contractor, Architect/Engineer, and the Owner.

I. Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:
   1. General Information
   2. Summary
   3. Air Systems

J. Contents: Provide the following minimum information, forms and data:
   1. General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.
   2. Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.
   3. The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

1.4 REFERENCE STANDARDS

A. AABC National Standards for Total System Balance, Sixth Edition, 2002.

B. ASHRAE ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.

C. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 5 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.
   2. A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact General Contractor immediately.
   3. Submit Qualifications of firm and project staff to the Architect/Engineer upon request.

1.6 DESCRIPTION

A. The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

B. Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

C. Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

D. Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

E. Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

1.7 SCHEDULING

A. The test and balance agency shall give the General Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Division 1 for General Contractor responsibilities for scheduling.

1.8 PRE-BALANCE CONFERENCE

A. 30 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the General Contractor and the mechanical system and temperature control system installing Contractors. Provide Architect/Engineer a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

PART 2 – PRODUCTS

2.1 INSTRUMENTATION

A. Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

B. All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Architect/Engineer upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards.

PART 3 – EXECUTION

3.1 DAILY REPORTS

A. Submit to General Contractor daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

3.2 PRELIMINARY PROCEDURES

A. Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

B. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals. Inspect all systems components for proper installation and operation. Use manufacturer's ratings for all equipment to make calculations except where field test shows ratings to be impractical. Verify that all instruments are accurately calibrated and maintained.

C. Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, related temperature controls for completion of installation.

D. Notify General Contractor on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

3.3 EXISTING EQUIPMENT

A. Balancing Agency shall perform testing, adjusting and balancing procedures on each of existing rooftop systems identified on the drawings. Existing rooftop units are noted on drawings and schedules as RTU-1, 2, 3, 4 and 5.

B. Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Test and record motor full load amperes and current draw. Test and record system static pressure suction and discharge. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

C. Existing rooftop shall follow requirements the performing testing, adjusting and balancing as noted in items below for 3.4A to 3.4Q.

3.4 PERFORMING TESTING, ADJUSTING AND BALANCING

A. Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

B. In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the General Contractor.

C. Cut insulation, ductwork for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

D. In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

E. Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Test and record motor full load amperes and current draw. Test and record system static pressure suction and discharge. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

F. Check and record the following items at each gas-fired heating and DX cooling coil:
   1. Inlet air temperature.
   2. Leaving air temperatures.
   3. Pressure drop of each coil.
   4. Actual/rated running amperage of fan motor.

G. Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

H. Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

I. Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

J. Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the Engineer by giving the Engineer properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct system within its design limitations with respect to speed of the device and pressure classification of the distribution system.

K. Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

L. Final air system measurements to be within the following range of specified cfm:

1.	Fans	0% to +10%
2.	Supply grilles, registers, diffusers	0% to +10%
3.	Return/exhaust grilles, registers	0% to -10%
4.	Room pressurization air	-5% to +5%

M. Contact the temperature control contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

N. Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

O. Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

P. Verify and record, in the T&B Report, "K" factors for all VAV air terminal devices and air flow stations.

Q. Coordinate rooftop minimum outside air set points with the Mechanical Contractor.

3.5 VAV SUPPLY AND EXHAUST DUCT SYSTEM STATIC PRESSURE SET POINT

A. For VAV supply systems with VAV air terminal devices, determine the minimum required duct static pressure at the DDC static pressure sensor location(s) needed to insure that all VAV air terminals are operating at their design airflows with temperature controls contractor and record them in the T&B report for each system.

3.6 BYPASS DUCT SYSTEM SET POINT

A. For CAV supply rooftop systems with VAV air terminal devices, contractor shall determine and validate the bypass damper operation mode and insure that all VAV air terminals are operating at their design airflows at both minimum and maximum settings. Provide these duct static pressure profile numbers at fan discharge, 2/3 downstream in duct system and downstream of the bypass damper. Record these duct static pressure profile in the T&B report for each system. In addition, contractor shall transverse the main ductwork supply airflow and the bypass airflow under modes of operation.

3.7 DEFICIENCIES

A. Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the General Contractor and/or Engineer of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the owner. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION 230593

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SECTION 230700 - HVAC INSULATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Fire-Stop Insulation
      d. Duct Liner Insulation
   2. Accessories

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230515 – Piping Specialties

D. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

E. Section 233100 – HVAC Ducts and Casings

1.4 SUBMITTALS

A. Refer to Division 1 for submittals. At a minimum, provide submittals for the following items:
   1. Insulation Types
      a. Flexible Fiberglass Insulation
      b. Rigid Fiberglass Insulation
      c. Fire-Stop Insulation
      d. Duct Liner Insulation
   2. Accessories

B. Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

1.5 REFERENCE STANDARDS

A. ASTM B209 Aluminum and Aluminum Alloy Sheet and Plate

B. ASTM C165 Test Method for Compressive Properties of Thermal Insulations

C. ASTM C177 Heat Flux and Thermal Transmission Properties

D. ASTM C195 Mineral Fiber Thermal Insulation Cement

E. ASTM C302 Density of Preformed Pipe Insulation

F. ASTM C303 Density of Preformed Block Insulation

G. ASTM C355 Test Methods for Test for Water Vapor Transmission of Thick Materials

H. ASTM C449 Mineral Fiber Hydraulic Setting Thermal Insulation Cement

I. ASTM C518 Heat Flux and Thermal Transmission Properties

J. ASTM C610 Expanded Perlite Block and Thermal Pipe Insulation

K. ASTM C921 Properties of Jacketing Materials for Thermal Insulation

L. ASTM C1136 Flexible Low Permeance Vapor Retarders for Thermal Insulation

M. ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension

N. ASTM D1000 Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications

O. ASTM D2240 Standard Test Method for Rubber Property – Durometer Hardness

P. ASTM E84 Surface Burning Characteristics of Building Materials

Q. ASTM E814 Standard Test Method for Fire Tests of Penetration Firestop Systems

R. ASTM E2336 Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems

S. MICA National Commercial & Industrial Insulation Standards

T. NFPA 225 Surface Burning Characteristics of Building Materials

U. UL 723 Surface Burning Characteristics of Building Materials

1.6 QUALITY ASSURANCE

A. Refer to Division 1 equals and substitutions

B. Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 - Common Work Results for HVAC.

1.8 DESCRIPTION

A. Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:
   1. Pipe Insulation
   2. Duct Insulation
   3. Equipment Insulation

B. Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Architect/Engineer.

1.9 DEFINITIONS

A. Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

B. Protect installed insulation work with plastic sheeting to prevent water damage.

C. Delivery, Storage And Handling:
   1. Deliver field applied material to site in factory fabricated containers with manufacturer's stamp or label showing fire hazard rating of products.
   2. Store in original wrappings and protect from weather and construction traffic.
   3. Protect against dirt, water, chemical and mechanical damage.
   4. Remove damaged insulation from project site, do not install.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex, VentureTape.

B. Materials or accessories containing asbestos will not be accepted.

C. Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less when tested in accordance with ASTM E84, NFPA 255 or UL 723, with the following exceptions:

D. Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

2.2 INSULATION TYPES

A. Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

B. Flexible Fiberglass Insulation: Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

C. Rigid Fiberglass Insulation: Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

D. Fire-Stop Insulation:
   1. Noncombustible, non-asbestos, non-ceramic fiber, high temperature blanket or board fireproofing insulation, constructed of calcium silicate or calcium/magnesium/silica amorphous wool with 2-hour ASTM E814 "F" and "T" fire ratings, UL or equivalent third party listed, labeled and specifically evaluated for such purpose in accordance with ASTM E2336. Foil-scrim-polyethylene fiberglass reinforced factory applied jacket.

E. Duct Liner Insulation: (It is not recommended to use duct liner insulation. Duct liner is against code in hospitals.)
   1. Semi-rigid glass fiber blanket, 1 inch thick, 1.5 lbs./cu/ft. density, K value of 0.25 at 75 degrees F.
   2. Facing: NFPA 90A and 90B, fire resistant anti-bacterial neoprene coating or coating shall not allow moisture penetration into insulation.
   3. Temperature Range: 35 degrees F. to 180 degrees F.
   4. Air Velocity: Up to 4000 ft./min.
   5. Minimum Sound Absorption:

Frequency	1 inch
125	.26
250	.48
500	.70
1000	.90
2000	.93
4000	.80

Frequency	1 inch	1-1/2 inch	2 inch
Minimum NRC:.70	.85	.95	

6. Fire Hazard Classification: 25 maximum flame spread; 25 maximum fuel contributed; 50 maximum smoke developed.
7. Manufacturers:
   a. Knauf: Duct Liner M
   b. Schuller Linacoustic HP
   c. Owens-Corning Fiberglas: Aeroflex Duct Liner
8. Accessories:
   a. Provide mechanical fasteners and similar accessories recommended by insulation manufacturer for applications indicated.
   b. Provide cements, waterproof adhesives, coatings, sealers, protective finishes and similar compounds recommended by insulation manufacturer to meet fire ratings and for applications indicated.

2.3 JACKETS

A. Foil Scrim All Service Jackets (FSJ): Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

2.4 ACCESSORIES

A. All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

B. Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

C. Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

D. Tack fasteners to be stainless steel ring grooved shank tacks.

E. Staples to be clinch style.

F. Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

G. Finishing cement to be ASTM C449.

H. Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

I. Bedding compounds to be non-shrinking and permanently flexible.

J. Vapor barrier coatings to have maximum applied water vapor permeance of .05 perms.

K. Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

B. Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

3.2 INSTALLATION

A. All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics and insulation cements. Maintain temperature during and after installation for minimum period of 24 hours.

B. Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

C. Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

D. Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

E. Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

F. Existing or new insulation damaged and/or removed by the Contractor during remodeling work shall be repaired or replaced with new insulation.

G. All duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

H. Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

I. Provide a complete vapor barrier for insulation on the following systems:
1. Insulated Duct
2. Equipment, ductwork with a surface temperature below 65 degrees F

3.3 DUCT INSULATION

A. General:
1. Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.
2. Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.
3. Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.
4. Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.
5. External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner. Provide 4" overlap of external insulation over ends of acoustically lined sections.
6. Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.
7. Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.

B. Grease Ducts: Strictly adhere to manufacturer's installation instructions and rating requirements for application of fire-stop insulation. Cover all exhaust ducts serving Type I kitchen hoods with fire-stop insulation from a point prior to penetration of ceiling, wall, floor or concealment through building to termination at outside of building. Extend fire-stop insulation through roof curbs.

3.4 DUCT INSULATION SCHEDULE

A. Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	Insulation Type	Jacket	Insulation Thickness
Outside air ducts	Rigid Fiberglass	FSJ	2"
Mixed air ducts	Rigid Fiberglass	FSJ	2"
Exposed supply ducts*	Rigid Fiberglass	FSJ	2"
Concealed supply ducts	Flexible Fiberglass	FSJ	2"
Supply ductwork downstream of VAV boxes	Flexible Fiberglass		2"
Supply ductwork downstream of VAV boxes as indicated on drawings	Duct Liner Insulation		1-1/2"
Ductwork in unconditioned space	Rigid Fiberglass	FSJ	2"
All Ducts located in unconditioned Attics***	Flexible Fiberglass	FSJ	3"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2"
Grease ducts serving Type I Kitchen hoods	Fire-Stop	See Spec.	As Req'd. for Specified Hourly Rating

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

*** Outside air ductwork between the isolation damper and the outside air intake does not require insulation where it is located in an unheated attic.

B. Duct Liner Insulation Installation:
   1. Acoustical Lining:
      a. See SMACNA, Duct Liner Application Standard for minimum standards.
      b. Apply to interior of ducts where indicated or scheduled.
      c. Secure to ductwork with 100% coverage adhesive and 12 gauge impale anchor tabs as recommended by SMACNA Figure #5, 1975 Edition.
      d. Continuously seal corner joints, tightly butted smooth joints no exposed edges; full coverage adhesive on all edges and butting surfaces; horizontal duct lining overlapping vertical section.
      e. Flat or longitudinal Joints: tightly butted, no exposed edges, full coverage adhesive at butting edges.
      f. Transverse Joints:
         1) Tight butt type, to preceding section of duct lining.
         2) Exposed edges: Coat with 100% saturated coat sprayed adhesive at shop.
         3) Edges tacky at time of installation, or re-coat in field.

4) Make positive bond to preceding section duct lining.
5) Protect edges from dirt and debris.

g. Tightly seal tears, scuffs, breaks on air side with 100% continuous glass cloth sealing strips embedded in full coverage adhesive.
h. Duct vanes not lined unless otherwise indicated.
i. Insulation 1 inch thick unless otherwise indicated.

2. Repair separation or cracking of insulation due to thermal movement or poor workmanship.
3. Inspection of Duct Lining:
   a. At completion, Architect, Engineer may select at random inspection point in each type of system.
   b. At each inspection point, remove 1.0 sq. ft. or more of lining, including sheet metal duct for inspection.
   c. Inspection points based on 1 opening per 100 lin. ft. of total duct run.
4. Inspection Items: Full adhesion and fastening methods; joints; holes in sheet metal at joints and fasteners.
5. When one inspection point shows non-compliance, additional Architect/Engineer, and inspection repeated.
6. When 20% of total number of inspection items, at all inspection points shows noncompliance, remove and replace entire duct required, correct all non-compliances.
7. Repaint to equal new conditions.

END OF SECTION 230700

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SECTION 230914 - ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes electrical control system specifications for all HVAC work as well as related electrical control for systems found in other specification sections. Included are the following topics:
1. Control Dampers
2. Control System Instrumentation
3. Electric/Electronic Thermostats
4. Receiver Controllers
5. Duct Smoke Detector and Fire Alarm Interface Modules
6. Time Clocks
7. Temperature Control Panels
8. Temperature Sensors
9. Carbon Dioxide (CO2) Sensor
10. Power Supplies

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230593 – Testing, Adjusting, and Balancing for HVAC - Coordination

D. Section 231500 – Piping Specialties

E. Section 233100 – HVAC Ducts

F. Section 233300 – Ductwork Accessories - for control damper installation

G. Division 23 - HVAC - Equipment provided to be controlled or monitored

H. Division 26 – Electrical – Installation requirements & Equipment provided to be controlled or monitored

I. Division 28 - Electronic Safety and Security

1.4 SUBMITTALS

A. Refer Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Control Dampers
   2. Control System Instrumentation
   3. Electric/Electronic Thermostats
   4. Receiver Controllers
   5. Duct Smoke Detector and Fire Alarm Interface Modules
   6. Time Clocks
   7. Temperature Control Panels
   8. Temperature Sensors
   9. Power Supplies

B. Include the following information:
   1. Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.
   2. Schematic flow diagrams of systems showing fans, dampers, and other control devices. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.
   3. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings location of mechanical equipment controlled (room number), horsepower and flow of motorized equipment (when this data is available on plans), locations of all remote sensors and control devices (either by room number or column lines).
   4. Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.
   5. A complete description of each control sequence for equipment that is not controlled by direct digital controls.

C. Prior to request for final payment, submit record documents which accurately record actual location of control components including panels, thermostats, wiring, and sensors. Incorporate changes required during installation and start-up.

1.5 REFERENCE STANDARDS

A. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

B. ANSI/ASTM B32 Specification for Solder Metal

C. ASTM B75 Seamless Copper Tube

D. ASTM D1693 Environmental Stress-Cracking of Ethylene Plastics

E. ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position

F. UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

G. AMCA 500-D Laboratory Method of Testing Dampers for Rating

H. ASHRAE Guideline 16-2010 Selecting Outdoor, Return and Relief Dampers for Air-Side Economizer Systems

1.6 QUALITY ASSURANCE

A. Installing contractor must be a manufacturer's branch office or an authorized representative of a Direct Digital Control (DDC) equipment manufacturer that provides engineering and commissioning of the DDC equipment. Submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems and that such authorization has been in effect for a period of not less than three years. DDC equipment may or may not be required to be installed by this contractor as part of the project, but the intent of this quality assurance specification is to ensure that the installing contractor has the capabilities to engineer, install, and commission the field devices supplied under this section for temperature control.

1.7 DESIGN CRITERIA

A. Size all control apparatus to properly supply and/or operate and control the apparatus served. For example damper and valve actuators shall have sufficient power to operate their respective valve or damper from 0 to 100% under load smoothly, without jerking or hysteresis.

B. Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.

C. Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 - Common Work Results for HVAC.

1.9 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

1.10 SYSTEM DESCRIPTION

A. System is to be electric/electronic.

1.11 DEMOLITION

A. Where existing control devices, piping, or wiring are discontinued from use, remove and disregard as appropriate. Remove any previously abandoned control devices in a similar manner.

PART 2 – PRODUCTS

2.1 CONTROL DAMPERS

A. Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal to or greater than the ductwork pressure class of the ductwork where the damper is installed, as specified in Section 23 31 00 - HVAC Ducts and Casings.

B. Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

C. Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

D. All dampers, unless otherwise specified, to be rated at a minimum of 180° F working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	Differential Pressure	Leakage
Class IA	1" w.g.	≤3 CFM/ft²
Class I	4" w.g.	≤8 CFM/ft²
Class I	8" w.g.	≤11 CFM/ft²
Class I	12" w.g.	≤14 CFM/ft²

E. Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

F. Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40.

G. Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20.

H. Dampers used for directed mixing of airstreams, i.e. outside air and return air, to be parallel blade type and sized for an air velocity of 1800 to 2000 fpm with the damper blades shall be arranged so that the air streams are directed at one another to facilitate mixing. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.

I. Dampers used for isolation on the discharge of centrifugal fans shall have damper blades perpendicular to the fan shaft to minimize system effect. Dampers mounted with blades vertically shall be designed for vertical blade orientation.

J. Dampers for applications to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

K. Multiple width damper sections shall utilize jack shaft linkages unless noted below. Double width damper sections for two-position operation may be actuated without jack shafts if each damper section is actuated separately. Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven loading.

L. Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the A/E unless the contract documents indicate in air stream mounting is acceptable.

M. Provide weatherproof NEMA 4 enclosures (Belimo N4 option, Belimo ZS-100 or ZS-150 are not acceptable) that have removable covers that have clasps or machine screws (no sheet metal screws) and that do not require removing fasteners from the ductwork to prevent actuator failure or freeze-up when mounting in locations exposed to harsh environments or outdoor locations.

N. Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered.
   1. For electric modulating actuation, use fully proportional actuators with zero and span adjustments.
   2. For terminal unit actuators, stepping motors may be used and zero and span is not required.

O. Refer to control diagram/point chart on drawings for specific type of input signal required. Actuator stroke times shall match the requirements of the DDC controllers provided under Section 23 09 23 - Direct Digital Control System for HVAC and/or the specific system requirements for proper operation. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered. Equip operators with spring return or stored energy fail-safe return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Provide damper end switches with form "C" contacts where control sequences require damper position indication. End switches shall not contain mercury.

P. All power required for electric actuation shall be provided by this contractor if it is not able to be directly provided from the DDC controller.

Q. Provide operators with linkages and brackets for mounting on device served.

R. All outdoor air, return air, and relief air dampers to be sized in accordance with the ASHRAE Guideline 16-2010.

2.2 CONTROL SYSTEM INSTRUMENTATION

A. Manufacturers: Averaging Type - Johnson Controls; Bulb Type - Johnson Controls, Ashcroft, Marshall, Weksler

B. Duct Thermometers: 3 inch or larger dial type with swivel mount. Maximum scale graduations of 2°F. Thermometers in ducts above 6 square feet to have averaging type, liquid or gas filled capillary sensing elements a minimum of 6 feet and supported across the width of the duct. Thermometer temperature range shall not be more than twice the expected temperature range at installed location.

2.3 ELECTRIC/ELECTRONIC THERMOSTATS

A. Electric Thermostats: For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where otherwise specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal to electrical load of device being controlled.

B. Low Voltage Electronic Thermostats:
   1. Manufacturers: Honeywell, Johnson Controls, Viconics.
   2. Where unoccupied setpoints are specified, provide electronic programmable type with seven day setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through keypad entry on front of unit. For heating and cooling applications, provide automatic heating/cooling switchover. For applications that control fans, provide fan override switch. For ventilation or packaged economizer applications provide a dry contact for ventilation damper or economizer initiation. For thermostat control of economizer, provide a 0-10VDC modulated output for economizer damper control.

C. Firestats: UL labeled, manual reset, line voltage type with 135°F setpoint.

2.4 DUCT SMOKE DETECTOR AND FIRE ALARM INTERFACE MODULES

A. Detectors with auxiliary contacts or fire alarm control modules will be provided by Division 28. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.

2.5 TIME CLOCKS

A. UL listed, digital, 7-day, minimum of 10 on/off programs per day, holiday programming, automatic daylight savings switchover, and minimum of seven-day battery back-up.

2.6 TEMPERATURE CONTROL PANELS

A. Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide asbuilt wiring/piping diagram within enclosure. Provide raceways for wiring and poly tubing within panel for neat appearance and to separate high and low voltage wiring. Provide termination blocks and resettable circuit breaker for 120VAC power wiring. Provide label within the panel indicating circuit number of 120VAC serving panel. Label outside of panel with panel number corresponding to plan tags and asbuilt control drawings as well as building system(s) served.

2.7 TEMPERATURE SENSORS

A. Thermistor temperature sensor manufacturers: PreCon, BAPI, and ACI

B. Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is not affected by moisture, physical vibration, or other conditions that exist in each application.

C. RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70°F and 77°F respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

D. The temperature sensing device used must be compatible with the DDC controllers used on the project.

RTD	
Accuracy (Room Sensor Only)	minimum ± 1.0°F
Accuracy (Averaging)	minimum ± 1.2°F
Accuracy (Other than Room Sensor or Averaging)	minimum ± 0.65°F
Range	minimum -40 - 220°F
Thermistor	
Accuracy (All)	minimum ± 0.36°F
Range	minimum -30 - 230°F
Heat Dissipation Constant	minimum 2.7 mW/°C
Temperature Transmitter	
Accuracy	minimum ± 0.1°F or ±0.2% of span
Output	4-20 mA

E. Provide limited range or extended range sensors if required to sense the range expected for a respective point. Use RTD type sensors for extended ranges beyond -30 to 230°F. If RTD's are incompatible with DDC controller direct temperature input use temperature transmitters in conjunction with RTD's.

F. Use wire size appropriate to limit temperature offset due to wire resistance to 1.0°F. If offset is greater than 1.0°F due to wire resistance, use temperature transmitter. If feature is available in DDC controller, compensate for wire resistance in software input definition.

G. Provide sensors in occupied spaces with brushed aluminum or brushed nickel covers unless otherwise noted or features specified will not allow for this. Provide sensors in unoccupied spaces shall have metal enclosure. Terminal unit sensors with setpoint adjustments and digital displays may use plastic covers. Provide information to the AE on sensor colors offered by the manufacturer and obtain approval on what color should be provided on the project.

H. Terminal unit sensors shall be provided with digital displays that indicate room temperature and setpoint and have a manual occupancy override and indication of occupancy status. Provide setpoint adjustment as specified in the control diagram and sequence of operation.

I. Use averaging elements on duct sensors when the ductwork is ten square feet or larger. All mixed air and heating coil discharge sensors shall have averaging elements regardless of duct size.

2.8 CARBON DIOXIDE (CO_2) SENSOR

A. Provide a Carbon Dioxide (CO_2) sensor that shall utilize non-dispersive infrared (NDIR) technology. The sensor shall have a linear analog output over a range of 0-2000 ppm and have built in display of CO_2 level. The sensor shall have an automatic calibration algorithm that will compensate for sensor drift over time due to sensor element degradation. Unit shall be provided with a 0-10VDC or 4-20mA analog output that is selectable and a field adjustable relay alarm output. Accuracy shall be better than ±5% of reading or ±50ppm whichever is higher. The sensor shall be user calibratible with a minimum calibration interval of five years.

2.9 POWER SUPPLIES

A. Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where installing contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

B. Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control devices must be installed in accessible locations. This contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified.

C. Label all control devices with the exception of dampers, valves, and terminal unit devices with permanent printed labels that correspond to control drawings. Temperature control junction and pullboxes shall be identified utilizing spray painted green covers. Other electrical system identification shall follow the Division 26 identification specification requirements.

D. All control devices and electrical boxes mounted on insulated ductwork shall be mounted over the insulation. Provide mounting stand-offs where necessary for adequate support. Cutting and removal of insulation to mount devices directly on ductwork is not acceptable. This contractor shall coordinate with the insulation contractor to provide for continuous insulation of ductwork.

E. Mounting of electrical or electronic devices shall be protected from weather if the building is not completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

F. Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical Code.

G. Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

H. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

I. Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit. Wire for wall sensors must be run in conduit. Wiring for radiation valves shall be run in conduit where routed through walls.

J. Where wiring is installed free-air, installation shall consider the following:
   1. Wiring shall utilize the cable tray wherever possible.
   2. Wiring shall run at right angles and be kept clear of other trades work.
   3. Wiring shall be supported utilizing "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting ring with a strap.
   4. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6-inches; another support shall be used.
   5. Wiring shall never be laid directly on the ceiling grid or attached in any manner to the ceiling grid wires.
   6. Wall penetrations shall be sleeved.

K. Wiring shall not be attached to existing cabling, existing tubing, piping, ductwork, ceiling supports or electrical or communications conduit.

L. This contractor shall be responsible for all 120VAC power, not provided in the Division 26 specifications, required for equipment provided under this section.

M. Install "hand/off/auto" selector switches on systems where automatic interlock controls are specified and "hand/off/auto" selector switches are not supplied with the equipment controlled. Control panel power will not be required for "hand" switch to operate. When switch is in "hand" position, allow manual operation of the selected device without operating the interlocked motors but allowing all unit safety devices to stay in the circuit.

N. All electrical wiring are to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with the "Record Drawings".

O. After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

3.2 WIRE AND AIR PIPING CONDUIT AND TUBING INSTALLATION SCHEDULE

A. The following conduit schedule shall apply to wire in conduit where conduit is specified for wiring. Conduit referenced below shall meet specifications in Division 26 and as defined below.

B. Conduit other than that specified below for specific applications shall not be used.

C. Exposed Outdoor Locations: Rigid steel conduit.

D. Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

E. Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

F. Wet Interior Locations: conduit.

G. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

H. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

3.3 CONTROL DAMPERS

A. All control dampers furnished by the control manufacturer are to be installed by the Contractor under the coordinating control and supervision of the Temperature Control Contractor in locations shown on plans or where required to provide specified sequence of control.

B. Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted. Blank-off plates or transitions required to facilitate dampers shall be provided by Contractor.

C. Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

D. Furnish control dampers as shown on drawings and/or as required to perform control sequences specified, except those furnished with other equipment.

E. Control dampers furnished by Temperature Control Contractor shall be installed by Contractor under coordinating control and supervision of Temperature Control Contractor.

3.4 CONTROL SYSTEM INSTRUMENTATION

A. Install thermometers at each point of temperature transmission (sensors) and control, unless the drawings indicate a thermometer is to be installed by the piping or sheetmetal installer. Install thermometers to permit easy reading from the floor or operating platform. Provide remote mounting or swiveled mounting as required for easy reading. Flush mounting where not easily read is not acceptable.

3.5 ROOM THERMOSTATS AND TEMPERATURE SENSORS

A. Check and verify location of thermostats, and other exposed control sensors with plans and room details before installation. Locate room thermostats and sensors 48 inches above floor. Align with light switches. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

B. Any room thermostats or sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

C. Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will affect the measurement.

D. Provide guards on thermostats in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

3.6 TEMPERATURE CONTROL PANELS

A. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

B. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

3.7 CARBON DIOXIDE (CO_2) SENSOR

A. Install in accordance with room temperature and sensor installation instructions in this specification.

B. Provide CO_2 sensors in the following locations:
1. Conference rooms

3.8 TRAINING

A. See Section 23 05 00 - Common Work Results for HVAC for general training requirements.

B. Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 2 hours.

END OF SECTION 230914

SECTION 231100 - FACILITY FUEL PIPING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:
   1. Natural Gas
   2. Vents and Relief Valves
   3. Unions and Flanges
   4. Valves
   5. Piping System Leak Tests

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 019113 – Commissioning Requirements

C. Section 230515 – Piping Specialties

D. Section 230523 – General-Duty Valves for HVAC Piping

E. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Natural Gas
   2. Vents and Relief Valves
   3. Unions and Flanges
   4. Valves
   5. Piping System Leak Tests

B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

C. Type E Or S Steel Pipe: Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

1.5 REFERENCE STANDARDS

A. ANSI B16.3 Malleable Iron Threaded Fittings

B. API Spec 12P Fiberglass Reinforced Plastic Tanks; American Petroleum Institute; 2008.

C. API Std 650 Welded Steel Tanks for Oil Storage; American Petroleum Institute; 2009.

D. API RP 1615 Installation of Underground Petroleum Storage Systems; American Petroleum Institute; 1996 (Reapproved 2001).

E. API RP 1632 Cathodic Protection of Underground Petroleum Storage Tanks and Piping Systems; American Petroleum Institute; 1996 (Reapproved 2002).

F. API Std 2000 Venting Atmospheric and Low-Pressure Storage Tanks: Nonrefrigerated and Refrigerated; American Petroleum Institute; 2009.

G. ASME (BPV) Boiler and Pressure Vessel Code; The American Society of Mechanical Engineers; 2007.

H. ASME (BPV IX) Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2010.

I. ASME B16.3 Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

J. ASME B16.18 Cast Copper Alloy Solder-Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005) (ANSI B16.18).

K. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers; 2001 (R2005).

L. ASME B16.26 Cast Copper Alloy Fittings for Flared Copper Tubes; The American Society of Mechanical Engineers; 2006.

M. ASME B31.1 Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).

N. ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids; The American Society of Mechanical Engineers; 2006.

O. ASME B36.10M Welded and Seamless Wrought Steel Pipe; The American Society of Mechanical Engineers; 2004.

P. ASTM A53/A53M Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2010.

Q. ASTM A123/A123M Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2009.

R. ASTM A234/A234M Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2011.

S. ASTM B32 Standard Specification for Solder Metal; 2008.

T. ASTM D2310 Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2006.

U. ASTM D2996 Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe; 2001 (Reapproved 2007).

V. AWS A5.8/A5.8M Specification for Filler Metals for Brazing and Braze Welding; American Welding Society; 2004 and errata.

W. AWWA C105/A21.5 Polyethylene Encasement for Ductile-Iron Pipe Systems; American Water Works Association; 2005 (ANSI/AWWA C105/A21.5).

X. MSS SP-58 Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.

Y. MSS SP-80 Bronze Gate, Globe, Angle and Check Valves; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2008.

Z. MSS SP-110 Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 1996.

AA. NFPA 30 Flammable and Combustible Liquids Code; National Fire Protection Association; 2008.

BB. STI STI-P3 Specification and Manual for External Corrosion Protection of Underground Steel Storage Tanks; Steel Tank Institute; 2007.

1.6 QUALITY ASSURANCE

A. Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

B. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.7 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

C. Non-metallic piping will be not acceptable for the project. This includes the occupied spaces and ventilation plenum spaces, including plenum ceilings.

D. Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

E. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

1.9 NATURAL GAS SERVICE

A. All charges for the gas service as shown on the plans, including the connection to the existing gas meter, shall be paid by this Contractor, and all work performed by the gas company.

PART 2 – PRODUCTS

2.1 NATURAL GAS

A. 2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2.2 VENTS AND RELIEF VALVES

A. Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

2.3 UNIONS AND FLANGES

A. 2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi. Copper tube: 250 psi bronze unions with brazed joints.

2.4 VALVES

A. Refer to specification section 23 05 23 for General Duty Valves for HVAC.

PART 3 – EXECUTION

3.1 PREPARATION

A. Remove all foreign material from interior and exterior of pipe and fittings.

3.2 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

C. Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

D. "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

E. Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

F. Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

G. Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main. Teflon tape is acceptable for use on natural gas lines.

H. Do not install gas pipe in a ventilation air plenum.

I. Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

J. Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

K. Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

3.3 THREADED PIPE JOINTS

A. Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.4 NATURAL GAS

A. Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main. Teflon tape is acceptable for use on natural gas lines.

3.5 VENTS AND RELIEF VALVES

A. Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

B. If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

C. Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

D. Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

3.6 UNIONS

A. Install a union, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange connection on the equipment side of the valve. Concealed unions are not acceptable.

3.7 PIPING SYSTEM LEAK TESTS

A. Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

B. Provide all piping, fittings, and equipment to perform the testing.

C. Conduct pressure test with test medium of air. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the General Contractor. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

D. Do not insulate pipe until it has been successfully tested.

E. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

F. Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

G. Conduct fuel oil system test so as not to impose a pressure of more than 10 psig on the tank. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least one hour.

System	Pressure	Medium	Duration
Natural gas	100 psig	Air	24 hr.

H. All pressure tests are to be documented on attached form included in this specification.

I. On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

3.8 KITCHEN HOOD – SUPPRESSION SYSTEM

A. Hood shall be provided with a fire protection system per Section 11 40 00 release extinguishing medium onto the cooking surface and shut off power or fuel to the cooking appliances.

B. System shall provide for full-surface protection for all cooking appliances, as well as plenum and duct nozzles if required by local authorities. Wiring from cylinder to control center of hood is by the hood manufacturer, if cylinder is mounted on hood and by the hood manufacturer.

C. Remote manual release, cable run, and extinguishing piping are by the Contractor in Section 11 40 00.

D. Electric appliances requiring shutdown by local authorities shall be wired through shutdown devices which are signalled by the previously mentioned contactor. All devices and wiring are by the Electrical Contractor. All jobsite work on system must be done by or under the supervision of a factory-trained and certified installer.

E. Contractor shall looped gas supply lines, provide gas pressure reducing and regulating valves for pressure above 14" W.C., and gas shut-off valves (except for gas fire/fuel shut-off solenoid valves). The gas fire/fuel shut-off solenoid valves are furnished by 11 40 00 and installed by this contractor.

F. Shunt trip breakers for items shall be furnished and installed by the EC.

END OF SECTION 231100

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____

Project No: _____

Contractor: _____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other** _____

Test performed per specification section No. _____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____ **PSIG**

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____ **PSIG**

Stop Test Time: _____ **Final Pressure:** _____ **PSIG**

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments: _____

_____

_____

_____

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SECTION 232300 – REFRIGERANT PIPING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section contains specifications for all Refrigerant piping for this project. Included are the following topics:
   1. Refrigerant Piping
   2. Refrigerant Piping Accessories

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230515 – Piping Specialties

D. Section 230529 – H angers and Supports for HVAC Piping and Equipment

E. Section 230700 – HVAC Insulation

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Refrigerant Piping
   2. Refrigerant Piping Accessories

B. Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

C. Copper Tube: Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

1.5 REFERENCE STANDARDS

A. ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings

B. ASTM B88 Seamless Copper Water Tube

C. ASTM B280 Seamless Copper Tube for Air Conditioning and Refrigeration Field Service

D. ASHRAE 15 Safety Code for mechanical Refrigeration

1.6 QUALITY ASSURANCE

A. Order all copper refrigeration tube with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier; with soft straight lengths or coils identified with a tag indicating that the product was manufactured in accordance with ASTM B280; and with each hard temper straight length identified throughout its length by a blue colored marking not less than 3/16 inch in height and a legend at intervals of not greater than three feet that includes the designation "ACR" and pipe outside diameter.

B. As part of the shop drawings submittal, a piping isometric shall be submitted showing system components (including sight glass, filter/dryer, solenoid valve, etc.) and pipe sizes as recommended by manufacturer.

C. Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1.7 DESIGN CRITERIA

A. Use only new material, free of defects and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

B. Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

1.8 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

B. Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. If end caps are not present on tube bearing the "ACR" designation, clean and re-cap in accordance with ASTM B280. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

C. Offsite storage agreements will not relieve the contractor from using proper storage techniques.

D. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.1 REFRIGERANT PIPING

A. ASTM B88 type L hard drawn copper tube, cleaned and capped in accordance with ASTM B280, and marked "ACR", with ANSI B16.22 wrought copper or forged brass solder-type fittings. All refrigerant piping shall be cleaned, deoxidized, dehydrated and sealed by the manufacturer before shipment. All ends shall remain sealed at all times until used. The type of solder used shall depend on the location of the joint. For pipe runs and joints (copper to copper), Staz-Silv or Silfos, a solder composition with 15% silver (BCUP-S) should be used. Where dissimilar metals are joined, such as copper to brass or copper to steel, Staz-Silv or "easy-flow", a solder composition with 45% silver (BAG-1) should be used. Where auxiliary components are installed, such as expansion valves, Staz-brite (soft solder) with tin and 4% silver should be used so parts can be readily changed as needed.

2.2 REFRIGERANT PIPING ACCESSORIES

A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225° F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225° F.

B. Fittings and flanged unions shall be cast brass or wrought copper refrigeration type fittings. Cast fittings shall be internally tinned before use.

C. Flexible pipe connectors: Refer to specification Section 23 05 15 - Piping Specialties for refrigerant flexible pipe connections.

D. Filter Dryers: For circuits 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

E. Sight glasses: Two piece brass construction with solder end connections. Include color indicator for sensing moisture.

F. Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, Teflon diaphragm and solder end connections. Provide replaceable coil assembly.

G. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

H. Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.

I. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 – EXECUTION

3.1 PREPARATION

A. Remove all foreign material from interior and exterior of pipe and fittings.

3.2 ERECTION

A. Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult specifications and drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

B. Unless written authorization is obtained from the A/E, do not route piping through transformer vaults or above transformers, panelboards, motor control centers or switchboards, including the required service space for this equipment, unless the piping is serving this equipment. Per NFPA 70-2011, 110, 26E; it is not acceptable to run piping above panelboards, switchboards transformer vaults and motor control centers up to 6 feet above equipment.

C. Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in the specifications or drawings.

3.3 REFRIGERANT PIPING

A. Refrigeration piping to be installed by firms who are experienced in installation of such piping and in accordance with the requirements of the Wisconsin Administrative Code Section ILHR 45.

B. All solder joints to be ASTM Grade 4 or 5 and have a melting point of approximately 1250 degrees F. Solder impurities shall not exceed 0.15%. Tubing to be new and delivered to the job site with the original mill end caps in place. Clean and polish all joints before soldering. Avoid prolonged heating and burning during soldering. Purge all lines with nitrogen during soldering. Provide manual shut-off and check valves as required.

C. No refrigerant is to be vented directly to the atmosphere except that which may escape through leaks in the system during leak testing. During evacuation procedures, use equipment designed to recover and allow recycling of the refrigerant.

D. Leak test the system by charging the system to a pressure of 10 psig with an HFC refrigerant, with the compressor suction and discharge valves closed and with all other system valves open. Increase pressure to 300 psig with dry nitrogen. Rap all joints with a mallet and check for leaks with an electric leak detector having a certified sensitivity of at least one ounce per year. Seal any leaks that may be found and retest.

E. After completion of the leak test, evacuate the system with a vacuum pump to an absolute pressure not exceeding 1500 microns while the system ambient temperature is above 60°F. Break the vacuum to 2 psig with the refrigerant to be used in the system. Repeat the evacuation process, again breaking the vacuum with refrigerant. Install a drier of the required size in the liquid line, open the compressor suction and discharge valves, and evacuate to an absolute pressure not exceeding 500 microns. Leave the vacuum pump running for not less than two hours without interruption. Raise the system pressure to 2 psig with refrigerant and remove the vacuum pump.

F. Charge refrigerant directly from original drums through a combination filter-drier. Each drier may be used for a maximum of three cylinders of refrigerant and then must be replaced with a fresh drier. Charge the system by means of a charging fitting in the liquid line. Weigh the refrigerant drum before charging so that an accurate record can be kept of the weight of refrigerant put in the system. If refrigerant is added to the system through the suction side of the compressor, charge in vapor form only.

G. Refrigerant and Oil: The contractor shall furnish sufficient refrigerant to charge each system. The amount of the installed charges shall be permanently stamped on the receiver or the compressor. Systems shall be fully charged at the time of acceptance. In addition, the contractor shall furnish whatever additional amount of refrigerant may be required during the guaranteed period due to repairs, replacements or adjustments that the contractor may be required to make under the guarantee provisions. The same requirement shall apply to compressor lubricating oil except that amount charged or added shall be stamped on the system.

~~3.4~~ REFRIGERANT PIPING ACCESSORIES

A. Install accessories in accordance with the manufacturer's written instructions and recommendations.

END OF SECTION 232300

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SECTION 233100 - HVAC DUCTS AND CASINGS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for all duct systems used on this project. Included are the following topics:
   1. High Pressure Ductwork (Pressure class 3 inch and over)
   2. Low Pressure Ductwork (Maximum 2 inch pressure class)
   3. Kitchen Hood Exhaust Duct Construction
   4. Duct Sealant
   5. Gaskets

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230593 - Testing, Adjusting, and Balancing for HVAC

D. Section 233300 – Air Duct Accessories

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. High Pressure Ductwork (Pressure class 3 inch and over)
   2. Low Pressure Ductwork (Maximum 2 inch pressure class)
   3. Kitchen Hood Exhaust Duct Construction
   4. Duct Sealant
   5. Gaskets

B. Include manufacturer's data and/or Contractor data for the following:

C. Fabrication and installation drawings.

1. Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
2. Duct sealant and gasket material.

1.5 REFERENCE STANDARDS

A. ANSI SS-EN 485-2 Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
B. ASTM B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C. ASTM A90 Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
D. ASTM A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
E. ASTM A623 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
F. ASTM A527 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
G. ASTM 924 Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
H. ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials
I. ASTM C 1338 Test Method for Determining Fungal Resistance of Insulation Materials and Facings
J. ASTM G 21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
K. ASTM C 916 Standard Specification for Adhesives for Duct Thermal Insulation NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
L. UL 181 Standard for Safety for Factory Made Air Ducts and Air Connectors.

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

B. Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:
1. HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
2. HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
3. HVAC Systems - Duct Design, 4th Edition, 2006
4. Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
5. Round Industrial Duct Construction Standards, 2nd Edition, 1999

C. Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

1.8 DELIVERY, STORAGE AND HANDLING

A. Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

B. Protect Ductwork against damage.

C. Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

D. Offsite storage agreements do not relieve the contractor from using proper storage techniques.

E. Storage and protection methods must allow inspection to verify products.

PART 2 – PRODUCTS

2.1 GENERAL

A. All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

B. Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

2.2 DUCTWORK PRESSURE CLASS

A. Minimum acceptable SMACNA duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct upstream of VAV boxes	3 in. pressure class
Supply duct downstream of VAV terminals	2 in. pressure class
Transfer ducts	1 in. pressure class
Low pressure exhaust ducts	3 in. negative pressure class
Return ducts	2 in. negative pressure class
Relief ducts	2 in. pressure class
Outside air duct systems	2 in. negative pressure class
Grease exhaust systems	3 in. negative pressure class

2.3 MATERIALS

A. Galvanized Steel Sheet: Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or galvanneal sheetmetal for ductwork that will be painted.

B. Uncoated Black Steel Sheet: First quality, soft steel sheet capable of welding or double seaming without fracture.

C. Stainless Steel Sheet: Use ASTM A167, Type 304 or 316 stainless steel sheet as specified, 316L if welded ductwork, with No. 2B finish for concealed work and No. 3 finish for exposed work.

2.4 HIGH PRESSURE DUCTWORK (PRESSURE CLASS 3 INCH AND OVER)

A. Contractor shall use rectangular high pressure duct using a transverse joint system as manufactured by Ductmate, Nexus, TDC or TDF. Duct to be flanged, gasketed and sealed.

B. Contractor fabricated ductwork meeting specified construction standards is acceptable with prior approval of Engineer. Submit construction details, a description of materials to be used, type of service, reinforcing methods, and sealing procedures.

C. Use cemented slip joints with 2 inch minimum overlap, flanged connections, or welded/brazed connections, unless noted otherwise for special applications. Prime coat welded joints.

D. Provide standard 90 degree conical tee takeoffs except for exhaust at velocities over 2000 feet per minute, use 45° lateral connections; straight taps or bullhead tees are not acceptable.

E. Internal bracing will not be accepted on ductwork below 48 inches.

F. Use turning vanes as specified in Section 23 33 00 – Air Duct Accessories.

G. Provide bellmouth fittings or expanded fittings at each duct connection to air plenums.

H. Provide pressure relief fittings as indicated on the plans and/or details.

I. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

2.5 LOW PRESSURE DUCTWORK (MAXIMUM 2 INCH PRESSURE CLASS)

A. Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

B. Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

C. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00 - Air Duct Accessories. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

D. Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00 - Air Duct Accessories.

E. Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

F. Button punch snaplock construction or snaplock pipe will not be accepted on ductwork.

G. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer. Substitution of round ducts for rectangular ducts will only be considered if sized in accordance with ASHRAE table of equivalent rectangular and round ducts.

H. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

2.6 KITCHEN HOOD EXHAUST DUCT CONSTRUCTION

A. In concealed locations use minimum 16 gauge black steel or minimum 18 gauge stainless steel with all joints welded liquid tight.

B. In exposed areas, use 18 gauge or heavier stainless steel with a number 3 finish and with all joints welded liquid tight or prefabricated Underwriters Laboratory, Inc. listed duct with stainless steel shell. Grind and polish all welded joints and seams to a number 3 finish.

C. Provide expanded take-offs for branch duct connections or 45 degree entry fittings. Square edge 90 degree take-off fittings or straight taps will not be accepted.

D. Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits shall be used wherever possible. Shorter radius elbows may be used in areas with limited space with prior approval of the Engineer.

E. No turning vanes may be used in kitchen exhaust ductwork.

F. No square throat elbow with or without turning vanes may be used in exhaust/return ductwork.

G. Supporting steel and hangers shall not be lighter than the duct gauge.

2.7 DUCT SEALANT

A. Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal. Silicone sealants are not allowed in any type of ductwork installation.

B. Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

C. For plenums installations, use duct sealant with a flame spread index of not more than 25 and smoke-developed index of not more than 50. When tested in accordance with ASTME84 or UL 723.

2.8 GASKETS

A. 2 Inch Pressure Class And Lower: Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

B. 3 Inch Pressure Class And Higher: Butyl gaskets.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

B. Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure ductwork, or kitchen hood exhaust ductwork.

C. Test openings for test and balance work will be provided under Section 23 05 93 – Testing, Adjusting and Balancing for HVAC.

D. Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

E. Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

F. Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

G. Install all motor operated dampers and connect to or install all equipment furnished by others.

H. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

I. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

J. Provide adequate access to ductwork for cleaning purposes.

K. Provide temporary capping of ductwork openings on job site, both before and after installation, to prevent entry of dirt, dust and foreign material.

L. Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the ductwork.

M. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

N. All ductwork not welded, at a minimum, shall be sealed using duct sealant or gaskets on all seams, joints and penetrations.

O. Provide 45 degree entry fitting with a minimum throat length of 25% of the width of the branch duct takeoff or 4 inches, whichever is larger.

3.2 DUCTWORK SUPPORT

A. Support ductwork in accordance with the latest SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

B. Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

C. On ductwork sections exceeding 8', provide at least two supports.

3.3 HIGH PRESSURE DUCT (PRESSURE CLASS 3 INCH AND OVER)

A. Seal all duct in accordance with SMACNA seal class "A". All seams, joints, and penetrations shall be sealed using duct sealant or gaskets per Part 2 - Products.

B. Single wall high pressure ductwork shall be installed.

3.4 LOW PRESSURE DUCT (MAXIMUM 2 INCH PRESSURE CLASS)

A. Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A". All seams, joints, and penetrations shall be sealed using duct sealant or gaskets per Part 2 - Products.

B. Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

C. Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

3.5 KITCHEN HOOD EXHAUST DUCT CONSTRUCTION

A. Where welded joints are used with black steel duct, coat all external welded joints and seams with paint. Grind and polish to #3 finish all exposed stainless steel joints and seams.

B. Apply bracing and reinforcement to the outside of the duct to prevent breathing, rattling, vibration or sagging of duct.

C. Install without forming dips, sag or traps which might collect residue by supporting at not greater than 5 foot intervals; fasteners at hangers shall not penetrate the duct. Do not use sheet metal screws on supports; use bolted, riveted or welded connections. Where ductwork is listed, install in accordance with listing.

D. Construct grease tight access doors of the same material and thickness as the duct and as large as possible, up to 24 inches in any dimension. Provide access doors in the ductwork per NFPA 96 at max 10' intervals and at all changes in direction.

E. Insulation or fire protection enclosure shall be removable at each access door and clean out.

F. Pitch horizontal ducts back to hood at 1/4 inch per foot.

3.6 CLEANING

A. Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

B. Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

3.7 LEAKAGE TEST

A. Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

B. If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

C. Leakage rate shall not exceed more than 5% of the system air quantity for Hign/low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

D. Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the contractor from duct sealing requirements.

E. Submit a signed report to the General Contractor, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

END OF SECTION 233100

DUCT LEAKAGE TEST REPORT

Project Number:_____

Date Submitted:_____

Project Name: _____

Location:_____

Contractor:_____

System: **Fan No.:**_____ **Leakage Class (C_L):**_____

Data **Fan Design CFM:**_____ **Duct Pressure Class (P_c):**_____

Test Pressure (P_T):_____

Test Equipment: **Manufacturer:**_____

Model No.:_____ **Serial No.:**_____

Design Data									Field Test Data			
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

SECTION 233300 - AIR DUCT ACCESSORIES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes accessories used in the installation of duct systems. Included are the following topics:
1. Manual Volume Dampers
2. Turning Vanes
3. Fire Dampers
4. Control Dampers
5. Smoke Detectors
6. Access Doors
7. Flexible Duct
8. Duct Lining
9. Flashings
10. Duct Flexible Connections

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230529 – Hanger and Supports for HVAC Piping and Equipment

D. Section 230548 – Vibration Controls for HVAC Piping and Equipment

E. Section 233100 – HVAC Ducts and Casings

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
1. Manual Volume Dampers
2. Turning Vanes
3. Fire Dampers
4. Control Dampers

5. Smoke Detectors
6. Access Doors
7. Flexible Duct
8. Duct Lining
9. Flashings
10. Duct Flexible Connections

B. Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

1.5 REFERENCE STANDARDS

A. NAIMA Fibrous Glass Duct Liner Standard

B. NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems

C. SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995

D. UL 214

E. UL 555 (6th edition) Standard for Fire Dampers and Ceiling Dampers

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 - Common Work Results for HVAC.

PART 2 – PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Manufacturers: Ruskin, Vent Products, Air Balance.

B. Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

C. Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

2.2 TURNING VANES

A. Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley.

B. Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

2.3 FIRE DAMPERS

A. Manufacturers: Air Balance, Advanced Air, American Warming and Ventilating, Greenheck, Phillips-Aire, Prefco, Ruskin, Safe-Air.

B. Curtain type fire damper blades shall not inhibit the free area of connecting ductwork. Unless high temperature fire dampers are required, select fusible links for 160° F release.

C. Static Fire Dampers: Static fire damper assemblies must be UL 555 (6th edition) listed and labeled for static applications (where air systems do not operate during a fire) and meet requirements of NFPA 90A. Damper must be type B curtain type with blades out of the air stream; dampers with blades in the air stream will not be accepted. Damper fire rating to be compatible with the rating of the building assembly in which the damper is used.

2.4 CONTROL DAMPERS

A. Control dampers are specified in section 230914.

2.5 SMOKE DETECTORS

A. Each duct smoke detector indicated on the contract documents shall be installed in cooperation with the electrical contractors. Duct detector locations shown are diagrammatic only and require pressure differential testing to insure proper smoke detector operation. Each duct detector housing and sampling tube kit installed shall be mounted and tested prior to the installation of the duct smoke detector. Air sampling tube installation shall be tested per the manufacturer's written instructions.

B. The Electrical contractor shall furnish the duct detector assembly and sampling tube kits sized for the installation locations indicated on the mechanical ductwork drawings. This contractor shall maintain possession of the duct detector smoke detection device.

C. The Electrical contractor shall provide smoke detector installation, interconnecting cabling, and testing of the smoke detection system in accordance with the specification.

D. Contractor shall install detector housing and sampling tubes in accordance with the listing manufacturer's installation instructions, project documentation, and provide differential pressure testing and adjustments as described in Section 3 – Execution.

2.6 ACCESS DOORS

A. Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

B. Use insulated 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

2.7 FLEXIBLE DUCT

A. Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster, Hart and Cooley.

B. Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

C. Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

D. Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

E. Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

2.8 DUCT LINING

A. Manufacturer: Manville, Owens-Corning, Knauf.

B. 1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq. ft. deg F.

C. Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.

D. Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.

E. Install liner using adhesive conforming to ASTM C 916.

2.9 FLASHINGS

A. Flashing and counterflashing for roof curbs will be provided by others.

B. Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

2.10 DUCT FLEXIBLE CONNECTIONS

A. Material shall be fire retardant, shall be UL 214 listed, and shall meet the requirements of NFPA 90A.

B. Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

C. Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, or kitchen exhaust to be double coated with Elastomer, air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal weight of 26 ounces per square yard.

2.11 THERMOMETERS

A. Dial Thermometers
   1. Manufacturers: Ametek/US Gauge, Ashcroft, Marshall Instruments, Moeller Instrument Co., Inc., H.O. Trerice Company, Weiss Instruments, Weksler.
   2. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E 1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
      a. Size: inch diameter dial.
      b. Lens: Clear glass.
      c. Accuracy: 1 percent.
      d. Calibration: Degrees F.

PART 3 – EXECUTION

3.1 MANUAL VOLUME DAMPERS

A. Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

3.2 TURNING VANES

A. Install turning vanes in all rectangular, mitered elbows in accordance with the latest SMACNA standards and/or manufacturer's recommendations.

B. Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

C. If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

3.3 FIRE DAMPERS

A. Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles per UL listing. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

B. Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

3.4 CONTROL DAMPERS

A. Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

3.5 SMOKE DETECTORS

A. Duct smoke detector assemblies shall be tested and installed in accordance with the following:

1. Post air system balancing – testing and adjusting for proper operation shall be done by the installing contractor with a pressure differential manometer.
2. The differential pressure readings taken across the duct detector housing inlet and return tube shall be between 0.06 minimum and 1.28 maximum inches of water. Provide adjustment to sampling tube as needed to accomplish required pressure differential.
3. Provide a written record of readings. Submit to the project engineer for review and acceptance prior to the final installation of the duct smoke detector.
4. Initial tests shall be conducted to qualify installation location suitability. If initial testing concludes appropriate pressure differential may be available, contractor shall install the duct detector assembly complete in accordance with the installation details.
5. If acceptable differential pressure readings are not obtained, the inlet sampling tube may be rotated until the proper differential pressure readings are obtained. If inlet sampling tube rotation does not yield the proper differential pressure reading, the duct detector assembly shall be relocated further downstream at no additional cost to the owner.

B. Final installation wiring of the duct smoke detector shall not be completed by the electrical contractor until after the proper differential pressure reading has been obtained, documented, and approved.

C. Installation Requirements:
1. In addition to the manufactures instructions the following guidelines will be enforced:
   a. Duct detector may be installed in any wall of the duct unless otherwise restricted by the manufacturer's instructions.
   b. Cut inlet sampling tube length to suite dimension of duct. If duct is more than 18" wide drill an appropriate diameter hole directly opposite to support inlet sampling tube of lengths longer than 18". Sampling tube shall protrude no longer than 1" outside of duct wall.
   c. Contractor to note that air inlet sampling tubes are designed for differing duct widths employing air inlet holes in a quantity matching the duct width. Verify each inlet tube is appropriately sized for the duct width (typically 10 to 12 holes, each 0.193" diameter holes [#11 drill bit]).
   d. Angle cut return tube at a length as recommended by manufacturer if required. Support in accordance with manufacturer's recommendations.
   e. Position inlet holes facing upstream of airflow. This initial installation position shall be used as the starting point for differential pressure testing. If required adjust as stated in the testing/adjusting procedure above. Angle cut of return tube shall be orientated downstream of airflow.
   f. Once acceptable differential pressure readings are obtained, tubes shall be locked in place in accordance with the manufacturer's installation instructions.
   g. Duct detector assembly and sampling tubes shall be mounted rigidly to prevent noise, chatter, and mechanical fatigue. Any installation found unacceptable will be corrected at the installing contractor's expense.
   h. Inlet tubes installed protruding through duct walls greater in width of 18" shall have the sampling tube end plugged with the manufacturer furnished air stopper.
   i. Air leaks are unacceptable, the installing contractor shall provide gaskets, or duct sealant around inlet and outlet air tubes. Sealing around detector housing perimeter is not acceptable. Seal all duct wall penetration to pressure class rating of duct assembly.
   j. Once the detector is installed, verify correct differential pressure readings across sampling tubes and record. Install manufacturer furnished sampling tube filters.

k. If duct is insulated, provide detector housing standoffs, equivalent in depth of the duct wall insulation, to rigidly support detector assembly. Seal any sampling tube air holes that are not inside duct wall and duct sealant and tape.

l. At each duct detector installation location provide a service opening. Include a minimum 12" x 12" access door as specified in division 23.

2. After assembly is installed and tested, coordinate with electrical contractor and fire alarm vendor for smoke detector installation.

3.6 ACCESS DOORS

A. Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

B. Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

C. Label fire, smoke and combination fire smoke dampers on the exterior surface of ductwork directly adjacent to access doors using a minimum of 0.5 inch height lettering reading, "FIRE DAMPER". The tags must be coordinated with the mechanical schedules. Utilize stencils or manufactured labels. All other forms of identification are unacceptable. All labels shall be clearly visible from the ceiling access point.

3.7 FLEXIBLE DUCT

A. Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 6 feet in length, and have no more than one (1) 90 degree bend.

B. Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

C. Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

D. Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

E. Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

F. Penetration of any partition, wall, or floor with flexible duct will not be accepted.

3.8 DUCT LINING

A. Apply lining to the following ductwork:
   1. Transfer ductwork
   2. Supply and return ductwork from rooftop unit to the first branch take-off.

B. Do not apply lining to the following ductwork:
   1. Outside air ductwork.
   2. Kitchen exhaust ductwork.
   3. Dishwashing exhaust ductwork.
   4. Branch supply and return.
   5. General exhaust ductwork

C. Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

3.9 FLASHINGS

A. Flashing for roof curbs, equipment supports or rails located on roof will be installed by others.

3.10 DUCT FLEXIBLE CONNECTIONS

A. Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

3.11 THERMOMETERS

A. Dial Type For Air Temperature Measurement: Install in ductwork where detailed or specified. Support capillary inside duct so it measures a uniform sample of air. Mount readout so it is readily visible on a portion of ductwork that is not externally insulated or on a sheetmetal angle support secured to a nearby structural element.

END OF SECTION 233300

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SECTION 233400 - HVAC FANS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for fans that are not an integral part of a manufactured device. Included are the following topics:
   1. Centrifugal Fans
   2. Power Roof Exhaust Fans

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230513 – Common Motor Requirements for HVAC Equipment

D. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

E. Section 230548 – Vibration Controls for HVAC Piping and Equipment

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Centrifugal Fans
   2. Power Roof Exhaust Fans

B. Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.

C. Submit color selection charts for equipment where applicable.

D. Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Maximum and minimum RPM curves shall be displayed on fan curve. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

1.5 REFERENCE STANDARDS

A. AMCA 203 AMCA Fan Application Manual - Troubleshooting

B. AMCA 210 Laboratory Method of Testing Fans for Rating

C. AMCA 300 Reverberant Room Method for Sound Testing of Fans

D. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems

E. NFPA 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations

F. UL 762 Power Roof Ventilators For Restaurant Exhaust Appliances

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. Tested and certify all fans in accordance with the applicable AMCA test code.

B. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

C. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

D. Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.

E. All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.

F. All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.1 GENERAL

A. Use fan size, class, type, arrangement, and capacity as scheduled.

B. Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.

C. Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

D. Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

E. Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

F. All fans handling grease laden vapors serving kitchen hood shall meet the requirements of UL 762 and NFPA 96.

2.2 CENTRIFUGAL FANS

A. Manufacturers: PennBarry, Peerless, Buffalo, Carrier, Champion, Chicago Blower, Greenheck, New York Blower, Trane, Twin City, Cook.

B. Construct housing of welded steel with angle iron frame. Use spun or die formed inlet cones to provide a streamlined flow into the wheel. Use airfoil blades welded to spun wheel cones unless otherwise indicated. Shafts shall be AISI C 1045 hot rolled steel turned, ground and polished. Shaft shall be sized for at least 125% of the fans maximum cataloged RPM.

C. Bearings to be self-aligning grease packed pillow block type with grease seal and external grease fittings with a minimum L50 life of 200,000 hours at the maximum cataloged operating speed. Provide each fan housing with a capped drain connection and bolted and gasketed access door for inspection of fan wheel. Unless a special coating is scheduled, paint fans with a prime coat after metal cleaning and surface preparation; apply a second coat of paint to all exterior surfaces.

D. Fans shall bear the AMCA Certified Ratings Seal for Sound and Air Performance.

E. Provide one inch galvanized mesh inlet screens for fans without inlet ductwork.

F. Electrical Contractor will provide disconnect switches and thermal overload protection for units with three phase motors.

2.3 POWER ROOF EXHAUST FANS

A. Manufacturers: Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME.

B. Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.

C. Electrical Contractor will provide disconnect switches and the necessary the thermal overload protection for units with three phase motors.

D. Upblast units to have motor, bearings, and drives completely enclosed and isolated from the exhaust air stream with ventilation provided by outside air. Units handling grease laden vapors for kitchen hood to be U.L. listed for conveying such vapors, operating continuously at 300 degrees F.

E. See Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment for roof curb information.

F. Provide variable pitch sheaves for EF-1 and EF-2.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions. On units provided with a drain connection, reduce drain connection down to ½" fitting and leave open.

B. Install thrust restraints in accordance with the requirements of Section 230548 - Vibration Controls for HVAC Piping and Equipment.

C. Coordinate with EC on time clock and local switches for EF-1 and EF-2. EC to install time clock and local switch for exhaust fans.

D. Contractor to coordinate exhaust airflow for EF-2 between various construction phases. Coordinate with TAB contractor in adjusting the variable pitched sheaves.

END OF SECTION 233400

SECTION 233600 - AIR TERMINAL UNITS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. Supply Variable Air Volume Boxes
   2. Terminal Unit Insulation

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230593 – Testing, Adjusting and Balancing for HVAC

D. Section 230914 – Pneumatic and Electric Instrumentation and Control Devices for HVAC

E. Section 233100 – HVAC Ducts and Casings

F. Section 233300 – Air Duct Accessories

G. Section 238200 – Heating and Cooling Terminal Units

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Supply Variable Air Volume Boxes
   2. Terminal Unit Insulation

B. Contractor shall submit air terminal unit data including materials of construction, dimensions, scheduled flow rates, pressure drops, radiated and discharge sound power levels, reset volume controller data, actuator spring range and torque data.

1.5 REFERENCE STANDARDS

A. NFPA 90A Installation of Air Conditioning and Ventilation Systems.

B. UL 181 Factory-Made Air Ducts and Connectors.

C. ARI-ADC Standard 880

D. ASTM E84 Surface Burning Characteristics of Building Materials

E. UL 723 Surface Burning Characteristics of Building Materials

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. Select sizes, capacities, configuration, and operating characteristics as shown on the plans and/or as scheduled.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.1 SUPPLY VARIABLE AIR VOLUME BOXES

A. Units shall be single duct and pressure independent.

B. Manufacturers: Carnes, Envirotec, Krueger, Metal-Aire, Nailor, Titus, Trane, Price.

C. Construction:
1. Unit casing shall be minimum 22 gauge steel and internally insulated with 13/16" rigid fiberglass insulation with a foil scrim face or ¾" thick polyolefin closed cell insulation. Construction to meet UL 181 and NFPA 90A. Casing shall be sealed to limit leakage to a maximum of 15 cfm at 6.0 inches of static pressure. Casing outlet shall have slip and drive joint for connection to discharge ductwork.

2. Metal damper blade shall be mounted to shaft having self-lubricated bearings. Shaft end shall be marked to indicate damper position and shall have a built-in stop to prevent overstroking. Damper blade shall close off against gasket to limit leakage to 10 cfm at 6.0 inches of differential static pressure. Damper linkage shall be sized to accept at least 40 inch-pounds of torque to the damper shaft. Damper shaft shall be provided with a marking indicating damper position.
3. Round inlet collar shall be equipped with a multi-point flow sensor that shall amplify the measured velocity pressure. Pneumatic tubing from flow sensor to differential pressure transducer shall be UL listed, fire retardant (FR) type.

2.2 ACCESS DOORS

A. Refer to Section 233300 – Air Duct Accessories for Access Doors.

2.3 TERMINAL UNIT INSULATION

A. Materials or accessories containing asbestos will not be accepted.

B. Use composite insulation systems (insulation, jackets, sealants, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less.

C. The following two internal insulation options may be utilized.

D. Rigid Fiberglass Insulation:
1. Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.
2. Foil-scrim-kraft vapor barrier jacket, factory applied to insulation, maximum permeance of .02 perms. All exposed insulation edges shall be covered with metal nosing.

E. Polyolefin Insulation: Flexible closed cell, minimum nominal density of 1.5 lbs. per cu. ft., thermal conductivity of not more than 0.24 at 75 degrees F, minimum compressive strength of 5 psi at 25% deformation, maximum water vapor permeability of 0.0 perm inch, maximum water absorption of 0% by weight and volume, rated for service range of -165 degrees F to 210 degrees.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install air terminal units as indicated on project drawings and in accordance with the manufacturer's installation instructions.

B. Mount air terminal boxes with a minimum 3 feet of straight ductwork upstream of inlet flow sensor for sizes 12" diameter and below. Provide a minimum of 3X the inlet diameter of straight duct upstream of the inlet flow sensor for inlet sizes above 12" diameter.

C. Provide at least 24" of clearance on controller side of the air terminal unit. The clearance area shall extend the full length of the supply air terminal unit and the full length (including the access door) of the air terminal unit

D. Support air terminal units from building structure using sheet metal straps or trapeze hanger with rods. Do not mount air terminal units off of adjacent ductwork or piping.

E. Access Doors:
   1. Duct Access Doors – Square Duct: Provide duct access doors in duct or extended supply air terminal unit upstream and downstream of the reheat coil. Duct access doors shall be as large as duct allows with a maximum size of 18"x18". Install heating coils in accordance with Section 237312 - Air Handling Unit Coils.
   2. Duct Access Doors – Round Duct: Install round duct access doors on the side of the duct upstream of the return/exhaust terminal unit. At no time shall the access door be installed in the bottom of the duct. Piano hinged style access doors shall be installed with the piano hinges located ½ above the bottom of the duct to allow the access door to swing down toward the floor.

F. Insulation:
   1. Rigid Fiberglass Insulation: All rigid duct insulation edges shall be covered with metal nosing. Foil scrim face must completely separate the rigid fiberglass duct material from the air stream.
   2. Polyolefin Insulation:
      a. Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.
      b. For supply air terminal units, provide five feet of 1" thick lining immediately downstream from air terminal unit discharge. Refer to Section 23 33 00 – Air Duct Accessories for liner specification.

3.2 ADJUSTING

A. Coordinate adjustment of air terminal units with Section 230593 - Testing, Adjusting and Balancing.

3.3 TRAINING

A. See Section 230500 – Common Work Results for HVAC for general training requirements.

B. In addition to the training provided in Section 230500 – Common Work Results for HVAC, provide an additional 1 hour of training for each type of terminal unit provided on the project.

END OF SECTION 233600

SECTION 233713 - DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for air terminal equipment. Included are the following topics:
   1. Square Ceiling Diffusers - Plaque
   2. Self-Modulating Diffusers - Plaque
   3. Side-Wall Registers and Grilles
   4. Eggcrate Grille

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 - Common Work Results for HVAC

C. Section 230593 - Testing, Adjusting and Balancing for HVAC

D. Section 230914 - Electric Controls

E. Section 233100 - HVAC Ducts and Casings

F. Section 233300 - Air Duct Accessories

1.4 SUBMITTALS

A. Refer to Section 230500 - Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 - Common Work Results for HVAC, supply the following submittals:
   1. Square Ceiling Diffusers - Plaque
   2. Self-Modulating Diffusers - Plaque
   3. Side-Wall Registers and Grilles
   4. Eggcrate Grille

B. Furnish submittal information including, but not limited to, the following:
   1. Manufacturer's name and model number
   2. Identification as referenced in the documents

3. Capacities/ratings
4. Materials of construction
5. Sound ratings
6. Dimensions
7. Finish
8. Color selection charts where applicable
9. Manufacturer's installation instructions
10. All other appropriate data

1.5 REFERENCE STANDARDS

A. NFPA 90A Installation of Air Conditioning and Ventilation Systems.

B. UL 181 Factory-Made Air Ducts and Connectors.

C. ARI-ADC Standard 880

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price, and United Sheet Metal.

B. Acceptable manufacturers for specific products are listed under each item.

2.2 SQUARE CEILING DIFFUSERS - PLAQUE

A. Titus model OMNI, Carnes series SFPA/SHPA, Price model SMDP, Metal Aire series 5750, and Krueger series PLQ/5PLQ.

B. Unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

C. Directional blow pattern as shown on the drawings and/or as scheduled.

D. One-piece removable square face plaque with one-piece backpan.

E. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.3 SELF MODULATING CEILING DIFFUSERS

A. Price model "Prodigy" PPD2 or Titus model "T3SQ" VAV diffusers.

B. Diffuser shall be high-torque gear motor, low voltage motor. Provide microprocessor controller located in diffuser for space control. Diffuser shall be controlled by remote wall mounted stat. This will be a standalone control with no BAS interface. Unit mounted RJ modular jacks for two drone outputs and modular power supply input. Microprocessor is advanced proportional integral (PI) control.

C. Thermostat shall be Dial thermostat with set-point adjustment capabilities. Thermostat shall provide automatic heating/cooling change over. Setpoints flow limits are retained if power is lost.

D. Provide a pressure relief collar to regulate the status pressure at self-modulating diffuser inlet.

E. The thermal room sensing element shall be located behind an induction cap in the center of the diffuser panel and shall provide no more than1oF thermal deadband between induced temperature and zone temperature. Each diffuser shall be individually adjustable to sense room temperature within the space between 68°F and 77°F. Each diffuser shall be individually adjustable for minimum airflow from 0 to 30%.

F. Unless otherwise indicated, louvered face furnished with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

G. Directional blow pattern as shown on the drawings and/or as scheduled.

H. One-piece construction louver cones with no corner joints.

I. White, baked enamel finish or powder coat finish, unless otherwise indicated.

2.4 SIDE-WALL REGISTERS AND GRILLES

A. Titus series 300 (supply) and series 350 (return/exhaust), Carnes model R series, Price model 520 (Supply) or 530 (return/exhaust), Metal Aire series V4000 or H4000, Krueger series 880.

B. Unless otherwise indicated, with frame type appropriate to installation. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

C. Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

D. Opposed blade volume control damper supply registers, operable from face.

E. Fixed blade core return and exhaust registers and grilles.

F. Opposed blade volume control damper return registers, operable from face.

G. Register and grille sizes as shown on drawings and/or as scheduled.

H. White, baked enamel finish or powder coat finish, unless otherwise indicated.

I. Screw holes on surface counter sunk to accept recessed type screws.

2.5 EGGCRATE GRILLE

A. Titus model 50, Carnes model RAE or RAT, Price model 80, Metal Aire model CC, Krueger model EGC.

B. Aluminum construction with frame type appropriate to installation.

C. Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1" deep with a minimum of 85% free area.

D. Grille sizes and finishes as shown on drawings and/or as scheduled.

E. White, baked enamel finish or powder coat finish, unless otherwise indicated..

F. Refer to architectural plan for ceiling installation conditions types. It is the responsibility of the contractor to coordinate frame and border of diffusers with general contractor.

G. Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

B. Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

C. Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

D. Seal connections between ductwork drops and diffusers/grilles airtight.

E. Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

3.2 SELF MODULATING CEILING DIFFUSERS

A. Install self-modulating ceiling diffusers as shown on drawings and according to manufacturer's instructions.

B. Contractor shall wire the self-modulating ceiling diffusers with the remote thermostats as indicated on the drawings. Contractor is responsible for all wiring and devices required to provide a full functional system to variable control the cooling/heating at the spaces.

C. Contractor shall functional test each self-modulating ceiling diffusers with existing rooftop units at max./min cooling and heating cycle.

D. Master diffusers are created by connecting the diffusers to a wall mounted controller/thermostat using the blue RJ-45 control cable. Drone diffusers are created by connecting the diffuser to a master unit using the blue RJ-45 control cable.

E. The self-modulating diffuser shall be configured as either a master or drone unit. Each shall have a wiring interface box mounted on the diffuser backpan with three RJ-45 and two RJ-12 receptacles for plug and play operation. Each master unit wiring interface box shall have a supply air temperature changeover sensor. Each master unit shall have a thermostat/control module and each drone shall be connected to a master unit. The self-modulating diffuser diffusers shall be powered by a power module. Manufacturer may have up to 6 non-reheat units can be connected to a power module.

END OF SECTION 233713

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SECTION 234100 – PARTICULATE AIR FILTRATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for air system filters. Included are the following topics:
1. Panel Filters
2. MERV 13 Filters
3. Housings for Panel Filters
4. Side Access Filter Housings
5. Filter Gauges

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 - Common Work Results for HVAC

C. Section 237413 - Roof Top Air-Handling Units

1.4 SUBMITTALS

A. Refer to Section 230500 - Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
1. Panel Filters
2. MERV 13 Filters
3. Housings for Panel Filters
4. Side Access Filter Housings
5. Filter Gauges

B. Include data concerning dimensions, materials, efficiencies, installation instructions and appropriate identification.

C. Independent test reports verifying filter performance, test procedures and ratings.

1.5 REFERENCE STANDARDS

A. ASHRAE Standard 52

B. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors

C. UL 586 - Standard for High Efficiency Particulate Air Filter Units

D. UL 900 - Standard for Air Filter Units

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 DESIGN CRITERIA

A. Use UL Class 1 or Class 2 filters unless noted otherwise.(Reference applicable UL standard referenced)

B. Efficiencies indicated in this section are based on ASHRAE Standard 52.

C. Fan motors have been selected to operate against the resistance of mid-life filters as specified in this section.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 - Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. American Air Filter, Barnebey-Cheney, Cambridge, Continental, Flanders, Camil-Farr, Mine Safety Appliances, Research Products, BLC Industries.

B. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement.

2.2 PANEL FILTERS

A. Use 1" (or as scheduled) thick fiberglass blanket enclosed in a cardboard frame and reinforced with a perforated metal retainer on the air leaving side, Coat media with flameproof, non-volatile adhesive.

B. Media nominal rating to be 500 FPM face velocity, 0.15 inch WG initial resistance, 0.50 inches WG recommended final resistance. Average arrestance of filter media shall be 80%.

C. Provide filter holding frame.

2.3 MERV 13 FILTERS

A. Use 2" box type, ultra-fine microglass pleated media, water resistant, plastic or aluminum separators, fully bonded and sealed in a factory fabricated frame. Media pleats to be self-supporting under varying airflow conditions.

B. Media nominal rating to be 500 FPM face velocity, 0.58 inch WG initial resistance, 1.5 inches WG recommended final resistance,

C. Provide a gasket on the vertical sides to prevent leakage between cartridges.

D. Furnish a side access filter housing or holding frame as scheduled. Filter tracks shall be constructed to provide a minimum clearance of 2 inches between the pre-filter and final-filter media to facilitate the installation of static pressure tips.

2.4 HOUSINGS FOR PANEL FILTERS

A. Manufactured by rooftop unit manufacturer. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

2.5 HOUSINGS FOR MERV 13 FILTERS

A. Housing or holding frame to be of the same manufacturer as filter media or provided by the rooftop unit manufacturer. Contractor fabricated housings or filter racks will not be accepted. Casing and tracks constructed of galvanized or enameled steel or aluminum. Provide access to the media tracks from outside the casing so media and be readily changed.

2.6 FILTER GAUGES

A. Manufacturers: Dwyer.

B. Each filter section shall be provided with a factory-installed, flush-mounted, direct reading Dwyer 3 ½" type differential pressure gauge with metal case piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5% accuracy within operating temperature limits of -20° F to 120° F. Lettering shall be black figures on white background. Provide front recalibration adjustment.

C. Provide gauges with the following ranges:

Filter Type	Scale Range (inch W.G.)
Panel filters	0.0 to 0.5
MERV 13	0.0 to 1.0

PART 3 – EXECUTION

3.1 INSTALLATION

A. Where rooftop unit equipment is to be used for temporary heating or ventilation of a facility, do not operate the equipment until specified filter media has been installed. Contractor shall be responsible for maintaining the cleanliness of air handling apparatus and air distribution systems during construction through regular inspection and changing of filter media throughout the construction period.

B. Where rooftop unit equipment is used during the construction period, install new filter media prior to start of air balancing. Additionally, deliver one new set of media to the owner prior to substantial completion.

C. Install units as shown on drawings and details according to manufacturer's instructions.

D. Reinforce filter holding frames per manufacturer's instructions.

E. Maintain necessary clearance for changing filters.

3.2 FILTER GAUGES

A. Install filter gauge static pressure tips upstream and downstream of filters. Mount gauge on outside of filter housing in accessible position outside of the unit housing. Install tubing and gauge valves between gauge and sensor tips. Adjust and level each gauge.

END OF SECTION 234100

SECTION 235100 – BREECHINGS, CHIMNEYS, AND STACKS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for all breechings, chimneys, and stacks. Included are the following topics:
   1. Vents for Condensing Appliances
   2. Double Wall Type "B" Vents and Breeching

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230700 - HVAC Insulation

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Vents for Condensing Appliances
   2. Double Wall Type "B" Vents and Breeching

B. Include materials of construction, dimensions, weight, support and layout of breechings. Where factory built units are used, submit layout drawings indicating plan view and elevations. Identify all methods of support and building structural members utilized for such support.

C. Submit manufacturer's installation instructions including required clearance to combustible materials.

1.5 REFERENCE STANDARDS

A. UL 959

B. ANSI/ASTM C64

C. ANSI/ASTM C105

D. ANSI/ASTM A525 Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dipped Process

E. ASTM A527 Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dipped Process, Lock-Forming Quality

F. ASTM A53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

G. ASTM A234 Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions

1.7 DESIGN CRITERIA

A. Follow the requirements of NFPA 211 and State codes.

B. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

PART 2 – PRODUCTS

2.1 VENTS FOR CONDENSING APPLIANCES

A. Provide vents, fittings, and accessories constructed of schedule 40 CPVC where in accordance with appliance manufacturer's recommendations.

B. Size vents in strict accordance with appliance manufacturer's requirements.

2.2 DOUBLE WALL TYPE "B" GAS VENTS AND BREECHING

A. Manufacturer: Selkirk Metalbestos, Metal-Fab, Air-Jet, Hart & Cooley, General Products Co.

B. Vent pipe, breeching, and accessory fittings to be UL listed type "B".

C. Fabricate inner pipe of sheet aluminum or stainless steel, and outer pipe of galvanized sheet steel, tested in compliance with UL 441. Minimum thickness of inner and outer pipes to be as follows:

Pipe Size	Thickness Inner Pipe	Thickness Outer Pipe
Round, up to 6"	0.012"	28 gage

D. Provide all necessary accessories including flashing, counter flashing, storm collar, insulated thimble, rain cap with bird screen, clean out, fittings and all necessary supports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Condensing appliance vents:
1. Pitch exhaust vents up from appliance to point of termination outside building.
2. Termination of exhaust within 10 feet of operable windows, other building openings, or air intakes will not be accepted.
3. Locate these terminations with respect to normal wind direction so that the products of combustion are not likely to enter the building, regardless of the distance from the vent to the building openings or air intakes.
4. Pitch combustion air vents from intake down toward appliance connection.
5. All joints of combustion air and exhaust vents shall be solvent welded and leak tight. Provide drain connection at base of exhaust vent, and pipe to nearest open site drain.

B. Double wall metal stacks and breeching:
1. Install stack, breeching, and accessories in accordance with the manufacturer's recommendations, maintaining minimum clearances from combustibles specified in UL listing.
2. Support breechings from building structure with suitable ties, braces, hangers and anchors to hold shape and prevent buckling. Minimum support for vertical sections shall be at all floor penetrations. Support from floor structure, roof structure, or adjacent structural surfaces. Verify load bearing capacity of support points with Architect/Engineer.
3. Install breechings with a minimum of joints. Align connections accurately and maintain smooth internal surfaces.
4. Install concrete inserts for support of breechings, chimneys, and stacks in coordination with formwork.
5. Maintain UL listed minimum clearances from combustibles.
6. Install stacks plumb. Pitch breeching upward from fuel-fired equipment to chimney or stack.
7. Clean breechings during installation, removing dust and debris.
8. At appliances, provide slip joints to allow removal of appliances without removal or dismantling of breechings.
9. Seal all joints of positive pressure stacks and breeching in accordance with manufacturer's recommendations, using only sealants recommended by stack manufacturer.

3.2 CLEANING AND PROTECTION

A. Clean breeching internally during installation to remove dust and debris. Clean external surfaces to remove welding slag and mill film.

B. At ends of breeching which are not completed or connected to equipment, provide temporary closure which will prevent entrance of dust and debris until final connections are made.

END OF SECTION 235100

SECTION 235500 - FUEL-FIRED HEATERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for fuel-fired heaters. Included are the following topics:
   1. Gas Fired Unit Heaters

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230513 – Common Motor Requirements for HVAC Equipment

D. Section 230523 – General-Duty Valves for HVAC Piping

E. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

F. Section 230548 – Vibration Controls for HVAC Piping and Equipment

G. Section 231100 – Facility Fuel Piping

H. Section 235100 – Breechings, Chimneys and Stacks.

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Gas Fired Unit Heaters

B. Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

1.5 REFERENCE STANDARDS

A. AGA American Gas Association

B. GAMA Gas Appliance Manufacturers Association

C. NEC National Electrical Code

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.7 WARRANTY

A. Gas fired unit heaters heat exchangers warranted for five years. Remainder of unit heater components warranted for 1 year from startup.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 – Common Work Results for HVAC.

PART 2 - PRODUCTS

2.1 GAS FIRED UNIT HEATERS

A. Manufacturers: Modine, Reznor, Sterling or Trane

B. Horizontal discharge, direct vent sealed combustion type. AGA certified for use with gas. Minimum combustion efficiency (Ec) of 80%. All wiring shall comply with the National Electrical Code. Separated combustion type is also acceptable unit.

C. Construct casing of cold rolled steel with baked enamel finish. Direct drive propeller type fan statically and dynamically balanced and including fan safety guard and adjustable vertical and horizontal louvers for control of air diffusion on discharge of unit. Aluminized steel burners, electronic spark ignition with electronic flame supervision and timed lockout control. Heavy gauge steel heat exchanger and factory installed induced draft blower for heat exchanger prepurge and combustion gas venting. Provide a hinged access panel on the bottom of the unit to access the burner or provide side access (pull out drawer) to burner assembly. Single point power connection. Unit must be approved for vertical or side wall venting

D. Provide a powered vented arrangement.

E. Provide spark ignited intermittent pilot system with electronic flame supervision

F. AGA gas controls, including manual main shut-off valve, 24 volt redundant combination gas control valve with 100 percent safety shut-off valve and main gas pressure regulator.

G. Provide fan controls and limit safety controls including but not limited to:
1. Pressure switch to verify combustion/exhaust gas airflow
2. High limit controls
3. Fan time delay to delay the fan start until the heat exchanger reaches a predetermined temperature and to allow the fan to operate, after burner shut down, to remove heat exchanger residual heat.

H. This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with Division 26 00 00 - Electrical and comply with the NEC.

I. Provide an air inlet/vent termination assembly and threaded hanger connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.

B. Pipe vents from gas regulator to outside (where regulators are provided).

C. Contractor to duct inlet/outlet to exterior wall per manufacturer's installation instructions. Refer to Section 23 51 00.

D. Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.

3.2 GAS FIRED UNIT HEATERS

A. Install units and connect gas, combustion air and vent piping as instructed by the manufacturer and in compliance with applicable code requirements. Suspend from building structure to maintain headroom beneath units as indicated in Section 23 05 29, Hangers and Supports for HVAC Piping and Equipment. Connect combustion air and venting to outside of building as indicated on the drawings and terminate per the manufacturer's instructions.

END OF SECTION 235500

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SECTION 236213 - PACKAGED AIR-COOLED REFRIGERANT COMPRESSOR AND CONDENSING UNITS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for air cooled condensing units for use with split system type air conditioning. Included are the following topics:
   1. Units up to 5 Tons
   2. Refrigerant Piping Sizing
   3. Refrigerant Piping Accessories

1.3 RELATED WORK

A. Section 230500 – Common Work Results for HVAC

B. Section 230513 – Common Motor Requirements for HVAC Equipment

C. Section 230548 – Vibration Controls for HVAC Piping and Equipment

D. Section 230914 – Electric Instrumentation and Control Devices for HVAC

E. Division 26 - Electrical

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Units up to 5 Tons
   2. Refrigerant Piping Sizing
   3. Refrigerant Piping Accessories

B. Submit air cooled condensing unit shop drawings including the following information: specific manufacturer and model numbers, dimensional and weight data, required clearances, materials of construction, capacities and ratings, stages of unloading capacity achievable without hot gas bypass, refrigerant type and charge, component information, size and location of piping connections, electrical connections, wiring diagrams and information for all specialties and accessories.

C. Submit manufacturer's installation and start-up instructions, maintenance data, troubleshooting guide, parts lists, controls and accessories.

D. At substantial completion, submit warranty certificate and copy of start-up report.

1.5 FUNCTIONAL TESTS

A. Refer to Section 230500 - Common Work Results for HVAC, Functional Tests. In addition to the general content specified under Section 230500 - Common Work Results for HVAC, perform the following functional tests:
1. Units up to 5 tons.

1.6 REFERENCE STANDARDS

A. Applicable provisions of Division 1 shall govern work under this section.

B.	ARI 210/240	Unitary Air Conditioning and Heat Pump Equipment
C.	ARI 365	Commercial and Industrial Unitary Air Conditioning Condensing Units
D.	ASHRAE 15	Safety Standard for Refrigeration Systems
E.	ASHRAE 90.1 Buildings	(2004 edition)Energy Standard for Buildings Except Low Rise Residential
F.	NEC	National Electrical Code
G.	ASTM B117	Standard Practice for Operating Salt Spray (fog) Apparatus
H.	UL	Underwriters Laboratory

1.7 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

B. Unit Energy Efficiency Ratio (EER), Coefficient of Performance (COP) and Integrated Part Load Value (IPLV) shall meet the minimum applicable requirements of ASHRAE 90.1. Units that are labeled Energy Star ® will be acceptable.

C. Rate unit performance in accordance with the latest edition of ARI Standard 365 or ARI Standard 210/240, whichever is applicable for the equipment.

D. Construct units in accordance with ASHRAE 15, UL standards and the NEC. Units shall carry the UL label.

E. Factory run test units to see that each control device operates properly. Pressure test, evacuate, charge with holding charge of refrigerant and full oil charge prior to shipping from the factory.

1.8 WARRANTY

A. Provide a one year parts and labor warranty on the entire unit beginning upon substantial completion of project.

B. Provide a five year parts warranty on the compressor(s) beginning upon substantial completion of project.

1.9 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 23 05 00 – Common Work Results for HVAC.

1.10 DELIVERY, STORAGE AND HANDLING

A. Comply with manufacturer's instructions for storing, rigging, unloading, and transporting units. Protect units from physical damage. Leave factory-shipping covers in place until installation.

B. Ship units to jobsite fully assembled

PART 2 – PRODUCTS

2.1 UNITS UP TO 5 TONS

A. Manufacturers: Carrier, Trane, York, McQuay.

B. Provide factory assembled, outdoor mounted, air-cooled condensing unit suitable for on rooftop installation. Include compressor, air cooled condenser, refrigerant, lubrication system, interconnecting wiring, safety and operating controls, motor starting components and additional features as specified herein or required for safe, automatic operation. Capacity and steps of unloading as indicated in the equipment schedule. This contractor is responsible for all additional costs, including electrical and controls costs, associated with multiple units. Refrigerant is to be R-410.

C. CABINET
1. Construct cabinet of heavy gauge, galvanized steel coated with weather resistant paint. Provide removable access panels to facilitate full access to the compressor, fan and control components.

D. COMPRESSOR
1. Provide hermetic reciprocating or scroll type compressor with built in motor winding temperature and current protection, liquid and suction service valves, gage ports, sight glass and liquid line filter dryer. Provide crankcase heater with reciprocating type compressors. Mount compressors on vibration isolators.

E. CONDENSER
1. Provide condenser coils with aluminum alloy plate fins mechanically fastened to seamless copper tubing with integral subcooler. Construct coils with design working pressure suitable for the refrigerant.
2. Provide direct-drive statically and dynamically balanced propeller type fans with vertical or horizontal discharge as indicated on the drawings and guards constructed of heavy gage PVC coated wire or galvanized steel.

F. POWER WIRING
1. Provide factory installed 24-volt control circuit with fusing; control power transformer and all associated internal wiring. Provide a single point power connection to the unit(s). Provide factory installed magnetic contactors for compressor and condenser motors.
2. Electrical characteristics shall be as indicated in the equipment schedule.

G. CONTROLS
1. Provide high/low refrigerant pressure cutouts with manual reset and anti-short cycle compressor timer.
2. Unit must be capable of operating down to ambient temperature of 40° F. Provide low ambient lockout to prevent compressor from operating below 40 degrees.

2.2 REFRIGERANT PIPING SIZING

A. The unit manufacturer shall verify the final refrigeration pipe sizing process to insure conformance to specific unit requirements such as max lengths, refrigerant velocities, unloading considerations and proper oil return. This contractor shall provide refrigeration piping drawings from the field which details the way the piping will actually be installed.

2.3 REFRIGERANT PIPING ACCESSORIES

A. Provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 450 psig and a maximum working temperature of 225° F. For systems using R-410A, provide all refrigerant piping specialties with a maximum working pressure of full vacuum to 850 psig and a maximum working temperature of 225° F.

B. Flexible pipe connectors: Double braided bronze hose flexible pipe connectors with solder end connections.

C. Filter Dryers: For circuits 15 tons and over provide angle pattern filter dryers with replaceable core. For circuits below 15 tons provide straight pattern filter dryers without replaceable core.

D. Sight glasses: Two piece brass construction with solder end connections. Include color indicator for sensing moisture.

E. Solenoid Valves: Two way normally closed with two piece brass body, full port, stainless steel plug, stainless steel spring, Teflon diaphragm and solder end connections. Provide replaceable coil assembly.

F. Thermostatic Expansion Valves: Brass body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

G. Charging Valves: Provide ¼" SAE brass male flare access ports with finger tight, quick seal caps. Provide 2-inch long copper extension sections.

H. Check valves: Spring loaded type with bronze body, bronze disc, neoprene seat, bronze bonnet, stainless steel spring and solder end connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units, piping and accessories in accordance with the manufacturer's written instructions and recommendations. Mount unit(s) on a roof mounting as indicated on the drawings.

B. Maintain adequate service access and airflow clearances for all components as recommended by the manufacturer and as indicated on the drawings.

C. Charge unit(s) with full oil charge and refrigerant charge based on the entire refrigeration system pipe size and length.

D. Provide all control wiring in conduit in compliance with Section 23 09 14, Electric Instrumentation and Control Devices for HVAC and Division 26 00 00 - Electrical.

E. Coordinate power wiring requirements with the electrical trade.

3.2 STARTUP

A. Adjust units for maximum operating efficiency, adjust all controls to required final settings and demonstrate that all components are functioning properly. Submit four copies of a written startup report following the initial startup. Include in the report: work done to the system, all readings taken, a statement certifying that the refrigeration system(s) are leak free and a statement certifying that the unit(s) have been placed in proper running condition as recommended by the manufacturer and as intended in the drawings and specifications.

3.3 TRAINING

A. See Section 23 05 00 – Common Work Results for HVAC for general training requirements.

B. In addition to the training provided in Section 23 05 00 – Common Work Results for HVAC, provide an additional 2 hours of training for each type of packaged air-cooled refrigerant compressor and condensing unit provided on the project.

END OF SECTION 236213

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SECTION 237413 – ROOF TOP AIR-HANDLING UNITS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specifications for roof top package air-handling units. Included are the following topics:
   1. Units 7-1/2 to 25 Tons

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230513 – Common Motor Requirements for HVAC Equipment

D. Section 230529 – Hangers and Supports for HVAC Piping and Equipment

E. Section 230548 – Vibration Controls for HVAC Piping and Equipment

F. Section 231100 – Facility Fuel Piping

G. Section 233100 – HVAC Ducts and Casings

H. Section 233300 – Air Duct Accessories

I. Section 233400 – HVAC Fans

J. Section 234100 – Particulate Air Filtration

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC, Submittals. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Units 7-1/2 to 25 Tons

B. Submit shop drawings including the following information: specific manufacturer and model numbers, submittal equipment identification corresponding to project drawings and schedules, unit dimensional and weight data, materials of construction, capacities and ratings, fan curves, fan type, drive and motor information, vibration isolation, coil performance data, sound power levels, filter information, information for all accessories.

1.5 FUNCTIONAL TESTS

A. Refer to Section 230500 - Common Work Results for HVAC, FUNCTIONAL TESTS. In addition to the general content specified under Section 230500 - Common Work Results for HVAC, perform the following functional tests:
   1. Units 7-1/2 to 25 Tons

1.6 REFERENCE STANDARDS

A. ARI 430 (latest edition) Standard for Central Station Air Handling Units

B. ARI 210 Unitary Air-Conditioning Equipment.

C. ARI 270 Sound Rating of Outdoor Unitary Equipment.

D. NFPA 70 National Electrical Code.

E. NFPA 90A Standard for Installation of Air Conditioning and Ventilation Systems

1.7 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions.

1.8 DESIGN CRITERIA

A. Furnish factory fabricated roof top air handling units complete meeting the configuration shown on drawings and/or as scheduled.

B. Units to be tested, rated and certified in accordance with ARI Standard 430 and bear ARI certification label.

C. All material shall meet NFPA 90A flame spread and smoke develop rating requirements.

D. Any revisions made by the Contractor to the inlet and outlet ductwork conditions from that shown on the drawings shall not increase system effect and/or static pressure and shall not decrease mixing efficiencies.

1.9 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 – Common Work Results in HVAC.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Carrier, McQuay, Trane, York and Aaon Inc.

2.2 7-1/2 TO 25 TON UNITS

A. General:
   1. The units shall be dedicated downflow or horizontal airflow. Refrigerant shall be R410A. Performance shall be certified in accordance with ARI Standard 210 and 270, American Gas Association, and UL listed. All units shall be factory assembled, internally wired, fully charged with refrigerant and 100 percent run tested to check cooling operation, fan and blower rotation and control sequence, before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be UL listed and labeled with the following information:
      a. Refrigerant
      b. EER
      c. AFUE

B. Casing/Cabinet:
   1. Unit shall be constructed of 18 gauge, G90 galvanized steel with powder coat or baked enamel finish. Unit's finish shall be tested 500 hours minimum in a salt spray test in compliance with ASTM B117. Casing shall be insulated with a minimum of ¾" foil faced fiberglass. Insulation shall be mechanically fastened to the unit. Double wall construction may be used as a substitution.
   2. Wall/Roof panel deflection shall not exceed L/240 ratio at a maximum +/- 5 inches of static pressure. Deflection shall be measured at the midpoint of the panel.
   3. Base frame shall be constructed of 16 gauge minimum G90 galvanized steel and shall have integral lifting and rigging holes for installation. Base shall overhang roof curb to provide for positive water runoff and weather tight seal.
   4. Duct openings in base shall be provided with 1" flange to prevent any water getting into duct system.
   5. All access panels shall have gaskets and be provided with fasteners and handles. Panels shall be insulated to match unit construction.
   6. Duct sealant and/or gaskets as indicated in Section 23 31 00 – HVAC Ducts and Casings may be utilized to seal duct connections to the roof top air handling unit casing. Silicone sealants are not acceptable. Unit leakage rate shall not exceed 1% of the total system air quantity when subjected to +/- 5" static pressure.

C. Fans:
   1. Supply fan wheels shall be backward inclined, forward curved or airfoil type as specified or required by performance characteristics.
   2. Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.
   3. Fans to be fastened to hollow or solid steel shafts and designed for continuous operation at maximum rated static pressure. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. Bearings shall be sized to provide a L-50 life of 250,000 hours.
   4. Furnish variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Drives shall be designed for 150% of motor rating. Furnish OSHA approved belt guards for all fans.
   5. Condenser fans shall be direct drive, axial type designed for low tip speed and vertical air discharge. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, non-reversing type with permanently lubricated ball bearing and thermal protection. Motor design shall be totally enclosed air over (TEAO) to protect the motors from rain and damage by water.
   6. Fan motors shall be provided in accordance with section 23 05 13 – Common Motor Requirements for HVAC Equipment.

D. Heating (Gas):
   1. Gas-fired heating section shall provide completely assembled, wired, and piped gas-fired heating system within unit. Design certified AGA specifically for outdoor application.
   2. Burner shall be capable of providing a firing rate.
   3. Heat exchanger shall be embossed, formed, and seamed 18 gauge stainless steel, factory tested for gas leaks, stress relieved, free floating design.
   4. Burners shall be stamped and seam-welded 20 gauge stainless steel.
   5. Provide induced draft combustion blower to ensure flame stability under varying wind conditions and to give high combustion efficiency.
   6. Provide induced draft type burner, pressure regulator, gas valves, manual shut-off, intermittent spark or hot surface ignition, flame sensing device, and automatic 100 percent shut-off pilot.
   7. Provide gas burner safety controls to energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after air flow proven and slight delay, allow gas valve to open.
   8. Provide high limit control to de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

E. Cooling:
   1. Provide a minimum of two steps of cooling capacity with independent refrigeration circuits.
   2. Provide low ambient control to allow mechanical cooling to operate down to 0 degrees F.
   3. Provide unit with a minimum EER per drawings. If EER is not indicated on drawings, the minimum EER shall be equal to or greater than the 2009 International Energy Conservation Code.

F. Compressors:
1. All units shall have direct-drive, hermetic, scroll type compressors with centrifugal type oil pumps.
2. Motor shall be suction gas-cooled and shall have Internal overloads shall be provided with the scroll compressors. All models shall have crankcase heaters, phase monitors and low and high pressure control as standard.
3. Provide a time delay between starting of first and second compressor with multiple compressor units.
4. A lockout timer shall provide a minimum off time of five minutes between compressor cycling.

G. Coils:
1. Condenser coils shall be multi-row and fabricated from high efficiency copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig. Provide hail guards to protected coils.
2. Evaporator coils shall be multi-row and fabricated from high efficiency copper tubing mechanically bonded to high efficiency aluminum fins. Each coil shall have interlaced coil circuiting. Each evaporator coil shall be factory leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
3. Fabricate cooling coil drain pans from type 304 stainless steel. Install a drain pan under each cooling coil. Extend drain pans the entire width of each coil, including the header, and from the upstream face of each coil to a distance ½ of the vertical coil height of the bottom coil or 6", whichever is greater, downstream from the downstream face. Pitch drain pans in two directions towards the outlet. Pipe drain pans individually down to the drain pan below using a minimum 1" type 304 stainless steel piping. The bottom drain pan shall be piped to the exterior of the unit base.

H. Economizer:
1. Provide dry bulb economizer.
2. Provide factory installed economizer to include modulating outside air dampers, unpowered barometric relief damper, and relief hood.

I. Electrical:
1. Provide unit mounted disconnect for a single point power connection.
2. Provide unit mounted GFI convenience outlet. Outlet shall be powered from unit. Outlet shall be provided with a separate power circuit.

J. Filters:
1. Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2" filter – MERV 13. The unit design shall have a hinged access door for the filter section. See Section 23 41 00 – Particulate Air Filtration for filter information.

K. Roof Curb:
1. Provide high insulated roof curb with vibration isolation.
2. See Sections 23 05 29 – Hangers and Support for HVAC Piping and Equipment and 23 05 48 – Vibration Controls for HVAC Piping and Equipment for additional information.

L. Controls:
   1. Provide complete DDC controls to operate the RTU. Manufacturer controls shall be standalone. No interface with building automation system.
   2. DDC control shall accept the following inputs: space temperature, setpoint adjustment, outdoor air temperature, compressor lock-out, fire shutdown, enthalpy switch, and fan status / filter status / humidity / remote occupancy.
   3. DDC control shall provide the following outputs: economizer enable, fan enable, cooling stage 1 on, cooling stage 2 on, heat stage 1on, heat stage 2 on.
   4. Refer to Section 23 09 93 - Sequence of Operations for HVAC Controls for Control of discharge temperature, space temperature and fan speed.

M. Warranty:
   1. Provide a 1 year warranty on unit parts, 5 year warranty on compressors, and 10 year warranty on heat exchanger.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install all roof top air handling units and accessories as indicated on drawings and/or as scheduled and according to manufacturer's installation instructions.

B. Mount units at appropriate height above roof to insure proper condensate trap depth and condensate drainage.

C. Install roof top air handling unit to provide for adequate service access. Coordinate with other trades to assure unit does not infringe upon access or service clearances of other equipment.

D. Lubricate fan bearings. Verify fan isolators have proper deflection and curb mounted spring rail has been installed properly.

E. Upon completion of installation of roof top air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning components, then retest to demonstrate compliance.

F. Furnish one spare set of fan drive belts and three reinforced nylon access door handles.

G. Contractor to provide 6 lbs 2" fiberglass board insulation inside of roof curb for acoustics purpose. Also provide (2) 5/8" moisture-resistant drywall laid on top of deck prior to laying the 2" fiberglass board insulation. Contractor to caulk and seal all joints and perimeter of the roof curb. Contractor to lay-in 6" batt insulation over the fiberglass insulation.

3.2 TRAINING

A. See Section 230500 – Common Work Results for HVAC for general training requirements.

B. In addition to the training provided in Section 230500 - Common Work Results for HVAC, provide an additional 2 hours of training for each type of roof top air-handling unit provided on the project.

END OF SECTION 237413

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SECTION 238200 - HEATING AND COOLING TERMINAL UNITS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall provide all labor and materials for a complete system in this specification section.

1.2 SECTION INCLUDES

A. This section includes specification for heating and cooling terminal equipment using **Electric** as the source. Included are the following topics:
   1. Cabinet Heaters
   2. Convectors
   3. Fin Tube Radiation
   4. Electric Heaters

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this Section.

B. Section 230500 – Common Work Results for HVAC

C. Section 230513 – Common Motor Requirements for HVAC Equipment

D. Section 233300 – Air Duct Accessories

E. Section 234100 – Particulate Air Filtration

1.4 SUBMITTALS

A. Refer to Section 230500 – Common Work Results for HVAC. In addition to the general content specified under Section 230500 – Common Work Results for HVAC, supply the following submittals:
   1. Cabinet Heaters
   2. Convectors
   3. Fin Tube Radiation
   4. Electric Heaters

B. Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

1.5 REFERENCE STANDARDS

A. ARI 210 Standard for Unitary Air-Conditioning Equipment

B. ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils

C. CS 140

1.6 QUALITY ASSURANCE

A. Refer to Division 1 for equals and substitutions

1.7 DESIGN CRITERIA

A. Forced Circulation Coils: Ratings certified in accordance with ARI 410.

B. Electrical Equipment and heaters shall be UL listed for the service specified.

C. Electrical components and work must be in accordance with National Electrical Code.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified in Section 230500 – Common Work Results for HVAC.

PART 2 – PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers: Berko, Chromalox, Markel, Q Mark, Trane or approved equal.

B. Electric heating elements shall be corrosion resistant, installed to prevent noise of expansion and contraction. Units shall be designed for even distribution of air across heating element.

C. Units shall be furnished with necessary over-heat protection, reset devices, contactors, transformers and control as required. Provide adjustable thermostatic control for operation of fan and heater.

D. Furnish adjustable horizontal and vertical discharge louvers for units with horizontal discharge. Provide an adjustable cone diffuser for projection units with vertical discharge.

E. Furnish motors with characteristics as scheduled. Single phase, 120 volt motors to be permanently lubricated and provided with thermal overload protection.

2.2 CABINET HEATERS

A. Manufacturers: Berko, Chromalox, Markel, Q Mark, Trane or approved equa

B. Electric heating elements shall be corrosion resistant, installed to prevent noise of expansion and contraction. Units shall be designed for even distribution of air across heating element.

C. Units shall be furnished with necessary over-heat protection, reset devices, contactors, transformers and control as required. Provide adjustable thermostatic control for operation of fan and heater. Motors to be 120 volt, single phase, permanently lubricated, with thermal overload protection and disconnect switch at unit.

D. Construct vertical unit casings with 16 gauge steel front panels and minimum 18 gauge steel end and side panels. Horizontal units located in concealed spaces or mounted in ceiling to have minimum 18 gauge front, end, and side panels.

E. Furnish exposed cabinets in a baked enamel finish in colors selected by the Architect or Owner.

F. Furnish ceiling mounted units with a hinged front panel to allow access to all internal components.

G. Use centrifugal type fans, statically and dynamically balanced to operate without objectionable noise and vibration.

H. Furnish each unit with filter rack and 1" panel filters as specified in Section 23 41 00 - Particulate Air Filtration.

2.3 CONVECTORS

A. Manufacturers: Berko, Chromalox, Markel, Q Mark, Trane or approved equa

B. Electric heating elements shall be corrosion resistant, installed to prevent noise of expansion and contraction. Units shall be designed for even distribution of air across heating element.

C. Units shall be furnished with necessary over-heat protection, reset devices, contactors, transformers and control as required. Provide adjustable thermostatic control for operation of fan and heater. Motors to be 120 volt, single phase, permanently lubricated, with thermal overload protection and disconnect switch at unit.

D. Construct enclosures of 18 gauge steel back and end panels, and 16 gauge steel front and top panels. Furnish in a baked enamel finish in one of the manufacturers' standard colors, selected by Architect.

2.4 FIN TUBE RADIATION

A. Manufacturers: Berko, Chromalox, Markel, Q Mark, Trane or approved equa

B. Electric heating elements shall be corrosion resistant, installed to prevent noise of expansion and contraction. Units shall be designed for even distribution of air across heating element.

C. Units shall be furnished with necessary over-heat protection, reset devices, contactors, transformers and control as required. Provide adjustable thermostatic control for operation of heater.

D. Unit shall provide a separate tampered double pole disconnect switch at extended 4" length of control section. Unit shall also be provided with an internal transformer and relay as a part of the unit components. Transformer and relay will be wired to local thermostat 24v.

E. Enclosures: Flat top with extruded aluminum grille. Constructed 2-piece uni-lock construction with removable front panels of 14 gauge steel, 20 gauge steel back panels, and furnished with a baked enamel finish in colors selected by Architect or Owner. Provide custom color option for unit.

F. Provide dirt gasket for mounting between back panel and wall.

G. Provide accessories such as inside and outside corners and end caps where required for the complete installation. Where wall-to-wall installations are indicated on plans, provide enclosure extensions or field modification of enclosure to conform to actual room dimensions.

H. Provide hinged access doors at all transformer/relays/controls.

2.5 ELECTRIC HEATERS

A. Manufacturers: Berko, Chromalox, Markel, Q Mark, Trane or approved equa

B. Use corrosion resistant heating elements, designed and spaced for even distribution of air across the heating element, and installed to prevent noise of expansion and contraction.

C. Provide units with necessary overheat protection, reset devices, air flow interlock switch, contactors, transformers, local non-fused disconnect switch that is prewired, and other controls as may be required by codes.

D. Fan powered units must be provided with thermostat and controls to maintain fan operation until residual heat in the heating elements has been dissipated. The fans and motors shall be balanced and mounted for vibration free operation.

E. Construct cabinets of 20 gauge steel, furnished exposed cabinets with a baked enamel finish in one of the manufacturer's standard colors, selected by Architect.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install units in accordance with manufacturer's installation instructions.

B. Coordinate location of units with other trades to assure correct recess size for recessed units.

C. After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

3.2 UNIT HEATERS

A. Coordinate with Electrical Contractor on 208v, Phase 1. Units will be wired by the Electrical Contractor.

B. Suspend units from building structure and as high as possible to maintain headroom beneath units; supporting from piping systems will not be accepted.

C. Install a drain valve on the coil side of the shutoff valves for each hot water unit heater.

3.3 CABINET HEATERS

A. Coordinate with Electrical Contractor on 208v, Phase 1. Units will be wired by the Electrical Contractor.

B. Mount units in locations indicated on the drawings and as detailed. Install a drain valve on the coil side of the shutoff valves for each hot water cabinet heater.

3.4 FIN TUBE RADIATION

A. Coordinate with Electrical Contractor on 208v, Phase 1. Units will be wired by the Electrical Contractor.

B. Install dirt guard gasket to mounting strip or caulk along top of mounting strip.

C. Install a drain valve on the radiation side of the shutoff valves for each separately valved section of radiation.

D. Install access doors or panels, centered in front of each shut-off valve, balancing valve, steam trap, and temperature control valve located inside radiation enclosure.

3.5 ELECTRIC HEATERS

A. Coordinate with Electrical Contractor on 208v, Phase 1. Units will be wired by the Electrical Contractor.

B. Install units where indicated on the drawings and details.

C. Electric heaters shall be installed at least 6" above the finished floor.

D. Coordinate controls wiring with the self modulating ceiling diffusers in Section 233713 – Diffusers, Registers and Grilles.

END OF SECTION 238200

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Base Bid: Electrical Contractor provide: It is the intent of these specifications to provide complete and workable electrical systems as shown on the accompanying plans and as specified herein except such parts as are specifically exempted herein. Provide all necessary supervision, coordination, labor, materials, equipment, fixtures, dryage, hoisting, tools, transportation, plant services and facilities, machinery and connections to utilities for the installation of complete and operable electrical systems. If details or special conditions are required in addition to those shown on drawings, provide all material and equipment usually furnished with such systems or required to complete their installation, whether noted in plans and specification or not.

B. Materials and labor shall be new (unless noted otherwise), first class and workmanlike and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

C. The layout shown on the drawings is necessarily diagrammatic but shall be followed as closely as other work will permit. The drawings provide design intent. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

D. All sizes as given are minimum except as noted.

E. Because of the scale of the Drawings, certain basic items, such as, pipe fittings, duct fittings, access panels, and sleeves, may not be shown. Where such items are required by Code or by other Sections, or where required for proper installation of the Work, such items shall be included, whether shown or not.

F. In the event of any inconsistencies between the specifications, drawings, contract documents, applicable laws, statutes, ordinances, building codes, rules and regulations, the contractor shall provide the better quality or greater quantity of work and comply with or conform its work to the most stringent legal or contractual requirements.

G. Changes from these drawings required to make this work conform to the building construction shall be made only with prior written approval of the Architect/Engineer. All proposed changes shall be shown on shop drawings. All measurements shall be verified by actual observation and all work shall fit in place meeting the approval of the Architect/Engineer.

H. Equipment Specification may not deal individually with minute items required, such as, components, parts, controls, and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required to make the system operational, they shall be included by the supplier of the equipment at no additional cost, whether or not specifically called for.

1.2 SECTION INCLUDES

A. The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

1. Submittals
2. Reference Standards
3. Quality Assurance
4. Guarantee
5. Work By Owner
6. Operation And Maintenance Instructions
7. Record Documents
8. Continuity Of Existing Services
9. Protection Of Finished Surfaces
10. Sealing And Firestopping
11. Off Site Storage
12. Regulatory Requirements
13. Certificates And Inspections
14. Coordination
15. Demolition And Existing Requirements
16. Request And Certification For Payment
17. Temporary Electrical Work
18. Approved Electrical Testing Laboratories
19. Sleeves And Openings
20. Omissions
21. Definitions
22. Project/Site Conditions
23. Work Sequence And Scheduling
24. Work by Other Trades
25. Salvage Materials
26. Training
27. Access Panels And Doors
28. Identification
29. Demolition
30. Excavation And Backfill
31. Concrete Work
32. Cutting And Patching
33. Lintels
34. Building Access
35. Equipment Access
36. Housekeeping And Clean Up

1.3 RELATED WORK

A. Applicable provisions of Division 1 govern work under this section. Drawings and general provisions of the Contract, including supplementary conditions apply to this Section.

B. The electrical work included in all other divisions is the responsibility of the contractor performing the Division 26 work unless noted otherwise.

C. Division 21 – Fire Suppression

D. Division 22 – Plumbing

E. Division 23 – Heating, Ventilating and Air Conditioning

F. Division 27 – Communications

G. Division 28 – Electronic Safety and Security

1.4 SUBMITTALS

A. Submit shop drawings for equipment under each section per requirements listed in that section, as well as per Division 1.

B. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Do not submit hard copies of web pages. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

C. On request from the A/E, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

D. Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

E. The submittals must be approved before fabrication is authorized.

F. Provide electronic copies of all submittals for review.

G. Submittals Low-Emitting Materials: Submit manufacturer's product data for adhesives and sealants, including printed statement of VOC content.

1.5 REFERENCE STANDARDS

A. Abbreviations of standards organizations referenced in this and other sections are as follows:

1.	ANSI	American National Standards Institute
2.	ASTM	American Society for Testing and Materials
3.	EPA	Environmental Protection Agency
4.	ETL	Electrical Testing Laboratories, Inc.
5.	IEEE	Institute of Electrical and Electronics Engineers

6. IES Illuminating Engineering Society
7. ISA Instrument Society of America
8. NBS National Bureau of Standards
9. NEC National Electric Code
10. NEMA National Electrical Manufacturers Association
11. NESC National Electrical Safety Code
12. NFPA National Fire Protection Association
13. UL Underwriters Laboratories Inc.

1.6 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Division 1 for equals and substitutions.
   1. Where the following conflicts with Division 1, the requirements of Division 1 shall govern.
   2. If the Contractor wishes to submit an alternate to the named manufacturers for any equipment, he may submit a voluntary alternative minimum 7 days prior to bid, stating the manufacturer's name, model number, written, detailed product data.
   3. Where materials or equipment are specified by name the proposed material or equipment must be identical to the specified material or equipment in all characteristics of quality, function and serviceability, regardless of application in the Project and, in addition, when the Architect deems that aesthetic significance is important, the equal material or equipment must be identical in all characteristics of visual appearance, design, color and texture. Any proposed equal shall be submitted to Architect/Engineer for prior approval, which Architect/Engineer may approve or disapprove in its sole discretion. Work performed or constructed with unapproved equals is at Contractor's risk and any required correction of work incorporating unapproved equals shall be at Contractor's sole cost and expense.
   4. In all instances, Contractor shall assume full responsibility for proof of equality of the statute to the equipment hereinafter specified. All data and information necessary for proof of equality, function and space requirements shall be prepared and accompany the submittal of the substitution to the Architect/Engineer. Approval by the Architect/Engineer of equipment other than the specified does NOT relieve Contractor of this responsibility.

B. All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

C. Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system, including, but not limited to, coordination with other trades and any required changes by other trades and for obtaining the intended performance from the system into which these items are placed.

D. All materials, except medium voltage equipment and components, shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, if available, applicable, and approved by A/E, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system, except for medium voltage equipment and components, shall be so labeled.

1.7 GUARANTEE

A. Refer to Division 1 for Guarantees and Warranties. In addition to the requirements in Division 1, this Contractor shall meet the following requirements.

B. In entering into a contract covering this work, the contractor accepts the specifications and guarantees that the work will be carried out in accordance with the requirements of this specification or such modifications as may be made under the contract documents.

C. Contractor further guarantees that the workmanship and material will be of the best procurable and that none but experienced workmen familiar with each particular class of work will be employed.

D. Contractor further guarantees to replace and make good at his own expense, including travel time, all defects, which may develop within 1 year after final payment and acceptance by the Architect/Engineer, due to faulty workmanship or material, upon, receipt of written notification from the Owner.

1.8 WORK BY OWNER

A. PCB equipment (other than light fixture ballasts) removal and disposal, if required, will be by the Owner under separate contract.

B. Electrical testing not described in these contract documents will be by the Owner under separate contract.

1.9 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Refer to Division 1 for all operations and maintenance instructions.

B. In addition to the general content specified under Division 1 supply the following additional documentation:
   1. Manufacturer's wiring diagrams for electrically powered equipment.
   2. Copies of all approved submittals along with approval letters.

1.10 RECORD DOCUMENTS

A. Refer to Division 1 for record documents.

B. In addition to the general content specified under Division, follow the following procedures.
   1. During the progress of the work, Contractor shall maintain a current (daily) record set of the drawings and specifications, indicating thereon all work installed at variance with such Contract Documents including, without limitation, work covered by Addenda, Field Work Orders, Change Orders and Engineers additional instructions, interpretations and clarification. All changes or deviations from the original layout of the work and all critical dimensions of buried or concealed work shall be recorded. It shall be Contractor's responsibility to assure that said record sets are complete, accurate and up-to-date, Engineer shall have the right to inspect and review such record sets.
   2. At the completion of the work, Contractor shall indicated on record sets all record changes and such additional details necessary or appropriate to provide a complete reference document for use by Engineer. If variations and details cannot be shown clearly thereon, the Contractor shall prepare supplemental drawings adequate to impart the information. The foregoing drawings collectively shall constitute the "Record" drawings for the work.
   3. All indication on "Record" drawings shall be executed in a legible manner at Contractor's cost, using methods and legend presentations compatible with the overall scheme of the record drawings with respect to scale, drawing sheet sizes and sequential indexing. All changes shall be marked clearly in red and clouded.
   4. Engineer may review Contractor's "Record" drawings and notify Contractor of observed discrepancies or deviations. Contractor shall promptly correct discrepancies, deviations or illegible markups at Contractor's expense and resubmit revised drawings for Engineer review.
   5. Contractor shall provide final electronic record drawings to the Owner through the Engineer.
   6. Engineer will provide final electronic record drawings to the Owner based on Contractor's markups.

1.11 CONTINUITY OF EXISTING SERVICES

A. Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

B. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, capping of services or providing temporary service. Each interruption shall be for as short a duration as possible.

C. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

D. This Contractor shall restore any circuit interruption as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven day week schedule.

1.12 PROTECTION OF FINISHED SURFACES

A. Refer to Division 1 for protection of finished services.

B. Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" per Division 1.

1.13 SEALING AND FIRESTOPPING

A. Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

B. Contractor shall request current life safety drawings from the Architect/Owner.

1.14 OFFSITE STORAGE

A. If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the Owner. Prior approval by Owner's personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

1.15 REGULATORY REQUIREMENTS

A. All work and materials are to conform in every detail to applicable rules and requirements of the Wisconsin State Electrical Code Volumes 1 and 2, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, present manufacturing standards (including NEMA) and the Authority Having Jurisdiction (AHJ).

B. All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

1.16 CERTIFICATES AND INSPECTIONS

A. Refer to Division 1 for permits, regulations, utilities and taxes.

B. Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer in accordance with State Code. Deliver originals of these certificates to the Owner. Include copies of the certificates in the Operating and Maintenance Instructions.

C. Coordinate and provide inspections as required by the Authority Having Jurisdiction over the site.

D. This contractor is responsible for coordination of Owner's electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this contractor and the Owner's Electrical Inspector (See Article 15 of the General Conditions).

1.17 COORDINATION

A. Refer to Division 1 for coordination. In addition to the requirements specified under Division 1, the following requirements apply.

B. It shall be the responsibility of each Contractor to coordinate and consult with each other to determine space requirements and to determine that adequate space for servicing is provided for all equipment whether furnished by the Contractor or others. The General Contractor shall have final decision on all space priority conflicts among Contractors. All space priority conflicts shall be brought to the attention of the Architect/Engineer and Owner's Representative.

C. Each Contractor shall thoroughly familiarize himself with existing systems which will affect and be affected by relocation of existing equipment and installation of new lines and equipment. They shall plan installation of their work so that interruptions of services to any building or portion thereof will be a minimum, and such interruptions shall occur only when system is not required, if possible. If not possible, each Contractor shall insure the operation of services by whatever means possible, such as, installing bypasses, or providing temporary service or circuits. Each interruption shall be for as short a duration as possible.

D. Cooperation among all Contractors shall be required. Any Work that is installed without cooperating or coordinating with other Contractors and is in conflict shall be removed and reinstalled at that particular Contractor's cost. No cost additions to the Project will be considered due to a Contractor's lack of participation in the cooperation and coordination process. The following list of items of Work shall be the priority of order for all Contractors:
1. Structure
2. Recessed light fixtures
3. Gravity-flow systems for sanitary, storm, steam and steam condensate piping
4. Ductwork and appurtenances
5. Electrical primary and secondary feeder conduits and low voltage cable tray
6. Plumbing vent piping
7. Fire protection (sprinkler system)
8. HVAC piping
9. Medical gas piping
10. Gas piping, process piping and domestic water
11. Electrical branch circuit conduit and low voltage conduit
12. Control air lines or conduit

E. The above list, in descending order, is the precedence assigned the Work items for space priority. Gravity-flow systems have first priority.

F. Exception: Plumbing lines below or behind plumbing fixtures shall have precedence over all other work. Electrical conduit above or below switchgear, panelboards and control panels shall have precedence over all other work. Do not install any fluid conveying piping over electrical or elevator equipment.

G. In the case of interconnection of the work of two or more contractors, verify at the site or on shop drawings all dimensions relating to such work. All errors due to the failure to so verify any such dimensions shall be promptly rectified.

H. Any installed work that is not coordinated and interferes with another contractor's work shall be removed or relocated at the installing contractor's expense.

I. Prior to start of Construction, the General Contractor shall schedule a meeting with all of the Contractors responsible for the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

J. At the initial Coordination Meeting, the Mechanical Contractor / Ventilating Contractor shall provide to the General Contractor outline drawings at 1/4" scale indicating column centerlines, interior partition locations, and ceiling heights. The General Contractor shall verify all information shown on these drawings and relay any changes in the information to the Ventilation Contractor to be reflected on the Drawings. The Ventilating Contractor, with reference and consideration to the Structural, Heating, Electrical, Fire Protection, and Plumbing Drawings, shall draw to scale his proposed installation showing duct sizes, equipment layouts, and dimensions from column lines and from finished floors to bottom of ducts. Ductwork shall be maintained as tightly as possible to the underside of floor slabs and/or beams. For congested areas the Ventilating Contractor shall, in addition, prepare Drawings in section view. During this phase of the program, it shall be the Electrical Contractor's responsibility to furnish the Ventilating Contractor with recessed lighting installation and clearance requirements. This information shall be outlined on the Drawings by the Ventilating Contractor.

K. The ductwork layouts shall be produced in sequence as mandated by the Project Schedule. The earliest area indicated in the Schedule shall receive the first effort, etc.

L. When the Ductwork Drawings for the earliest scheduled area have been completed (time limitation as determined at the initial coordination meeting), the Ventilating Contractor shall provide the General Contractor with one set of drawings for each participant in the effort. The General Contractor will distribute the drawings to the participating Contractors for their use in drawing thereon the major components of their proposed installation using the general scheme shown on the Contract Drawings as a guide.

M. The major components to be indicated include (but are not limited to) the following:
1. Structure
2. Roof drain leaders
3. Above 3" waste piping
4. Sprinkler mains
5. Heating hot water mains
6. Chilled water mains
7. Conveying systems
8. Significant primary and secondary feeder conduit runs
9. Cable trays
10. Contract ceiling heights
11. Soffits
12. Access points
13. Fire wall penetrations

14. Steam and condensate mains
15. Gas, water, and process piping

N. Information delineated shall be distance from column centerlines, pipe/equipment size, and distance from finished floor to bottom of pipe/equipment and hangers. Included on the Drawings shall be piping layout with hanger locations and hanger point loads. This information shall be developed satisfactorily enough to allow the Structural Engineer to verify the adequacy of the structural system for the projected loads. The hanger locations may have to be moved depending on the structural system review. No hanger shall be fabricated and/or installed until the hanger locations are reviewed and accepted by the Architect/Engineer.

O. Within a period not to exceed two weeks after distribution of the drawings, the General Contractor will schedule a meeting with the Architect/Engineer and participating Contractors at which time areas of conflict shall be resolved. The drawings shall be overlaid to identify areas of conflict. All parties shall then cooperate in resolving the conflicts. Records of the agreements shall be entered on the Ventilating Contractor's drawings, acknowledged by all participants by signature in space provided for this purpose, and two copies distributed to all involved parties. All coordination drawing preparation and reproduction costs shall be borne by the Ventilating Contractor. The above drawings, review, and coordination process shall be repeated until all areas on the Project have been coordinated.

P. In the event a Contractor fails to cooperate in the Coordination Program, they shall be held responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative Contractor's installations.

1.18 DEMOLITION AND EXISTING REQUIREMENTS

A. Existing active services: water, gas, medical gas, steam, ventilation, compressed or control air, sanitary waste, sanitary vent, storm electric, and any other building systems when encountered shall be protected against damage. Where existing services are to be abandoned, the services shall be removed back to the point of origin and removed from the site unless otherwise directed by the Owner's Representative.

B. Submit a "Sequence of Work Schedule" in respect to all temporary and permanent utility and service cutovers after final determination. This schedule shall be submitted for approval to the Owner and Architect/Engineer. The submittal shall designate priority order, service or utility affected, date of cutover, and time of day to start and finish.

C. Bidders should inspect the site to become familiar with conditions of the site which will affect the Work. Bidders should verify points of connection with utilities, routing of outside piping to include required clearances from any existing structures, or other obstacles.

D. Extra payment will not be allowed for changes in the Work required because of the successful bidder's failure to make this inspection.

1.19 REQUEST AND CERTIFICATION FOR PAYMENT

A. Within 10 days after Notice to Proceed, the successful bidder will submit to the Owner's Project representative in a form prescribed by Division 1, a cost breakdown of the proposed values for work performed which, if approved by the Owner's project representative, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

B. In addition, if payment will be requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

1.20 TEMPORARY ELECTRICAL WORK

A. The Contractor shall make all arrangements with the local utility company for metered electrical service, pay for the installation of all temporary service to utility point of termination shown on drawings, and upon completion of project, pay for removal of temporary service. The Contractor shall patch surfaces and structure after services have been removed. The service shall be 120/208 volt, 3 phase, 4 wire, amps.

B. If a Contractor contemplates the use of equipment that requires a different voltage or greater capacity than that specified, then that Contractor must arrange with Utility for this additional service and pay for installation of the service and the necessary additional switches and wiring required.

C. The meter shall be taken out in the Contractor's name.

D. The Lead Contractor shall pay for all electrical energy consumed for construction purposes for all trades including temporary offices, for operation of ventilating equipment, for heating of building, and for testing and operating of all equipment. The Contractor shall continue to pay for energy used until substantial completion even though equipment has been connected to the permanent wiring.

E. Any Trade that has a temporary office shall provide and pay for installation of temporary service for lighting of such temporary office.

F. The Electrical Trade shall provide meter base and wiring to point of utility termination, provide main fused service switch, and fused or breaker distribution panel(s). The Electrical Trade shall also provide, at no cost to others, all lamps, wiring, switches, sockets and similar equipment required for temporary system until substantial completion. Upon completion of the project, the Electrical Trade shall remove the temporary system.

G. The temporary lighting system shall be sufficient to enable all trades to safely complete their work and to enable Owner's Project Representative to check all work as it is being done. Illumination shall be 5 foot-candles minimum in all areas and, in addition, shall meet or exceed the requirements of 29 CFR 1926.56 Illumination (OSHA regulations).

H. Provide at least one duplex outlet for small power tools for each 400 square feet of floor space, 120 volt single phase. Circuits shall be 20 ampere, single pole.

I. In accordance with the latest issue of the National Electrical Code, all temporary electrical circuits for construction purposes shall be equipped with combination ground fault interrupter and circuit breakers meeting the requirements of UL for Class A, Group 1 devices. The ground fault interrupter portion shall be solid state type, insulated and isolated from the breaker mechanism. A test button shall be provided for checking the device. The breaker mechanism shall provide overload and short circuit protection and shall be operated by a toggle switch with overcenter switching mechanism so that contact cannot be held closed.

J. All Trades shall furnish their extension cords and lamps other than those furnished for general lighting.

K. All Trades and other separate Contractors shall be allowed to use the service provided for general lighting and fractional horsepower hand tools at no cost.

L. The Contractor shall be compensated by those requiring three phase and single-phase energy used for equipment other than fractional horsepower hand tools. Arrangements shall be made with the Lead Contractor before construction equipment is used.

M. The Contractor shall post the cost rates at start of construction. Rates may be posted on an hourly use basis or energy may be submetered at the Contractor's option, but shall be based upon a fair and reasonable estimate of the cost of power used as billed by the Utility.

N. Those trades requiring lighting or other electrical service outside of building shall pay for the installation and removal of service, maintenance charges, and energy consumed.

O. Trades requiring voltage other than basic temporary system specified, three phase power, or a special single phase run, for operation of construction equipment or testing shall make their own arrangements with the Contractor for cost of energy used, and the Electrical Trade for the cost of installation, and removal when no longer required.

P. Heating and Ventilating Trade shall provide wiring, equipment and connections for portable or temporary heating units.

Q. The Electrical Trade shall expedite the work under this contract in such a manner that the permanent power wiring system and panels will be installed and connected to permanent heating and ventilating equipment in time to operate and test this equipment when the building has been closed sufficiently to permit the use of portions of heating and ventilating system for temporary heating during construction. Permanent wiring and connections may be used at permanent equipment; however, the use of the permanent system during construction shall in no way waive any part of the guarantee period.

R. After Substantial Completion of the permanent electrical system and building wiring, permanent receptacles may be used during finishing work. Permanent wiring for lighting fixtures, switches and receptacles shall be installed only after all masonry and plastering has been completed, but this wiring shall not be used for motors larger than fractional HP or for welding equipment. Circuits for larger motors and welding equipment may be provided with special circuits to mains of electrical panels at the expense of those trades requiring them, provided that special permission is obtained from Owner's Project Representative and the installation is made by skilled electricians.

1.21 APPROVED ELECTRICAL TESTING LABORATORIES

A. The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
1. Underwriters Laboratories Inc.
2. Electrical Testing Laboratories, Inc.

1.22 SLEEVES AND OPENINGS

A. Openings required in new or existing construction that may be necessary for the installation of new work shall be provided by the respective contractor and all patching and repairing shall be done by workmen competent in the trade required, at the expense of the respective contractor. The respective contractor shall be responsible for arranging the work so that minimum cutting will be required. All rubbish and excess materials involved in such cutting shall be promptly removed from the site and disposed of by the contractor. Cutting through the floor or roof systems or load bearing walls shall be done only with the prior written approval of the Architect/Engineer so as to avoid damaging the structural system.

1.23 OMISSIONS

A. No later than ten (10) days before bid opening, the Contractor shall call the attention of the A/E to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

1.24 DEFINITIONS

A. Wherever the words "the Contractor", "this Contractor" or "Electrical Contractor", appear in this section, they refer to the Contractor for Electrical Work.

B. The term "provide" includes such labor, methods, materials, equipment and transportation or other facilities required to complete the Contract and the performance of all duties thereby upon the Contractor.

1.25 PROJECT/SITE CONDITIONS

A. Install Work in locations shown on Drawings, unless prevented by Project conditions.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of A/E before proceeding.

C. Tools, materials and equipment shall be confined to areas designated by the Owner's project representative.

1.26 WORK SEQUENCE AND SCHEDULING

A. Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate schedule and operations with Owner's Construction Representatives.

1.27 WORK BY OTHER TRADES

A. Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

B. Electrical details on drawings for equipment to be provided by others are based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

1.28 SALVAGE MATERIALS

A. No materials removed from this project shall be reused (except as specifically noted below). All materials removed shall become the property of and shall be disposed of by the Contractor.

1.29 TRAINING

A. The contractor shall have the following responsibilities:

B. Provide a training plan sixty days before the planned training covering the following elements:
1. Equipment
2. Intended audience
3. Location of training
4. Objectives
5. Subjects covered (description, duration of discussion, special methods, etc.)
6. Duration of training on each subject
7. Instructor for each subject
8. Methods (classroom lecture, manufacturer's quality video, site walk-through, actual operational demonstrations, written handouts, etc.).

C. Provide designated owner personnel with comprehensive orientation and training in the understanding of the systems and the operation and maintenance of each piece of equipment that makes up the system.

D. Training shall normally start with classroom sessions followed by hands-on demonstration/training on each piece of equipment.

E. During any demonstration, should the system fail to perform in accordance with the requirements of the O&M manual or sequence of operations, the system shall be repaired or adjusted as necessary and the demonstration repeated at another scheduled time, if necessary.

F. The appropriate trade or manufacturer's representative shall provide the instructions on each major piece of equipment. Practical building operating expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment are required. More than one party may be required to execute the training.

G. The controls contractor shall attend sessions other than the controls training, as specified, to discuss the interaction of the controls system as it relates to the equipment being discussed.

H. The training sessions shall follow the outline in the table of contents of the operation and maintenance manual and illustrate whenever possible the use of the O&M manuals for reference.

I. Training shall include:
   1. Use of the printed installation, operation and maintenance instruction material included in the O&M manuals.
   2. A review of the written O&M instructions emphasizing safe and proper operating requirements, preventative maintenance, special tools needed and spare parts inventory suggestions. The training shall include startup, operation in all modes possible, shutdown, seasonal changeover and any emergency procedures.
   3. Discussion of relevant health and safety issues and concerns.
   4. Discussion of warranties and guarantees.
   5. Common troubleshooting problems and solutions.
   6. Explanatory information included in the O&M manuals.
   7. Discussion of any peculiarities of equipment installation or operation.
   8. Classroom sessions shall include the use of overhead projections, slides, video/audio-taped material as might be appropriate.
   9. Hands-on training shall include startup, operation in all modes possible, including manual, shut-down, alarms, power failure and any emergency procedures, and preventative maintenance for all pieces of equipment.

J. The contractor shall fully explain and demonstrate the operation, function and overrides of any local packaged controls not controlled by the central control system.

K. Video recording of the training sessions will be provided by the contractor and added to the O&M manuals. In addition, factory training videos identifying key troubleshooting, repair, service and/or replacement techniques shall be provided and reviewed with the owner.

L. Provide a minimum of 16 hours of instruction.

M. Provide additional training as specified in other specification sections for specific equipment.

PART 2 – PRODUCTS

2.1 ACCESS PANELS AND DOORS

A. Lay-in Ceilings:
1. Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under Division 9 are sufficient; no additional access provisions are required unless specifically indicated.

B. Concealed Spline Ceilings:
1. Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 9.

C. Metal Pan Ceilings:
1. Removable sections of ceiling tile held in position by pressure fit will be provided under Division 9.

D. Plaster Walls and Ceilings:
1. 16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

2.2 IDENTIFICATION

A. Refer to Electrical Section 260553 – Identification for Electrical Systems.

2.3 SLEEVES AND OPENINGS

A. General:
1. Pipe sleeves shall be constructed of standard weight ASTM A53 or ASME B36.10 steel with an anchor plate constructed of A36/A36M steel welded to the pipe. The sleeve shall be sized a minimum of 1" larger than piping insulation diameter. The entire assembly shall be hot-dip galvanized after fabrication.
2. Duct sleeves and piping sleeves passing through interior walls shall be constructed of 24 gauge galvanized steel minimum thickness.

B. Sleeves Through Below Grade Walls:
1. Provide steel pipe sleeve, ASTM A53, pressure sealing with membrane clamp ring, gasket, water stop ring, external rings, and nitrile rubber link seals. The assembly shall be hot-dip galvanized after fabrication.

a. Seals: Modular mechanical type seals, consisting of interlocking nitrile rubber links shaped to continuously fill the annular space between the pipe and the sleeve and electrically isolate the carrier pipe from the steel sleeve.
b. Sealing Element: Polychloroprene rubber material compounded to resist aging, ozone, sunlight, hydrocarbon gases, water, and chemical action.
c. Hardware: Type 300 series stainless steel fasteners. Threads rolled to produce smooth uniform threads and unbroken flow lines.
d. Compression Plates: Fiberglass-reinforced polyester plastic, injection molded for high physical properties, dielectric strength and non-cold flow creep characteristics, having high resistance to acidic and alkaline soils.

2. For sleeves located 15 feet or more below grade provide cast iron sleeve ASTM A74 with compression seals.

2.4 SEALING AND FIRESTOPPING

A. Fire And/Or Smoke Rated Penetrations:
1. Manufacturers:
a. 3M, STI/SpecSeal, Tremco, Hilti
b. All firestopping systems shall be by the same manufacturer.
2. Submittals:
a. Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgment can be based upon.
3. Product:
a. Firestop systems shall be UL listed or tested by an independent testing laboratory approved by the Owner and the Authority Having Jurisdiction (AHJ).
b. Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.
c. Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
d. All sealants shall meet the intent of VOC requirements, <250 g/L VOC contents (less H_20 and exempt solvents).

B. Non-Rated Penetrations:
1. Conduit Penetrations Through Below Grade Walls:
a. In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.
2. Conduit and Cable Tray Penetrations:
a. At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 – EXECUTION

3.1 DEMOLITION

A. Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

B. All devices, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. All designated equipment is to be turned over to the owner for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

C. All contractors requiring the personnel/ material hoist and or temporary construction elevator (i.e. new elevators, temporarily protected) at times other than outlined in the temporary facilities specifications will make arrangements directly with the general contractor. The general contractor is responsible for all coordination and scheduling of the use of any hoisting equipment so the flow of the project is smoothly maintained and all workers have access to the work areas to perform their work and deliver material to the areas needed according to the project schedule.

D. If any contractor's work requires the removal and replacement of any finished materials including but not limited to such materials as ceiling tiles, wall finishes, cabinets, doors, flooring, windows, etc. after those items are installed, each contractor will be responsible, at no additional cost to the owner, to replace any damaged, soiled or lost materials with new materials to match the existing materials and those materials damaged.

3.2 EXCAVATION AND BACKFILL

A. Perform all excavation and backfill work to accomplish indicated mechanical systems installation in accordance with Division 31. Blasting will not be allowed without written permission of the Architect/Engineer and the owner.

B. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

3.3 CONCRETE WORK

A. Coordinate the quantity and location of all cast-in-place concrete work with the architectural drawings. It is desired that the Electrical Contractor perform no concrete work.

B. The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

C. Required concrete and reinforcing steel shall be as specified in Section 03 30 00. Use only approved equipment shop drawings for dimensions.

D. Concrete equipment pads shall extend 3" beyond equipment in each direction. Chamfer top edges ½". Trowel all surfaces smooth.

E. Concrete equipment pads: Provide 3 ½" minimum thickness reinforced concrete bases under equipment installed on building floors. Rough up building floor to assure bonding of base to floor. Anchor base to floor with reinforcing bars set in floor at tie of pouring of floor or with power driven studs. Set required equipment anchor bolts in base at time of pouring.

3.4 CUTTING AND PATCHING

A. Refer to Division 1 for cutting and patching. In addition to the requirements in Division 1:

B. Each Contractor shall coordinate the placing of openings in the new structure as required for the installation of each Contractor's work.

C. Each Contractor shall furnish to the General Contractor the accurate locations and sizes for required openings in the new work, but this shall not relieve each Contractor of the responsibility of checking to assure that properly sized openings are provided. When additional patching is required due to the Contractor's failure to inspect this work, then the Contractor shall make arrangements for the patching required to properly close the openings to include patch painting, and the Contractor shall pay any additional cost incurred in this respect.

D. If cutting and patching of the new structure is made necessary due to the Contractor's failure to install piping, ducts, sleeves, or equipment on schedule, or due to the Contractor's failure to furnish on schedule the information required for the leaving of openings, then it shall be the Contractor's responsibility to make arrangements and obtain approval from the General Contractor and Architect/Engineer for this cutting and patching, and the Contractor shall pay any additional cost incurred in this respect. The Contractor shall also reimburse the Owner for any additional costs incurred to the Architect/Engineer for additional services caused by the Contractor in this respect.

E. The Contractor shall provide cutting and patching and patch painting in the existing structure as required for the installation of his Work and shall furnish lintels and supports as required for openings. Cutting of structural support members will not be permitted without prior approval of the Architect/Engineer. Extent of cutting shall be minimized; use core drills, power saws, or other machines which will provide neat, minimum openings. Patching shall match adjacent materials and surfaces and shall be performed by craftsmen skilled in the respective craft required.

3.5 LINTELS

A. All steel lintels required for opening in existing and/or new masonry walls shall be provided under Section 05 50 00 - Metal Fabrications. This contractor shall design, fabricate, and install all lintels required in masonry walls for conduit and cable tray penetrations. Contractor shall submit design drawings of lintels with professional engineers seal and signature prior to installation.

3.6 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

3.7 EQUIPMENT ACCESS

A. Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

B. The approximate location of all equipment and devices is shown on the drawings. The Architect/Engineer reserves the right to change the location of all equipment or devices 6 feet in any direction at no additional cost provided such changes are requested before final installation.

C. Install all equipment with ample space allowed for removal and repair. Provide ready accessibility to removable parts of equipment and to all wiring without moving equipment which is installed or which is already in place.

D. In mechanical and electrical equipment spaces, expose ceiling outlets and conduit with due consideration to ventilating ducts and mechanical piping. Where numerous ducts occur, install conduits and outlets after the ventilating ducts. Puncturing of ductwork or hanging equipment such as light fixtures, ceiling hangers and conduits from ductwork is prohibited unless specifically noted otherwise.

E. Electrical equipment shall be installed to maintain minimum clearances per Article 110 of NEC and ANSI C2 (National Electrical Safety Code).

F. No piping carrying fluids shall be installed directly over electrical equipment.

G. Equipment shall be installed in accordance with manufacturer's recommendation. Where conflicts occur between Contract Document and these recommendations, a ruling shall be requested of the Architect for decision before proceeding with such work.

3.8 COORDINATION

A. The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

B. The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls and other structural components as they are constructed.

C. Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

D. Coordinate arrangements, mounting and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
   3. To allow right of way for piping and conduit installed at required slope.
   4. So connecting raceways, cables, wireways, cable trays and busways will be clear of obstructions and of the working and access space of other equipment.

E. Coordinate with Division 27 and 28 contractors and equipment vendors for proper location, quantity and capacity of all required conduits, back boxes, device rings and power supplies required to support systems specified.

F. Cooperate with the testing consultant in ensuring Section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

3.9 SLEEVES AND OPENINGS

A. General:
   1. Sleeves are not required for piping and ducts passing through interior non-rated drywall, plaster, or wood partitions and interior poured concrete walls that have been saw cut or core drilled.
   2. Pack annular space between sleeves and pipe or ducts with fiberglass insulation and seal.
   3. Piping sleeves that pass through fire rated floors, walls, or ceilings shall be provided with a UL listed fire stop material meeting UL 1479 to seal the opening between the pipe and the pipe sleeve to maintain the fire rating.
   4. Provide escutcheon plates on piping to cover sleeve and insulation in finished areas.
   5. Refer to Division 1, General Requirements for additional information on sleeves and openings.

B. Sleeves Through Floors/Ceilings:
   1. Sleeves shall be installed to extend 1 inch above finished floor with a watertight sealant between floor and sleeve in all mechanical rooms and wet rooms listed below.
   2. If a sleeve is not provided, provide 1-1/2 inch angle ring with urethane caulk between the angle and the floor and seal at the corners to form a watertight seal.
   3. Wet Locations:
      a. Mechanical Rooms
      b. Parking Ramps
      c. Sanitary pumping stations
      d. Swimming pool equipment rooms
      e. Chemical storage and hazardous waste storage rooms
      f. Food service/kitchen areas (behind/under equipment, cabinets, tables, etc.)

3.10 SEALING AND FIRESTOPPING

A. The Contractor shall refer to building life safety drawings for all smoke and fire rates in addition to the mechanical drawings. Any discrepancies shall be brought to the attention of the Architect/Engineer before final addendum.

B. Fire and/or Smoke Penetrations:
   1. Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.
   2. Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

C. Non-Rated Surfaces:
   1. When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.
   2. Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.
   3. In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.
   4. At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

3.11 HOUSEKEEPING AND CLEAN UP

A. The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

END OF SECTION 260500

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SECTION 260502 – ELECTRICAL DEMOLITION FOR REMODELING

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes selective and/or total demolition of all existing electrical equipment, devices, conduit, wiring, back boxes and supporting associated devices for the electrical system.

1.2 SECTION INCLUDES

A. Materials and Equipment

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 28 – Electronic Safety & Security

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work as specified in the individual Sections.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements as shown on Drawings.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Verify whether or not PCB ballasts exist in light fixtures which will be disposed of. If PCB light fixture ballasts exist, then follow requirements in PCB BALLAST HANDLING AND DISPOSAL below.

D. Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the Owner, Architect/Engineer and Owner's Field Representative before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors and ceilings scheduled for removal.

B. Coordinate utility service outages with the Owner, Owner's Field Representative, Architect, Engineer and with the local Utility Company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. In particular, all security and safety systems must be maintained in operation at all times as required by the Owner. This includes security and safety lighting.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner and Owner's Field Representative at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

E. Existing Communication/Data System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner, Owner's Field Representative and local Telephone Utility. If required, make temporary connections to maintain service in areas adjacent to work area.

F. Existing fire protection System: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the Owner and Owner's Representative at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work to meet all requirements of these specifications.

B. If certain raceways and boxes are abandoned but not scheduled for removal, those items must be shown on the "As Built Drawings".

C. Remove, relocate, and extend existing installations to accommodate new construction.

D. Remove abandoned wiring to source of supply.

E. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

F. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

G. Disconnect and remove abandoned panelboards and distribution equipment.

H. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

I. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

J. Repair adjacent existing construction and finishes damaged during demolition and extension work to match adjacent existing surfaces.

K. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

L. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. This includes the extension of the circuit from the last active device to the next device in the system to be activated.

3.4 PCB BALLAST HANDLING AND DISPOSAL

A. Generally, all high power factor fluorescent light ballasts manufactured before 1978 and some HID ballasts contain PCB compounds in their capacitors. The Contractor shall inspect all ballasts in all light fixtures and take the actions described below.

B. All ballasts labeled as "NON-PCBs" or "NO PCBs" shall become the responsibility of the Contractor. If the PCB content is not stated on the ballast label, the ballast shall be handled as a PCB ballast.

C. All PCB ballasts shall be removed from the light fixtures and shall have the wires clipped off. However, before removal, all PCB ballasts shall be carefully inspected for leaks. If a ballast appears to be leaking(evidenced by potting compound leaking out or by an oily film on the ballast surface) the ballast must be handled per EPA and DNR PCB regulations. Basically, this means the ballast is to be carefully removed from the fixture and placed in an approved drum. See paragraph below for the drum specifications. The person removing the ballast from the fixture shall wear protective gloves, eye protection, and protective clothing as necessary.

D. If the fixture has also been contaminated, it must be cleaned to less than 10 micrograms/100 square centimeters contamination before disposal. This cleaning must be done by an approved PCB contractor and is not considered a part of this contract. Contact Owner for contractor approval before commencing with the cleanup.

E. The ballasts shall then be placed in US DOT approved type 17C or type 17H drums (barrels) furnished by Veolia Environmental Services. The quantity and size of the drums will be determined by the contractor at the time of construction, - 30 and 55 gallon drums are typically available.

F. These barrels shall be placed in storage with the cover that came with the barrels, in a location within a building, as designated by the Building Manager or Owner's project representative. The barrels are not to be placed outside where they are exposed to weather.

G. THESE BALLASTS ARE NOT TO BE REMOVED FROM THE WORK SITE BY THE CONTRACTOR. To do so, would be a violation of DNR and DOT hazardous waste regulations and may result in a fine to the Contractor.

H. The Contractor shall label and mark the PCB storage drums with EPA approved PCB labels and the storage area with signs, marks and lines to meet the regulations of Wisconsin Code NR 157.

I. The Contractor shall also provide approved PCB absorbent materials to be stored immediately adjacent to the drum storage area. Do not place loose absorbent material in the drums.

J. The Contractor shall provide to the Owner's Project representative, in written form, a total count of these ballasts (or their total weight by barrel) and where they are stored.

K. See Lamp and Ballast Handling and Disposal instructions below.

3.5 LAMP AND BALLAST HANDLING AND DISPOSAL

A. All lamps (fluorescent, incandescent, and HID) contain mercury and/or lead (in the base) as well as other heavy metals and compounds which are regulated by the EPA and DNR during the disposal process. As a result, regulations have been issued covering the handling and disposal of all lamps. Therefore, lamps which have been removed from service for disposal shall be handled as follows by the Contractor.

B. The Contractor shall very carefully remove all lamps (fluorescent, incandescent, and HID) from light fixtures before removal of the fixture from its mounted position. This is to reduce the likelihood that the lamp(s) will be broken. If the Contractor breaks more than 1% of the total lamps removed for the project, the Contractor will be charged the cost difference between disposal of broken lamps and disposal of unbroken lamps for all lamps broken in excess of 1% of the total lamps removed in the project.

C. The contractor shall contact Veolia Environmental Services (1-800-358-9095 or 262-243-8917) to coordinate the storage and pickup of disposed lamps and ballasts. The contractor shall obtain containers from Veolia Environmental Services, for the storage of lamps and ballasts. Removed lamps and ballasts shall be placed in containers by the contractor, marked with the number and type of lamp and ballast, and placed in storage at a location on the Owner's property. The contractor shall label the area as "Hazardous Material Storage - Mercury". The contractor shall make arrangements for pickup of the lamps and ballasts with Veolia Environmental Services, shall provide a count of all stored lamps and ballasts, and shall fill out any required forms.

D. When making disposal arrangements with Veolia Environmental Services, the contractor shall notify them of the Owner's project name and number, and the Owner's project manager, for invoicing purposes. Invoicing from Veolia Environmental Services shall be sent to the Owner's project manager for direct charge payment from that project (lamp and ballast disposal costs to be paid by Owner).

E. The contractor shall coordinate the lamp and ballast disposal with the Owner's field representative.

3.6 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts (if required) and broken electrical parts.

3.7 INSTALLATION

A. Install relocated materials and equipment under the provisions of other sections.

END OF SECTION 260502

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SECTION 260504 - CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this contractor for this project. Additional testing may be required and specified in other Division 26 section and shall also be provided.

1.2 SECTION INCLUDES

A. General Inspection and Cleaning of All Electrical Equipment

B. Grounding Systems

C. Lightning/Surge Arresters

D. Metering and Instrumentation

E. Ground Fault Systems

F. Cables

G. Manholes

H. Panelboards

I. Light Fixtures

J. Occupancy Sensors

K. Battery Pack Emergency Lighting

1.3 RELATED WORK

A. A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Division 28 – Electronic Safety & Security

PART 2 – PRODUCTS

2.1 NOT USED.

PART 3 – EXECUTION

3.1 GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT

A. Inspect for physical damage and abnormal mechanical and electrical conditions.

B. Any item found to be out of tolerance, or in any other way defective as a result of the required testing, shall be reported to the A/E. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.

C. Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

D. Verify proper auxiliary device operation and indicators.

E. Check tightness of accessible bolted electrical joints. Use torque wrench method.

F. Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

G. Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

H. Clean All Equipment:
   1. Vacuum inside of panelboards, fire alarm panels, etc.
   2. Loosen attached particles and vacuum them away.
   3. Wipe all insulators with a clean, dry, lint free rag.
   4. Clean insulator grooves.
   5. Re-vacuum inside surfaces as directed by the Owner's Construction Representative or Inspector

I. Inspect equipment anchorage.

J. Inspect equipment and bus alignment.

K. Check all heater elements for operation and control.

L. Lubricate nonelectrical equipment per manufacturer's recommendations.

3.2 GROUNDING SYSTEMS

A. Inspect the ground system for adequate termination at all devices.

3.3 CABLES

A. Visual and Mechanical Inspections:
   1. Inspect exposed sections for physical damage.
   2. Verify cable is supplied and connected in accordance with single line diagram.
   3. Inspect for shield grounding, cable support and termination.
   4. If cables are terminated through window type C.T.'s make an inspection to verify that neutrals and grounds are properly terminated for normal operation of protective devices.
   5. Inspect for visual jacket and insulation condition.
   6. Visible cable bends shall be checked against ICEA or manufacturer's minimum allowable bending radii -- 12 times the diameter for tape shielded cables.
   7. Inspect for proper fireproofing in common cable areas.
   8. There shall be NO tests performed on existing cable without specific direction from the Consulting Engineer.

B. Electrical Tests – Below 600 Volts:
   1. Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections
   2. Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor and bus terminations to manufacturer's recommendations.
   3. Check for proper grounding resistance at all services. Resistance shall be 2 ohms maximum.

3.4 PANELBOARDS

A. Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

3.5 LIGHT FIXTURES

A. Check the bonding and proper lamping. Verify that recessed fixtures are installed with hold down clips. Confirm operation of the fixture with the proper switch or sensor.

3.6 OCCUPANCY SENSORS

A. Confirm operation of the sensor per the manufacturers spec.

3.7 BATTERY PACK EMERGENCY LIGHTING

A. Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

END OF SECTION 260504

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing.

1.2 SECTION INCLUDES

A. General

B. Manufacturers

C. Building Wire

D. Variable Frequency Drive (VFD) Wire

E. Metal Clad Cable

F. Wiring Connectors

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260533 – Raceway and Boxes for Electrical Systems.

C. Section 260553 – Identification for Electrical Systems.

1.4 SUBMITTALS

A. Submit product data: Provide for each cable assembly type.

B. Submit factory test reports: Indicate procedures and values obtained.

C. Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

D. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 – PRODUCTS

2.1 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper. Aluminum conductors size #1/0 and larger may be substituted for copper. The following requirements shall be met when aluminum conductors are used:
   1. Aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).
   2. It is the responsibility of the contractor to increase the size of the conduit, wire gutter, or enclosure, if necessary, to accommodate the aluminum conductors and meet allowable code requirements.
   3. It is the responsibility of the contractor to increase the size of the aluminum conductor to match the ampacity of the copper conductor circuit shown on the Drawings.
   4. The contractor shall submit a feeder schedule to the Engineer for all conductor substitutions indicating the aluminum conductor wire size and the conduit size. The contractor shall not begin the installation until written approval is granted by the Engineer.
   5. All aluminum conductors shall terminate on a mechanical screw-type connector or mechanical compression-type connector. Connector shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors, and sized to accept aluminum conductors of the required ampacity. When using compression-type connectors, the lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable stripping tool, remove insulation from the required length of the conductor. Wire brush the conductor and apply a Listed joint compound. Tighten or crimp the connection per the connector manufacturer's recommendation. Wipe off any excess joint compound.

6. When terminating aluminum conductors to aluminum bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be anodized alloy and conform to current ANSI and ASTM chemical and mechanical property limits. Nuts shall be aluminum alloy and conform to current ANSI standards. Washers shall be flat aluminum alloy, Type A plain, standard wide series conforming to current ANSI standards. Lubricate and tighten the hardware per manufacturer's recommendations.
7. When terminating aluminum conductors to copper bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series conforming to current ANSI standards. Belleville conical spring washers shall be of hardened steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer's recommendations.
8. The contractor shall perform an infrared survey of all aluminum conductor connections after the installation is complete and in normal service. Infrared surveys shall be performed during periods of maximum possible loading with at least 30% of rated load of the equipment being inspected. All connections with elevated temperatures shall be corrected by the contractor. The infrared survey results shall be provided in report form, in the completed O&M manuals.
9. No copper-to-aluminum transitions permitted when splicing onto existing copper feeders.

C. Insulation shall have a 600 volt rating.

D. All conductors shall be stranded.

E. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1. Alcan Products Corporation; Alcan Cable Division
2. American Insulated Wire Corp.; a Leviton Company
3. General Cable Corporation
4. Senator Wire & Cable Company
5. Southwire Company
6. Houston Wire & Cable
7. AFC Cable Systems, Inc.
8. Hubbell Power Systems, Inc.
9. O-Z/Gedney; EGS Electrical Group, LLC
10. 3M; Electrical Products Division
11. Tyco Electronics Corp.
12. Insert Manufacturer's Name

2.3 BUILDING WIRE

A. Description: Single conductor insulated wire.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.
   1. Type XHHW-2 insulation for feeders with aluminum conductors.
      a. Insulation shall not contain halogenated flame retardants, including but not limited to polybrominated diphenyl ethers.
      b. Insulating jacket shall be 100% lead free.

2.4 METAL CLAD CABLE

A. Type MC cable may be used in IBC Business Group B occupancies or healthcare facilities non-emergency circuits for 15 and 20 ampere branch circuit wiring systems beyond the first outlet box.

B. Provide metal clad cable (Type MC) that complies with UL Standard 1569 – Metal Clad Cables, the NEC and this section. Metal clad cable (Type MC) for healthcare facilities shall be listed for 2 grounding means and complies with NEC 517.13.

C. Type MC cable shall consist of THHN insulated solid copper circuit conductors, an insulated solid copper equipment grounding conductor, a Mylar wrapping around the conductor bundle and a close fitting aluminum or galvanized steel outer sheath.

D. Provide minimum 12 AWG conductors in Type MC cable.
   1. Provide larger conductor sizes as required to limit branch circuit voltage drop to 3 percent at the full connected load.
   2. Use larger conductor sizes to adjust allowable ampacity if there are more than 3 current carrying conductors in a cable.
   3. For isolated ground power circuits provide Type MC cable with a separate neutral conductor for each phase conductor; uniquely identify each neutral with a colored stripe on the white insulation corresponding to the phase conductor insulation color.

E. Provide Type MC cable with the same conductor color coding as specified for BUILDING WIRE.

F. Provide NRTL listed, insulated throat, snap-in steel box connectors for Type MC cable.

2.5 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

C. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

D. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.

E. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.

PART 3 – EXECUTION

3.1 GENERAL WIRING METHODS

A. All wire and cable shall be installed in conduit.

B. Do not use wire smaller than 12 AWG for power and lighting circuits.

C. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

D. Make conductor lengths for parallel conductors equal.

E. Splice only in junction or outlet boxes.

F. No conductor less than 10 AWG shall be installed in exterior underground conduit.

G. Identify ALL low voltage, 600v and lower, wire per section 26 05 53.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

3.3 METAL CLAD CABLE INSTALLATION

A. Install Type MC cable according to NECA 120, Standard for Installing and Maintaining Armored Cable (Type AC) and Metal Clad Cable (Type MC) (ANSI), the NEC and requirements in this Section.

B. Route Type MC cable to meet project conditions.

C. Use Type MC cable for 15- and 20-ampere branch circuit wiring beyond the first outlet or junction box; however, use conduit for the "homerun" from the first outlet or junction box to the branch circuit panelboard.

D. Use Type MC cable in interior, dry locations that area classified by the International Building Code as "Business Group B" occupancy where they will be concealed above ceilings, in dry-wall partitions, in equipment enclosures or below raised floors. Type MC cable may be installed exposed in dedicated electrical rooms and mechanical rooms if they will not be exposed to physical damage or deteriorating agents.

E. Install and support Type MC cable as required in Article 330 of the NEC. Use NRTL listed spring steel Type MC cable supports to support Type MC cable; do not use wire or plastic zip-ties to support Type MC cable.

3.4 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.

C. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

D. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

E. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 04.

B. Additional testing as follows shall be performed if aluminum conductors are used:

C. Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.

D. Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.

E. Test procedures shall meet NETA guidelines.

F. Test results and report shall be provided to the engineer.

G. Contractor shall correct all deficiencies reported in the test report.

3.6 WIRE COLOR

A. General:
1. For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.
2. For wire sizes 8 AWG and larger – Use colored wire, or identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.
3. In existing facilities, use existing color scheme.
4. In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.
5. All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.
6. Isolation panel branch circuits: The isolated circuit conductors shall be identified as follows:
   a. Isolated Conductor No. 1: Orange with at least one distinctive colored stripe other than white, green or gray along the entire length of the conductor.
   b. Isolated Conductor No. 2: Brown with at least on distinctive colored stripe other than white, green or gray along the entire length of the conductor.
   c. For 3-phase systems, the third conductor shall be identified as yellow with at least one distinctive colored stripe other than white, green or gray along the entire length of the conductor. Where isolated circuit conductors supply 125-volt, single-phase, 15- and 20-ampere receptacles, the striped orange conductor(s) shall be connected to the terminal(s) on the receptacles that are identified in accordance with NEC 200.10(B) for connection to the grounded circuit conductor.

B. Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with a different stripe.

C. Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

D. Feeder Circuit Conductors: Each phase shall be uniquely color coded.

E. Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green colored wire, or with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

3.7 BRANCH CIRCUITS

A. The use of single-phase, multi-wire branch circuits with a common neutral are not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

END OF SECTION 260519

SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes furnishing and installing required remote control and signal cabling.

1.2 SECTION INCLUDES

A. General

B. Manufacturers

C. Remote Control and Signal Cable

D. Wiring Connectors

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Section 260533 – Raceway and Boxes for Electrical Systems

C. Section 260553 – Identification for Electrical Systems

1.4 SUBMITTALS

A. Submit product data: Provide for each cable assembly type.

B. Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

1.5 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code

1.6 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Conductor sizes are based on copper.

C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

PART 2 – PRODUCTS

2.1 GENERAL

A. All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

B. All conductors shall be copper.

C. Insulation shall have a 600 volt rating.

D. All conductors must be suitable for the application intended. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:

E. All conductors terminated with crimp type devices must be stranded.

F. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1. Alcan Products Corporation; Alcan Cable Division
2. American Insulated Wire Corp.; a Leviton Company
3. General Cable Corporation
4. Senator Wire & Cable Company
5. Southwire Company
6. Houston Wire & Cable
7. Insert Manufacturer's Name

2.3 REMOTE CONTROL AND SIGNAL CABLE

A. Refer to Section 283100 for requirements for cable to be used on fire alarm systems.

B. Refer to Section 270000 for requirements for cable to be used on communication systems.

C. All other systems cabling shall meet the requirements of NEC Article 725 and the following:

D. Control Cable for Class 1 Remote Control and Signal Circuits: 600 volt insulation, individual conductors twisted together and covered with an overall PVC jacket. Cable shall be Listed, temperature rated, and plenum or non-plenum rated for the application as required in the National Electrical Code.

E. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits shall be constructed, Listed, temperature rated, and plenum or non-plenum rated for the application as required in the NEC Article 725.

2.4 WIRING CONNECTORS

A. Split Bolt Connectors: Not acceptable.

B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

PART 3 – EXECUTION

3.1 GENERAL WIRING METHODS

A. Low voltage control and signal cables shall be installed in conduit. However, they may be installed without conduit above accessible ceilings if the cable meets NEC requirements for the application, unless specified to be in conduit in other sections of the specifications. See requirements for free-air cabling installation below.

B. Do not use wire smaller than 14 AWG for control wiring greater than 60 volts, or 18 AWG for voltages less than 60 volts, all sizes subject to NEC 725 requirements.

C. Splice only in junction boxes.

D. Identify wire per section 260553.

E. Neatly train and lace wiring inside boxes, and equipment.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling conditions when necessary.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.3 FREE-AIR CABLE INSTALLATION

A. When permitted in exposed ceiling areas, 'Free-Air' wiring runs shall avoid areas of high traffic (i.e. aisle way), shall be run as close as possible to outlining walls and shall be a minimum of ten (10) feet above finished floor.

B. Cabling shall be neatly run at right angles and be kept clear of other trades work.

C. Cabling shall be supported at a maximum of 4-foot intervals utilizing 'bridal-type' mounting rings anchored to ceiling concrete, piping supports or structural steel beams. If cable sag at mid-span exceeds 12-inches, another support shall be provided. Mounting rings shall be designed to maintain cables bend to larger than the minimum bed radius (typically 4 x cable diameter).

D. Cabling shall not be attached to or supported by existing cabling, plumbing or steam piping, ductwork, suspended ceiling supports or electrical conduit. Additionally, cabling shall not be laid directly on the ceiling grid.

E. To reduce or eliminate Electro-Magnetic Interference (EMI), the following minimum separation distances for 'Free-Air' cabling installations shall be adhered to:
   1. Twelve (12) inches from power lines of less than 5kV.
   2. Thirty-nine (39) inches from power lines of 5kV or greater.
   3. Eighteen (18) inches from lighting fixtures.
   4. Thirty-nine (39) inches from transformers and motors.

F. A coil of 2 feet in each cable shall be placed in the ceiling at each 'free-air' wired device. These coils shall be secured (wire tied) at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

G. All cable shall be free of tension at both ends. Nylon strain relief connectors shall be provided at each device and junction box where cables enter. In cases where the cable must bear some stress, Kellum type grips may be used to spread the strain over a longer length of cable.

H. Cable manufacturers minimum bend radius shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.

I. All exposed vertical cable extensions to devices located below the finished ceiling shall be in conduit.

J. Provide protection for exposed cables where subject to damage.

K. Use suitable cable fittings and connectors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

D. Thoroughly clean wires before installing lugs and connectors.

E. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 260504.

END OF SECTION 260523

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SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes grounding electrodes, connectors, equipment grounding conductors, bus and bonding.

1.2 SECTION INCLUDES

A. Rod Electrode

B. Mechanical Connectors

C. Compression Connectors

D. Exothermic Connections

E. Wire

F. Bus

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUBMITTALS

A. Product Data: Provide data for grounding electrodes and connections.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

C. Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

1.5 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code.

B. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

1.6 PERFORMANCE REQUIREMENTS

A. Grounding System Resistance: 2ohms maximum at building service entrance.

B. Testing of grounding system resistance is to be witnessed by the electrical inspector or Field Representative. Provide test report of grounding system resistance in final O&M manuals.

1.7 PROJECT RECORD DOCUMENTS

A. Accurately record actual locations of grounding electrodes.

1.8 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 – PRODUCTS

2.1 ROD ELECTRODE

A. Material: Copper-clad steel.

B. Diameter: ¾ inch (19 mm) minimum.

C. Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

2.2 MECHANICAL CONNECTORS

A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.

B. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.3 COMPRESSION CONNECTORS

A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.4 EXOTHERMIC CONNECTIONS

A. As manufactured by Cadweld or similar.

2.5 WIRE

A. Material: Stranded copper (aluminum not permitted).

B. Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

C. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

2.6 BUS

A. Material: Copper (aluminum not permitted).

B. Size: 1/4" X 2" minimum and 12" minimum length.

C. Provide insulated wall standoff – 2" minimum.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that final backfill and compaction has been completed before driving rod electrodes.

3.2 GENERAL

A. Install Products in accordance with manufacturer's instructions.

B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

D. Attach grounds permanently before permanent building service is energized.

E. All grounding electrode conductors shall be installed in PVC conduit, in exposed locations.

F. Conductor Termination and Connections:
   1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
   2. Underground Connections: Welded connectors, except otherwise indicated.

3.3 LESS THAN 600 VOLT SYSTEM GROUNDING

A. Provide code sized copper grounding electrode conductor from primary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.

B. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.

C. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.

D. Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.

E. Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

3.4 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION 260526

SECTION 260529 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc., and fastening hardware for supporting electrical work.

1.2 SECTION INCLUDES

A. Support, Anchorage And Attachment Components

B. Manufacturers

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.4 SUBMITTALS

A. Product Data: Provide data for support channel and equipment supports.

1.5 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code – Steel".

1.6 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports and roof penetrations as specified in Division 07 Section "Roof Accessories".

PART 2 – PRODUCTS

2.1 SUPPORT, ANCHORAGE AND ATTACHMENT COMPONENTS

A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

B. Hardware: Corrosion resistant.

C. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and ¼" for single conduits 1" and smaller.

D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

F. Mechanical-Expansion Anchors: Insert-wedge-type, (zinc-coated) (stainless) steel, for use in hardened Portland cement concrete with tension, shear and pullout capacities appropriate for supported loads and building materials in which used.

2.2 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1. Allied Tube & Conduit
2. Cooper B-Line, Inc.; a Division of Cooper Industries
3. ERICO International Corporation
4. GS Metals Corp.
5. Thomas & Betts Corporation
6. Unistrut; Tyco International, Ltd.
7. Wesanco, Inc.
8. Fabco Plastics Wholesale Limited
9. Seasafe, Inc.
10. Empire Tool & Manufacturing Co.

11. Hilti, Inc.
12. ITW Ramset/Red Head; a Division of Illinois Tool Works, Inc.
13. MKT Fastening, LLC
14. Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit
15. Insert Manufacturer's Name

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.

C. Power-actuated fasteners and plastic wall anchors are not permitted.

D. File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

E. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.

F. Do not drill structural steel members unless approved by Engineer.

G. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch (89 mm) concrete pads.

I. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or ¾" painted, fire-retardant plywood is acceptable).

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

3.2 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit and place miscellaneous metal supports accurately in location, alignment and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.3 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit and so anchors will be a minimum of 10 bolt diameters from edge of the base.

B. Use [300 psi (20.7 MPa)] <insert value>, 28 day compressive strength concrete. Concrete materials, reinforcement and placement requirements are specified in Division 03 Section "(Cast-in-Place Concrete) (Cast-in-Place Concrete - Limited Applications)".

C. Anchor equipment to concrete base.
   1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instruction and directions furnished with items to be embedded.
   2. Install anchor bolts to elevations required for proper attachment to supported equipment.
   3. Install anchor bolts according to anchor bolt manufacturer's written instructions.

3.4 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces.
   1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup: Comply with requirements in Division 09 (painting sections) (Section "High Performance Coating") for cleaning and touchup painting of field welds, bolted connections and abraded areas of shop paint on miscellaneous metal.

C. Galvanized Surfaces: Clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes.

1.2 SECTION INCLUDES

A. Rigid Metal Conduit and Fittings

B. Intermediate Metal Conduit (IMC) and Fittings

C. Electrical Metallic Tubing (EMT) and Fittings

D. Flexible Metal Conduit and Fittings

E. Liquidtight Flexible Metal Conduit and Fittings

F. Electrical Nonmetallic Tubing (ENT) and Fittings

G. Rigid Nonmetallic Conduit and Fittings

H. Conduit Supports

I. Auxiliary Gutters (Wireways)

J. Outlet Boxes

K. Floor Boxes

L. Pull and Junction Boxes

M. Hinged Cover Enclosures

N. Cabinets

O. Handholes and Boxes for Exterior Underground Wiring

P. General

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

B. Section 260529 - Hangers and Supports for Electrical Systems

C. Section 262702 - Equipment Wiring Systems

D. Section 262726 - Wiring Devices

E. Section 283100 - Fire Detection and Alarm

F. Division 28 - Electronic Safety and Security

1.4 SUBMITTALS

A. Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

B. Product data for wireways and fittings, floor boxes, hinged-cover enclosures or cabinets.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.

PART 2 – PRODUCTS

2.1 RIGID METAL CONDUIT AND FITTINGS

A. Conduit: Heavy wall, galvanized steel, schedule 40, threaded. ANSI C80.1

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.2 INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

A. Conduit: Galvanized steel, threaded. ANSI C80.6

B. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Conduit: Steel, galvanized tubing. ANSI C80.3

B. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.

C. Conduit Bodies: All steel threaded conduit bodies.

2.4 FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: steel, galvanized, spiral strip.

B. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

A. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

B. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

2.6 ELECTRICAL NONMETALLIC TUBING (ENT) AND FITTINGS

A. Conduit: ENT (smurf tube), UL listed and NEC recognized. NEMA TC13

B. Fittings: One piece quick connect fittings for 1/2 inch to 1 inch size and schedule 40 cemented fittings for larger size. When installed in concrete, fittings shall be suitable for damp locations and shall be concrete-tight, stub-ups and stub-downs kits shall meet manufacturer's recommendations.

2.7 RIGID NONMETALLIC CONDUIT AND FITTINGS

A. Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 900 C conductors. NEMA TC2

B. Fittings and Conduit Bodies: NEMA TC 2, Listed.

2.8 CONDUIT SUPPORTS

A. See Section 260529.

2.9 AUXILIARY GUTTERS (WIREWAYS)

A. Description: General purpose type wireway without knockouts.

B. Size: As indicated on Drawings and length as indicated on Drawings.

C. Cover: Screw applied cover.

D. Connector: screw applied cover.

E. Fittings: Lay-in type with removable top, bottom, and side; captive screws.

F. Finish: Rust inhibiting primer coat with gray enamel finish.

2.10 OUTLET BOXES

A. Sheet Metal Outlet Boxes and Device Boxes: galvanized steel, with stamped knockouts: NEMAN 0S1.

B. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

C. Concrete Ceiling Boxes: Concrete type.

D. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs: NEMA FB1.

E. Nonmetallic Outlet and Device Boxes: NEMA 0S2.

F. Small Sheet Metal Pull and Junction Boxes: NEMA 0S1.

2.11 FLOOR BOXES

A. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Full adjustable

B. Nonmetallic Floor Box: Nonadjustable round.

C. See floor box schedule on drawings for exact components required.

2.12 PULL AND JUNCTION BOXES

A. Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).

B. For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

C. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

D. Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.

E. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain tight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

F. Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.

G. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.

H. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

I. Wireways shall not be used in lieu of junction boxes.

2.13 HINGED COVER ENCLOSURES

A. NEMA 250, Type 1, with continuous hinge cover with flush latch, unless otherwise indicated.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic, finished inside with radio frequency resistant paint.

2.14 CABINETS

A. NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

B. Hinged door in front cover with flush latch and concealed hinges.

C. Key latch to match panelboards.

D. Metal barriers to separate wiring of different systems and voltage.

E. Accessory feet where required for freestanding equipment.

2.15 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. Description: Comply with SCTE 77.
   1. Color of Frame and Cover: Gray, Green.
   2. Configuration: Units shall be designed for flush burial and have open, closed, integral closed bottom, unless otherwise indicated.
   3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
   4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   5. Cover Legend: Molded letting, ELECTRIC, TELEPHONE as indicated for each service. Insert legend.
   6. Conduit Entrance Provisions: Conduit terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
   7. Handhole 12 inches wide by 24 inches long (300 mm wide by 600 mm long), Insert dimension and larger shall have inserts for cable racks and pulling in irons installed before concrete is poured.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with polymer resin and reinforced with steel or fiberglass or a combination of the two.

C. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet molded, fiberglass reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

D. Fiberglass Handholes and Boxes: Molded of fiberglass reinforced polyester resin, with covers of polymer concrete, reinforced concrete, cast iron, hot dip galvanized steel diamond plate, fiberglass.

2.16 GENERAL

A. All steel fittings and conduit bodies shall be galvanized.

B. No cast metal, or split-gland type fittings permitted.

C. Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

D. All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.

E. Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.

F. All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 – EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT AND SUPPORT

A. EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and telecommunication systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

B. Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (13 mm) minimum except all homerun conduits shall be ¾", or as specified elsewhere. Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.

C. Size conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

D. Arrange conduit to maintain headroom and present a neat appearance.

E. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

F. Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

G. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

H. Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

I. Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

J. Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.

K. Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.

L. In general, all conduit shall be concealed except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.

M. Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

N. For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

O. All conduits installed in exposed areas shall be installed with a box offset before entering box.

3.2 CONDUIT INSTALLATION

A. Cut conduit square; de-burr cut ends.

B. Conduit shall not be fastened to the corrugated metal roof deck.

C. Bring conduit to the shoulder of fittings and couplings and fasten securely.

D. Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.

E. All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 260526 - Grounding and Bonding for Electrical Systems for grounding bushing requirements.

F. Install no more than the equivalent of three 90 degree bends between boxes.

G. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

H. Conduit shall be bent according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bend of PVC conduit.

I. Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.

J. Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

K. Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint. Install expansion fitting in PVC conduit runs as recommended by the manufacturer.

L. Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

M. Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.

N. Route conduit through roof openings for piping and ductwork where possible.

O. Conduit is not permitted in any slab topping of two inches (50 mm) or less.

P. Ground and bond conduit under provisions of Section 260526.

Q. Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.

R. PVC conduit shall transition to galvanized rigid metal conduit before it enters up through a concrete floor.

S. Identify conduit under provisions of Section 260553.

T. All conduit installed underground (exterior to building) shall be buried a minimum of 24" below finished grade, whether or not the conduit is concrete encased.

U. PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer's recommendations.

3.3 CONDUIT INSTALLATION SCHEDULE

A. Conduit other than that specified below for specific applications shall not be used.

B. Underground Installations Within Five Feet (1.5 m) of Foundation Wall: Rigid steel conduit.

C. Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Rigid steel conduit or Schedule 40 PVC conduit.

D. Under Slab on Grade Installations: Schedule 40 PVC conduit.

E. Exposed Outdoor Locations: Rigid steel conduit.

F. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

G. Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

H. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

I. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

J. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

K. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

3.4 AUXILIARY GUTTERS (WIREWAYS) INSTALLATION

A. Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.

B. Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 260526.

3.5 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.

D. Boxes shall not be fastened to the metal roof deck.

E. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.

F. In case of any question or argument over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.

G. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.

H. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors.

I. Locate and install to maintain headroom and to present a neat appearance.

J. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.6 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.

B. Power:
   1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

C. Low Voltage:
   1. Recessed (1/4" maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 11/16 inch square, 2-1/8" deep. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

D. Provide knockout closures for unused openings.

E. Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.

F. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

G. Install boxes in walls without damaging wall insulation.

H. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

I. Ceiling outlets shall be 4 inch square, minimum 2-1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.

J. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.

K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

L. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

M. Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

N. Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

3.7 FLOOR BOX INSTALLATION

A. Set boxes level and flush with finish flooring material.

3.8 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install Owner approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

B. Support pull and junction boxes independent of conduit.

3.9 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from ½ inch (12.5 mm) sieve to No. 4 (4.75 mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

D. Install handholes and boxes with bottom below the frost line, insert depth of frost line below grade at project site, below grade.

E. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used and seal around penetrations after fittings are installed.

3.10 EXPANSION JOINT FITTINGS FOR RNC

A. Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30° F (17° C) and that has straight run length that exceeds 25 feet (7.6 m).

B. Install expansion joint fittings for each of the following locations and provide type and quantity of fittings that accommodate temperature change listed for location:
   1. Outdoor Locations not Exposed to Direct Sunlight: 125° F (70° C), temperature change.
   2. Outdoor Locations Exposed to Direct Sunlight: 155° F (86° C), temperature change.
   3. Indoor Spaces: Connected with the outdoors without physical separation: 125° F (70° C), temperature change.
   4. Attics: 135° F (75° C), temperature change.

C. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change.

D. Install each expansion joint fitting with position, mounting and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.

3.11 LOW VOLTAGE COMMUNICATIONS CONDUIT SYSTEM

A. Minimum size of conduit shall be 1" (one inch) for telecommunications (voice and data) including fiber optic installations, or where more than one type of cable or system is required to share a conduit.

B. Minimum size of conduit shall be 1/2" for paging system, security access control and CCTV, nurse call and other low voltage systems such as alarms. Use 1/2-inch minimum flexible metallic conduit when installing raceway into door frames for security systems.

C. Conduit provided for overhead projectors, audio-visual floor boxes and other audio-visual locations shall be minimum 1-1/4" or as indicated on drawings.

D. Conduits shall be sized for a maximum 40% fill ratio.

E. Provide flush two-gang box with single gang plaster ring for each communications outlet or as noted on drawings.

F. Minimum size back box shall be 4" x 4" or double gang extra deep, except where noted differently. Provide 2" x 4" or single gang plaster ring to reduce opening for standard data outlet. Size of plaster ring may be adjusted (to 4" x 4") as required by outlet quantity.

G. Use only couplings and fittings designed specifically for type of conduit or raceway shown. Provide insulated bushings on each fitting and raceway end.

H. Provide raceways in walls from each back box stubbed into nearest accessible ceiling, corridor or access floor toward cable trays or toward Telecommunications Room. Ensure accessibility after other trades systems installation by extending raceway where necessary to an accessible location or near a cable tray. Where back boxes are installed in laboratories or other areas where future access may be difficult, provide conduit out to nearest accessible hallway.

I. Provide one conduit from each communications box. Horizontal conduit runs between wall boxes are not allowed.

J. In areas where cable tray or j-hooks must cross an inaccessible ceiling, provide 4" EMT conduit in lieu of cable tray or j-hooks. For instance, where cables are supported by one 4" j-hook run prior to encountering an inaccessible ceiling, provide (1) 4" conduit to span the inaccessible area. Where 4"x12" cable tray is used, provide (4) 4" conduits to span the inaccessible area.

K. Provide a 1/8 inch (3 mm) nylon pull string in each empty conduit longer than 60" to facilitate the installation of cables by the Owner or systems installers.

L. Provide insulated bushings on exposed or cut end of every conduit.

M. Conduit bends to be no less than 10 times the nominal outside diameter of conduit.

N. No conduit run shall be longer than 100 linear feet without a pull box.

O. No conduit run shall have more than two (2) 90 degree bends or total of 180 degrees of bend (including all offsets) without a pull box.

P. Pull boxes shall not be used in lieu of bends. Pull boxes shall be installed in straight section of conduit.

Q. Electrical LBs are not permitted unless manufactured for the use of communication cabling, having an internal bend radius appropriate for the cable size and application. Obtain engineer approval prior to installation.

R. Provide conduit sleeves through walls as required by communications cable or as indicated on project documents. Where 1 to 4 communications cables are required, provide a 1" sleeve. For 5-20 cables are required, provide 2" sleeve. For 20-50 cables, provide 3" sleeve. Above 50 cables provide 4" sleeve. Sleeves shall extend min. 2" beyond wall on each side with plastic grommet or bushing to protect cable from abrasion. Conduit fill of sleeves may exceed 40%. All sleeves shall be fire stopped with UL listed system.

S. Sleeves for cable access through walls or floors may not always be indicated on drawings. It is the contractor's responsibility to provide all sleeves in all locations as required by cable routing and as dictated by field conditions. Changes in a planned cable route during construction to reduce cable length or avoid obstructions shall not be a cause for change orders if additional sleeves are required.

T. It is the contractor's responsibility to provide sleeves and support for communications cables for the entirety of the cable route, whether in conduit, cable tray or approved j-hooks (no bridle rings). The contractor shall review the reflected ceiling plans to determine the most appropriate method of support for any given area. The project documents may or may not indicate a method of support. If hard ceilings must be crossed, the contractor shall provide conduit through (above) the inaccessible areas into accessible areas, regardless whether the project documents indicate another method (or no method) of support. No change orders will be accepted to alter a means of support (for instance, a change from cable tray to conduit to cross an inaccessible ceiling or from cable tray to sleeves to shorten a cable route).

U. Provide UL listed fire stop material between sleeve and wall. Provide UL listed fire stop system (material) or cap in unused conduit sleeves. Provide fire stop material in open portions of sleeves after communications cable has been installed. Fire stop system shall match or exceed the fire rating of the floor or wall which is penetrated by conduit and cable.

V. If the services of a separate fire stop contractor are not secured for the project, the electrical or communications contractor is responsible to provide all fire stop systems and materials in conduit and sleeves which are used by the contractor. This includes all unused conduits in the immediate vicinity whether they are used on this project or not, as long as they are intended for future use by similar low-voltage systems cabling along the same route.

END OF SECTION 260533

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes the products and execution requirements relating to labeling of conduit, power, lighting, general wiring, signal, fire alarm cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling.

1.2 SECTION INCLUDES

A. Identification Materials

B. Power Raceway Identification Materials

C. Armored and Metal-Clad Cable Identification Materials

D. Power and Control Cable Identification Materials

E. Conductor Identification Materials

F. Underground-Line Warning Tape

G. Warning Labels and Signs

H. Instruction Signs

I. Equipment Identification Labels

J. Cable Ties

K. Miscellaneous Identification Products

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this section.

B. Section 260519 – Low-Voltage Electrical Power Conductors and Cables

C. Section 260523 – Control-Voltage Electrical Power Cables

D. Section 262413 – Switchboards

E. Section 262416 – Panelboards

F. Section 262728 – Disconnect Switches

G. Section 262816 – Enclosed Switches and Circuit Breakers

1.4 SUBMITTALS

A. Include product data for each electrical identification product indicated.

B. Include schedule for nameplates and stenciling.

C. Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8 1/2" x 11" sheets annotated, explaining their purposed use.

1.5 QUALITY ASSURANCE

A. Comply with ANSI A13.1.

B. Comply with NFPA 70.

C. Comply with 29 CFS 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers shall comply with UL 969.

1.6 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.1 IDENTIFICATION MATERIALS

A. General:
   1. Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED. Exception: back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.
   2. Cable label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Labels for power conductors (600V and lower) shall be cloth-type. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.
   3. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.
   4. Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.
   5. Adhesive type labels not permitted except for phase and wire identification. Machine generated adhesive labels shall be permitted for device plates, 4-11/16" and smaller junction boxes, Fire alarm and control devices.

2.2 POWER RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.

B. Colors for Raceways Carrying Circuits at 600 V or Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistance coating and matching wraparound adhesive tape for securing ends of legend label.

D. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Snap-Around, Color Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

F. Tape and Stencil for Raceways Carrying Circuits More than 600 V: 4-inch (100 mm) wide black stripes on 10-inch (250 mm) centers diagonally over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stop stripes at legends.

G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking cable tie fastener.

2.3 ARMORED AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Colors for Raceways Carrying Circuits at 600 V and Less:
   1. Black letters on an orange field.
   2. Legend: Indicate voltage and system or service type.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

D. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

2.4 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Color coding shall be as noted in Section 26 05 19.

2.5 CONDUCTOR IDENTIFICATION MATERIALS

A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.

B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

C. Snap-Around Labels: Slit, pretensioned, flexible, solid-colored acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identified and to stay in place by gripping action.

D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

F. Color coding shall be as noted in Section 26 05 19.

2.6 UNDERGROUND-LINE WARNING TAPE

A. Tape:
1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:
1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE

C. Tag: Type I (Utility Conductors)
1. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored [continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 5 mils (0.125 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight: 28 lb./1,000 sq. ft. (13.7 kg/100 sq. m.).
5. 3-Inch (75 mm) Tensile According to ASTM D882: 70 lbf (311.3 N), and 4,600 psi (31.7 MPa).

D. Tag: Type II (Utility Conductors)
1. Reinforced, detectable three-layer laminate consisting of a printed pigmented woven scrim, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
2. Overall Thickness: 8 mils (0.2 mm).
3. Foil Core Thickness: 0.35 mil (0.00889 mm).
4. Weight 34 lb./1,000 sq. ft. (16.6 kg/100 sq. m.).
5. 3-Inch (75 mm) Tensile According to ASTM D882: 300 lbf (1334 N), and 12,500 psi (86.1 MPa).

2.7 EQUIPMENT IDENTIFICATION LABELS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and UV-resistant seal for label.

C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a black background. Minimum letter height shall be 3/8 inch (10 mm).

D. Engraved, Laminated Acrylic or Melamine label: Punched or drilled for screw mounting. White liters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

E. Stenciled Legend: In nonfading, waterproof black ink or paint. Minimum letter height shall be 1 inch (25 mm)

2.8 CABLE TIES

A. General -Purpose Cable Ties: Fungus insert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73° F (23° C), According to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 50 to plus 185° F. (Minus 50 to plus 85° C).
4. Color: Black except where used for color-coding.

B. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one-piece, self-locking.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73° F(23 ° C), According to ASTM D638: 7,000 psi (48.2 MPa)
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284° F (Minus 46 to plus 140° C).
5. Color: Black.

2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 – EXECUTION

3.1 GENERAL

A. Identification legend, colors of labels and color of raceway shall match facility standards. When no standards established the following systems shall be used.

B. Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.

C. All branch circuit and power panels must be identified with the same identification legend used in circuit directory in main distribution center.

D. Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.

E. Install all labels firmly as recommended by the label manufacturer.

F. Labels shall be installed plumb and neatly on all equipment.

G. Install nameplates parallel to equipment lines.

H. Secure nameplates to equipment fronts using screws, rivets or manufacturer approved adhesive or cement.

I. Embossed tape will not be permitted for any application.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing of finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

F. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

G. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.

H. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.

J. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.3 IDENTIFICATION SCHEDULE

A. Accessible Raceway and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More than 30A, and 120V to ground: Install with self-adhesive vinyl label or self-adhesive vinyl tape applied in bands. Install labels at 30-foot (10-m) intervals.

B. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pullbox of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Power.

C. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags and a separate tag with the circuit designation.

D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
1. Identify conductors, cables and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

E. Locations of Underground Lines: Identify with underground-line warning tape for utility power.
1. Limit use of underground-line warning tape to direct-buried cables.

2. Install underground-line warning tape for both direct-buried cables and cables in raceway.

F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

3.4 JUNCTION AND PULLBOX IDENTIFICATION

A. The following junction and pullboxes shall be identified utilizing spray painted covers:

System	Color(s)
Secondary Power - 480Y/277V	Brown
Secondary Power - 208Y/120V, 240/120V	White
Emergency Power - 480Y/277V	Brown/Red
Emergency Power - 208Y/120V	White/Red
Fire Alarm	Red
Temperature Control	Green
Door Control and Door Monitoring System	Orange
Sound and Intercom Systems	Blue
Video Surveillance System/MATV	Yellow

B. Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

3.5 POWER AND CONTROL WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

B. All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

3.6 WIRING DEVICE IDENTIFICATION

A. Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells and time clocks shall be identified with circuit numbers and source. In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated labels, or neatly hand-written permanent marker.

3.7 NAMEPLATE ENGRAVING

A. Provide nameplates of minimum letter height as scheduled below.

B. A specific schedule may be included on the Contract Drawings, or specific schedules may be included in equipment Sections to which they apply; Panelboards, for example.

C. Panelboards 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.

D. Equipment Enclosures: 1 inch (25 mm); identify equipment designation.

E. Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch (13 mm); identify circuit and load served, including location.

F. Individual Circuit Breakers, Disconnect Switches, and Enclosed Switches: ½ inch (13 mm); identify source and load served.

G. Junction boxes: 1 inch (25 mm); identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

3.8 PANELBOARD DIRECTORIES

A. Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION 260553

SECTION 260926 - LOW VOLTAGE LIGHTING CONTROL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The Library and Neighborhood Center will have a low voltage lighting control system. Each system shall be capable of programming and storing data for settings for yearly, weekly, and daily switching schemes. It shall be capable adjusting light levels using step dimming ballast with and photocells.

B. Base Bid: The work under this section includes power supplies, control equipment, enclosures and switches associated with low voltage lighting control.

1.2 SECTION INCLUDES

A. Components

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

B. Section 265113 – Interior Lighting Fixtures, Lamps and Ballasts

1.4 SUBMITTALS

A. Submit product data indicating system and component construction, ratings, and operating parameters.

B. Submit manufacturer's installation instructions.

1.5 FUNCTIONAL TESTS

A. Refer to Section 260500 – Common Work Results for Electrical, Functional Tests.

1.6 RECORD DOCUMENTS

A. Accurately record location of switches, power supplies, and control enclosures. Include description of switching and circuiting arrangements.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 COMPONENTS

A. Power Supply: ANSI/NFPA 70; Class 2 energy limited. 120/24 volt transformer, rated 75 VA momentary, 40 VA continuous, with silicon rectifier rated 20 amperes intermittent, 7.5 amperes continuous, 30 VAC.

B. Low Voltage Relays: Heavy duty, two-coil momentary contact type remote control relays with contacts rated 20 amperes at 120 volts and with isolated and non-isolated pilot contacts where indicated. Include clamp type screw terminals for line voltage connections.

C. Switches: Momentary contact, three position switches, toggle type, ivory color, rated 20 amperes at 120 VAC with lighted handle or button.

D. Key Switches: Match non-key switch.

E. Switch Plates: Per section 262726.

F. Master Selector Switch: Capabilities with control of up to thirty-two relay outputs. Switch control shall be microprocessor based with two independent inputs and provide master group control, master switch leg extension and maintained to momentary input conversion.

G. Remote Control Interface: System shall be able to operate with remote input on an individual local switching basis.

H. Cabinets and Enclosures: Shop fabricated and wired. Include appropriate barrier strips for mounting relays and separating energy- limited wiring from line voltage wiring. Include knockouts for relay mounting. Include space for 20 percent minimum additional relays and one additional power supply in each cabinet and enclosure.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions are as shown on Drawings.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Use 20 AWG copper conductor building wire in conduit for low voltage wiring.

C. Use 20 AWG copper conductor building wire 'free-air' for low voltage wiring (see section 260523 for requirements). Install relays to be accessible. Allow space for adequate ventilation and circulation of air.

3.3 TRAINING

A. See Section 260500 for general training requirements.

B. In addition to the training provided in Section 260500, provide an additional 4 hours of training for each type of lighting control provided on the project.

END OF SECTION 260926

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SECTION 262416 - PANELBOARDS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes main, distribution and branch circuit panelboards.

1.2 SECTION INCLUDES

A. Main and Distribution Panelboards

B. Branch Circuit Panelboards

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

B. Section 264313 – Surge Protective Devices for Low Voltage Electrical Power

1.4 SUBMITTALS

A. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and location of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

C. Existing electrical service interruption shall comply with Section 260502 Electrical Demolition for Remodeling.

D. Distribution panels and branch circuit panelboards manufacturer shall be the same manufacturer as switchboards, motor starters and disconnect switches.

1.7 SPARE PARTS

A. Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 – PRODUCTS

2.1 MAIN AND DISTRIBUTION PANELBOARDS

A. Panelboards: Circuit breaker type.

B. Enclosure: NEMA 250 Type 1. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide, with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel.

C. Provide cabinet front with hinged door with flush lock. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim and standard door within hinged trim cover. Hinged trim shall be held in place with concealed trim clamps. Finish in manufacturer's standard gray enamel.

D. Skirt for Surface-Mounted Panelboards shall be the same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.

E. Gutter Extension and Barrier shall be the same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.

F. Provide metal directory holders with clear plastic covers.

G. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

H. Provide extra capacity neutral bus when scheduled rated 200 percent of phase and UL Listed as suitable for non-linear loads.

I. Feed-Through Lugs when scheduled shall be suitable for use with conductor material and located at opposite end of bus from incoming lugs or main device.

J. Subfeed (Double) Lugs when scheduled shall be suitable for use with conductor material and located at same end of bus as incoming lugs or main device.

K. Extra-Capacity Neutral Lugs when scheduled shall be rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

L. Provide UL Listed service equipment label for use as service equipment for panelboards where required with one or more main service disconnecting and overcurrent protective devices.

M. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.

N. Molded Case Circuit Breakers:
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
   a. Instantaneous trip.
   b. Long- and short-time pickup levels.
   c. Long- and short-time time adjustments.
   d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
5. Accessories:
   a. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   b. Zone-Selective Interlocking: Integral with electronic trip unit for interlocking ground-fault protection function.
   c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
   d. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
   e. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
   f. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

O. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be permitted.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

B. Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.

C. Provide flush or surface cabinet front, as identified on the drawings, with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

D. Provide metal directory holders with clear plastic covers.

E. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

F. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings.

G. Molded Case Circuit Breakers:
   1. Bolt-on type thermal magnetic trip circuit breakers.
   2. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings.
   3. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
   4. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250A and larger.
   5. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   6. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.
   7. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
   8. Accessories:
      a. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
      b. Zone-Selective Interlocking: Integral with electronic trip unit for interlocking ground-fault protection function.
      c. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
      d. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
      e. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
      f. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

H. Do not use tandem circuit breakers.

I. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be permitted.

J. All of the panelboards provided under this section shall be by the same manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION

A. See section 260529 for support requirements.

B. Install panelboards plumb with wall finishes.

C. Height: 6 ft. (2 m) to top or 6 ft. to center of breaker handle.

D. Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

E. Provide filler plates for unused spaces in panelboards.

F. See section 260553 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

G. Stub three (3) empty ¾" conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

3.2 FIELD QUALITY CONTROL

A. If aluminum conductors size #1/0 and larger (per Section 260519) are to be used as panelboard feeders, it is the responsibility of the contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

3.3 ADJUSTING

A. Adjust all operating mechanisms for free mechanical movement.

3.4 TRAINING

A. See Section 260500 for general training requirements.

B. In addition to the training provided in Section 260500, provide an additional 1 hour of training for each type of panelboard provided on the project.

END OF SECTION 262416

SECTION 262702 - EQUIPMENT WIRING SYSTEMS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes electrical connections to equipment specified under other Divisions and/or Sections, or furnished by Owner, including, but not limited to:
   1. HVAC motors, VFDs, and panels
   2. Plumbing motors, VFDs, and panels

1.2 SECTION INCLUDES

A. Cords and Caps

B. Other Products

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Section 260519 – Low-Voltage Electrical Power Conductors and Cables.

C. Section 260533 – Raceway and Boxes for Electrical Systems.

1.4 SUBMITTALS

A. Product Data: Provide data for cord and wiring devices.

1.5 COORDINATION

A. Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

PART 2 – PRODUCTS

2.1 CORDS AND CAPS

A. Straight-blade Attachment Plug: NEMA WD 1.

B. Locking-blade Attachment Plug: NEMA WD 5.

C. Attachment Plug Configuration: Match receptacle configuration at outlet provided for equipment.

D. Cord Construction: Oil-resistant thermoset insulated multiconductor flexible cord with identified equipment grounding conductor, suitable for hard usage in damp locations.

E. Cord Size: Suitable for connected load of equipment and rating of branch circuit overcurrent protection.

2.2 OTHER PRODUCTS

A. Refer to related sections for other product requirements.

PART 3 – EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

3.3 INSTALLATION

A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment.

B. Make conduit connections to equipment using flexible PVC-coated metal conduit.

C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.

D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.

E. Make wiring connections in control panel or in wiring compartment of pre-wired equipment in accordance with manufacturer's instructions. Provide interconnecting wiring where indicated.

F. Install disconnect switches, and control devices such as limit switches and temperature switches as indicated. Connect with conduit and wiring as indicated.

3.4 HVAC AND PLUMBING CONNECTIONS

A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters, variable frequency drives (VFDs), and disconnects to motors or to packaged control panels. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.

B. VFD Installations: Install VFD input wiring and output wiring in separate conduit systems. Do not mix VFD input power and output power, or control wiring in a common raceway.

C. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure switches, fan powered VAV boxes, switches, electro-pneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired by the Contractor supplying the devices.

D. Each motor terminal box shall be connected with a minimum 12", maximum 36" piece of flexible PVC-coated metal conduit to a fixed junction box. Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

E. Check for proper rotation of each motor.

3.5 KITCHEN EQUIPMENT CONNECTIONS

A. Check loose equipment delivered to job by equipment installer against approved shop drawings or other required Drawings. Loose electrical equipment including disconnects, starters, thermostats, controls, local and remote switches shall be furnished by equipment contractor and installed by electrical contractor.

B. Equipment contractor will receive all equipment and position in place.

C. Equipment contractor shall provide dimensioned equipment layouts, detailed shop drawings of equipment showing locations and method of installing loose equipment and making final connections, and wiring and control diagrams.

D. Electrical Contractor shall rough in for kitchen equipment only from approved kitchen equipment shop drawings.

E. Rough in location shall be within three inches of equipment. If direct connection is required, use liquidtight flexible conduit. If receptacle connection is required, verify proper receptacle configuration with equipment installer.

F. Final connections shall include extension of all service to each piece of equipment. All labor and material required to completely connect the equipment ready to operate shall be included in the final connections. All control wiring not integral with equipment shall be included.

G. Equipment contractor shall provide services of their representatives and or equipment manufacturer's representative at appropriate stage of construction to answer the Contractor's questions concerning the final connections.

H. For kitchen exhaust hoods provide all required power and control wiring. This may include (but is not limited to) the following:
   1. Provide switch in hood and branch circuit for integral light fixtures.
   2. Provide pushbutton switch or manual starter for exhaust fan.
   3. Provide emergency branch circuit for fire suppression system. Wire automatic heat detectors or manual station so, when activated, valve of dry chemical bottle opens, gas solenoid valve shuts down, all dampers close, and make-up fans shut down, electrical power contactor opens (integral in equipment), and building fire alarm system is activated. Provide all required wiring conduit and final connections. Refer to wiring diagrams supplied with equipment.

I. Wire washdown system; refer to schematic wiring diagrams supplied with hoods. Interconnect fire prevention system with washdown system so washdown system is activated upon alarm.

3.6 EQUIPMENT CONNECTION SCHEDULE

A. As indicated on the drawings.

END OF SECTION 262702

SECTION 262726 - WIRING DEVICES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, photo cells and time clocks.

1.2 SECTION INCLUDES

A. Wall Switches

B. Receptacles

C. Occupancy Sensors

D. Wall Dimmers

E. Device Plates and Box Covers

F. Poke-Through Assemblies

G. Photo Cells

H. Time Clocks

I. Time Switch

J. Mulitoutlet Assemblies

K. Service Poles

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.4 SUBMITTALS

A. Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

B. For occupancy sensor shop drawings, the manufacturer's actual layout of occupancy sensors and the wiring diagrams shall be provided.

C. Test Reports

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 WALL SWITCHES

A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw. Provide single pole, three way, four way and other configurations as noted on the drawings.

B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.

C. Handle: Ivory, made of nylon or high impact resistant material.

2.2 RECEPTACLES

A. Duplex Convenience and Straight-blade Receptacles: NEMA Type 5-20R, ivory nylon or high impact resistant face. Receptacles shall be UL498 Listed, comply with NEMA WD1, NEMA WD6 configuration 5-20R and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362-S, Hubbell model CR5362, Pass & Seymour model CRB5362, Pass & Seymour model PT5362 with 90° connector, Cooper model 5362, or approved equal.

B. Generally, all receptacles shall be duplex convenience type unless otherwise noted.

C. All receptacles installed, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.

D. GFCI Receptacles: Duplex convenience straight-blade feed through receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and include indicator light that is lighted when device is tripped. Device shall comply with NEMA WD1, NEMA WD6, and UL standard 498. GFCI receptacles shall be Leviton model 8899, Hubbell model GRF5352, Pass & Seymour model 2095, Cooper model VGF20 or approved equal.

E. Tamper-Resistant Duplex Straight-blade Receptacles: NEMA Type 5-20R, ivory nylon or high impact resistance face. Receptacles shall be UL 498 Listed supplement SD and comply with NEMA WD1 and NEMA WD6 configuration 5-20R. All duplex receptacles shall be hospital grade, 20 amp rated. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG with a separate green ground screw. Receptacles shall be Leviton model 8300 SGG, Hubbell model HBL8310SG, Pass & Seymour model 63H, Cooper model TR8300 or approved equal

F. USB Charging / Tamper Resistant Duplex Straight blade receptacle NEMA Type 5-20R. ivory nylon or high impact resistance face. Receptacles shall be UL 498 Listed supplement SD and comply with NEMA WD1 and NEMA WD6 configuration 5-20R. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG with a separate green ground screw. USB connection shall be rated for min 2.1A, 5VDC, comply with USB BC1.2, and Part 15 of FCC rules. Compatible with USB 1.1/2.0/3.0 devices. Receptacles shall be Leviton model T5830, Hubbell model USB8300, Pass and Seymour model TM8USBWCC6, Cooper model TR8645 or approved equal.

G. Locking-Blade Receptacles: As indicated on drawings.

H. Specific-use Receptacle Configuration: As indicated on drawings.

2.3 OCCUPANCY SENSORS

A. All occupancy sensors shall be hardwired type; battery type shall not be permitted.

B. Wall Mounted (Wall Switch Type)
1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.
2. Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz
3. Sensitivity shall be user adjustable or self-adjusting type.
4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The off switch shall have manual override for positive off and automatic on.
6. The test LED shall indicate motion.
7. The area of coverage shall be approximately 180 degrees by 35-40 feet.
8. The unit shall have a five year warranty.
9. See drawings for actual type of sensor.

C. Ceiling Mounted
1. The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.
2. Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.
3. Sensitivity shall be user adjustable or self-adjusting type.

4. The delay timer shall be adjusted within a range of 6 to 30 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.
5. The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.
6. Test LED to indicate motion.
7. The unit shall have a five year warranty.
8. See drawings for actual type of sensor.

2.4 WALL DIMMERS

A. Wall Dimmers: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters. Control shall be continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
   1. Rating: 600 Watts minimum, larger size to accommodate load shown on Drawings.
   2. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts, trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
   3. LED luminaire Dimmer Switches: Modular; compatible with dimmer ballasts, trim potentiometer to adjust low-end dimming; driver combination capable of consistent dimming with low end not greater than 10 percent of full brightness.

2.5 DEVICE PLATES AND BOX COVERS

A. Decorative Cover Plate: Ivory smooth thermoplastic nylon. Plate securing screws shall be metal with color to match plate finish.

B. Weatherproof Cover Plate: Gasketed metal with hinged device covers.

C. While in Use Cover: UL Listed outdoor die-cast hinged cover with integral lock tab.

D. Surface Cover Plate: Raised galvanized steel.

2.6 PHOTO CELLS

A. The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1" diameter.

B. The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

C. The enclosure shall include the positioning lug on the top of the enclosure.

D. The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.

E. Mounting shall be for a 1/2" conduit nipple.

F. The unit shall have a 5 year warranty.

G. The contacts shall be SPST normally closed.

H. The operational temperature range shall be -40 to 140 degrees F(-40 to +60 degrees C).

2.7 TIME CLOCKS

A. Unit shall be a multi-purpose, 7 day, 365 day advance single and skip a day, combination 2 channel electronic time clock with a SPDT switching configuration and astronomic dial.

B. The contacts shall be rated 10 amp resistive at 120/250 VAC, 7.5 amps inductive at 120/250 VAC, 5 amps inductive at 30 VDC and up to 1/2 hp at 250 VAC. The unit shall be rate for 30 VDC, 120 VAC, 250 VAC and 277 VAC.

C. The controller shall be capable of programming in the AM/PM or 24 hour format by jumper selection, in one minute resolution, using 2 buttons only for all basic settings.

D. Display shall be LED type.

E. The unit shall have 365 day and or holiday selection capabilities, with 16 single date and 5 holiday selection options and user selectable daylight savings/standard time functions.

F. The unit shall have 72 hour memory backup with rechargeable battery and charger.

G. The unit shall be capable of manual override, ON and OFF to the next scheduled event, using 1 button for each channel.

H. The enclosure shall be rated for indoor or outdoor installation.

2.8 TIME SWITCH

A. The switch shall be programmed to automatically turn lights off after a preset time.

B. The delay timer shall be adjustable with a range of 5 minutes to 12 hours.

C. Switch shall be rated for 120/277V, 1200W load.

D. The switch shall beep warning every 5 seconds during the last minute of countdown. Also, the switch shall flash lights (for warning) at one minute before timer expires.

E. Time scrolling shall be provided to override preset time by pressing the ON/OFF switch for four seconds.

F. LCD provided to show count down time.

G. The switch shall have zero crossing circuitry.

2.9 MULTIOUTLET ASSEMBLIES

A. Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles. Single or duplex receptacles shall be spaced as noted on drawings.

B. Raceway Material: Buff finish.

C. Wire: No. 12 AWG.

2.10 SERVICE POLES

A. Provide factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
   1. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling, and with separate channels for power wiring and voice and data communication cabling.
   2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
   3. Finishes: Manufacturer's standard painted finish and trim combination.
   4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
   5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.
   6. Voice and Data Communication Outlets: [Blank insert with bushed cable opening] [Two RJ-45 Category 5e jacks] [Four RJ-45 Category 5e jacks].

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install wall switches 48 inches (1.2m) above floor, OFF position down.

B. Install wall dimmers 48 inches (1.2 m) above floor; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.

C. Install convenience receptacles 18 inches (450 mm) above floor, 6 inches (152.4 mm) above counters, grounding pole on bottom. All dimensions are to the center of the box. Install ground pole to left when mounted horizontal.

D. Install box for information outlet 18 inches (450mm) above finished floor. Install box for telephone jack for wall telephone 48 inches (1.2 M) above finished floor. All dimensions are to the center of the box.

E. Install specific-use receptacles at heights shown on Contract Drawings.

F. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

H. Install devices and wall plates flush and level.

I. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

J. Oversized or extra deep coverplates not acceptable. Repair wall finishes and remount outlet box when standard device plates do not fit flush or do not cover rough wall opening.

K. Coordination with Other Trades:
   1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
   2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
   3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
   4. Install wiring devices after all wall preparation, including, painting, is complete.

L. Conductors:
   1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
   2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
   3. The length of free conductors at outlets for devices shall meet provisions of NPFA 70, Article 300, without pigtails.
   4. Existing Conductors:
      a. Cut back and pigtail, or replace all damaged conductors.
      b. Straighten conductors that remain and remove corrosion and foreign matter.
      c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

M. Device Installation:
   1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
   2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
   3. Do not remove surface protection, such as plastic film and smudg4e covers, until the last possible moment.
   4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
   5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductors tightly clockwise, 2/3 to ¾ of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

3.2 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch and sensor with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. The Engineer and Owner's personnel reserve the right to be present at all tests.

3.3 OCCUPANCY SENSORS

A. Power packs used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.

B. Provide a minimum of 4' of coiled cable for ceiling-mounted sensors.

C. Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

D. Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

3.4 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device, and on the back of the device cover.

3.5 TESTING

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test Instruments: Use instruments that comply with UL 1436.
3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

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SECTION 262728 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes disconnect switches and enclosures.

1.2 SECTION INCLUDES

A. Disconnect Switches

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

B. Section 262813 – Fuses

1.4 SUBMITTALS

A. Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

1.5 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.6 PROJECT COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Disconnect switch manufacturer shall be the same manufacturer as switchboards, distribution panelboards, branch circuit panelboards and motor starters.

PART 2 – PRODUCTS

2.1 DISCONNECT SWITCHES

A. Fusible Switch Assemblies (use only when overcurrent protection is required):UL 09 and NEMA KSI, horsepower rated Type HD, Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R cartridge type fuses.

B. Nonfusible Switch Assemblies: UL 89 and NEMA KSI, horsepower rated Type HD Heavy Duty; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

C. Enclosure: NEMA Type as indicated on Drawings.

D. Provide manufacturer's equipment ground kit in all disconnect switches.

E. Provide UL Listed service rating where required.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install disconnect switches where indicated on Drawings.

B. Provide identification as specified in Section 260553.

END OF SECTION 262728

SECTION 262813 - FUSES

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes 250 and 600 volt fuses.

1.2 SECTION INCLUDES

A. 250 Volt Fuses

B. 600 Volt Fuses

C. Spare-Fuse Cabinet

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Section 262413 – Switchboards

C. Section 262416 – Panelboards

D. Section 262728 – Disconnect Switches

E. Section 262816 – Enclosed Switches and Circuit Breakers

F. Section 262900 – Low Voltage Controllers

1.4 SUBMITTALS

A. Provide device dimensions, nameplate nomenclature, and electrical ratings.

B. Submit manufacturer's product data sheets with installation instructions.

1.5 REGULATORY REQUIREMENTS

A. Listed by Underwriter's Laboratories, Inc., and suitable for specific application.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit levels.

1.7 EXTRA MATERIALS

A. Provide three (3) spares of each size and type fuse.

PART 2 – PRODUCTS

2.1 250 VOLT FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.

2.2 600 VOLT FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 600 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.

B. Fuses 601 Amperes and Larger: Time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C. Provide enclosure for spare fuses.

2.3 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1 ½" (38 mm) high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Fuses shall not be installed until equipment is ready to be energized.

B. Install spare fuse storage enclosure in Electrical Room.

END OF SECTION 262813

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SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes enclosed molded case circuit breakers.

1.2 SECTION INCLUDES

A. Circuit Breakers

B. Ratings

C. Enclosure

D. Accessories

E. Disconnect Switches

1.3 RELATED WORK

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

B. Section 262728 – Disconnect Switches

1.4 REFERENCE STANDARDS

A. NEMA AB 1 - Molded Case Circuit Breakers.

1.5 SUBMITTALS

A. Include enclosure data, circuit breaker ratings, withstand ratings, frame size, time-current and let-through current curves, outline dimensions, and terminal lug sizes.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

1.8 REGULATORY REQUIREMENTS

A. Circuit breakers listed by Underwriter's Laboratories, Inc., and suitable for specific application.

1.9 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Enclosed switches and circuit breaker manufacturers shall be the same manufacturer as distribution panelboards, branch circuit panelboards, motor starters and disconnect switches.

PART 2 – PRODUCTS

2.1 CIRCUIT BREAKERS

A. Molded Case Circuit Breakers:
   1. Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
   2. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
   3. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   4. Electronic Trip Circuit Breakers: Field-replaceable rating plus, rms sensing with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long and short-time pickup levels.
      c. Long and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I^2t response.

B. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

C. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.

D. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

E. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

2.2 RATINGS

A. Ratings as shown on the Drawings.

2.3 ENCLOSURE

A. Enclosure: NEMA AB 1; Type 1.

B. Fabricate enclosure from steel.

C. Finish using manufacturer's standard gray enamel finish.

2.4 ACCESSORIES

A. Provide accessories as scheduled, to NEMA AB 1.

B. Handle Lock: Include provisions for padlocking.

2.5 DISCONNECT SWITCHES

A. See Section 262728 for disconnect switch requirements.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install enclosed circuit breakers where shown on Drawings, in accordance with manufacturer's instructions.

3.2 ADJUSTING

A. Adjust trip and time delay settings to values as recommended in coordination study provided by manufacturer or as instructed by the Architect/Engineer.

3.3 FIELD QUALITY CONTROL

A. Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.

END OF SECTION 262816

SECTION 262900 - LOW-VOLTAGE CONTROLLERS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes manual motor starters, magnetic motor starters, and combination magnetic motor starters.

1.2 SECTION INCLUDES

A. Magnetic Motor Starters

B. Controller Overcurrent Protection and Disconnecting Means

C. 250 Volt Fuses

D. 600 Volt Fuses

E. Spare-Fuse Cabinet

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

B. Section 260529 – Hangers and Supports for Electrical Systems

C. Section 262419 – Motor Control Centers

D. Section 262728 – Disconnect Switches

E. Section 262813 – Fuses

1.4 SUBMITTALS

A. Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

B. Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and overcurrent protective devices.

1.5 REFERENCE STANDARDS

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.

B. ANSI/UL 198E - Class R Fuses.

C. NEMA AB 1 - Molded Case Circuit Breakers.

D. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.

E. NEMA KS 1 - Enclosed Switches.

F. NEMA PB 1 - Panelboards.

G. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.7 DELIVERY, STORAGE AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

1.8 COORDINATION WITH OTHER TRADES

A. Motors: In general, all electric motors required for this installation will be supplied with equipment, apparatus and/or appliances covered under other sections of the specifications.

B. For the sake of consistency and conformity of manufacturer, design and construction, all motors shall conform to the following description unless otherwise noted or required.
   1. Motors 1/3 HP and smaller shall be wound for operation on single phase, 60 Hz. service unless otherwise noted.
   2. Motors 3/4HP and above shall be wound for operation on 3 phase, 60 Hz service unless otherwise noted.
   3. Refer to drawings in each case in order to verify voltage characteristics required.

C. Equipment:
1. All building utility motors such as fans, pumps, overhead doors, etc., together with certain "controlling equipment" for same, except motor starters and related apparatus, will be furnished under other sections of the specifications and delivered to the building site unless specifically noted otherwise. The above mentioned "controlling equipment" pertains to electrical thermostats, electro-pneumatic and pneumatic-electric and detection devices, or any other device not purely electrically operating in nature.
2. The starters for these motors shall be furnished and installed by the Electrical Trade unless noted otherwise. (See Motor Schedule on Drawings.)
3. The Electrical Trade shall set and connect all specified starting equipment, install all power conduits and wiring and shall furnish and make all connections from starting equipment to motors as required to leave the apparatus in running condition.

D. Wiring Connections:
1. Furnish branch circuits for all motors to the starting equipment and then to the motors, complete with all control wiring for automatic and remote control where required or noted. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible, PVC-coated metal conduit.
2. Provide all necessary labor and material to completely connect all electrical motors and controls (where required) in connection with the building utility equipment, including fans, pumps, overhead door operators, etc.
3. All conduits and wiring required for control work from the holding coil circuit of the starter, including the furnishing and installation of control devices such as auxiliary contacts, control relays, time delay relays, pilot lights, selector switches, alternators, etc., shall be provided and installed by other trades unless otherwise indicated.

E. Power Branch Circuits:
1. Wire sizes for branch circuits not specifically called for on drawings or in specifications shall be based on 125 percent of the full load current of the motor unless the voltage drop of motor branch circuits exceeds 1-1/2 percent from the distribution panel to the motor; in which case, voltage drop shall govern wire sizes. A power factor of 80 percent shall be used for motors in such calculations.

1.9 PROJECT COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Motor starter manufacturer shall be the same manufacturer as distribution panelboards, branch circuit panelboards, and disconnect switches.

1.10 SPARE PARTS

A. Keys: Furnish two (2) each to Owner.

B. Provide three (3) spares of each size and type fuse used. Provide enclosure for spare fuses.

C. Fuse Pullers: Furnish one fuse puller to Owner.

PART 2 – PRODUCTS

2.1 MAGNETIC MOTOR STARTERS

A. Magnetic Motor Starters: NEMA ICS 2; AC general-purpose Class A magnetic controller for induction motors rated in horsepower; NEMA size 0 minimum.

B. Full Voltage Starting: Non-reversing type.

C. Reduced Voltage Starting: Solid-state type, trip current rating shall be adjustable. The overload shall be self-powered, provide phase loss and phase unbalance protection, have a permanent tamper guard and be ambient insensitive. The overload shall have a mechanical test function.

D. Two Speed Starting: Two speed, two winding, constant torque type. Provide integral time delay transition between FAST and SLOW speeds.

E. Size: NEMA ICS 2; size as shown on Drawings, size 0 minimum.

F. Coil Operating Voltage: 120 volts, 60 Hz.

G. Overload Protection: bimetal or melting alloy.

H. Enclosure: NEMA Type: 1

I. Provide manufacturer's equipment ground kit in all starter enclosures.

J. Selector Switches: NEMA ICS 2; HAND/OFF/AUTO, in front cover.

K. Indicating Lights: NEMA ICS 2; LED Push-to-test type. RUN: red in front cover.

L. Relays: NEMA ICS 2; Provide on-time delay (0-60 sec) relays as indicated on the Drawings.

M. Provide phase loss protection relay with each motor starter, with contacts to de-energize each motor starter.

N. Control Power Transformers: Each magnetic starter shall have a fused primary and a fused 120Vsecondary control transformer, sized for the load, 100 VA minimum. Additionally, the X2 terminal of the control transformer shall be grounded.

O. Combination Motor Starters: Combine motor starters with disconnect in common enclosure.

2.2 CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS

A. Nonfusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

2.3 250 VOLT FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 250 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.

2.4 600 VOLT FUSES

A. Fuses 600 Amperes and Less: Dual element, time delay, 600 volt, UL Class RK 5. Interrupting Rating: 200,000 rms amperes.

B. Fuses 601 Amperes and Larger: Time delay, 600 volt, UL Class L. Interrupting Rating: 200,000 rms amperes.

C. Provide enclosure for spare fuses.

2.5 SPARE-FUSE CABINET

A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
   1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
   2. Finish: Gray, baked enamel.
   3. Identification: "SPARE FUSES" in 1 ½" (38 mm) high letters on exterior of door.
   4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

B. Install motor control equipment in accordance with manufacturer's instructions.

C. Select and install heater elements in motor starters to match installed motor characteristics.

D. Select and install fuses in each fusible switch enclosed controller.

E. Install fuses in control circuits if not factory installed.

F. Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

3.2 IDENTIFICATION

A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved nameplate.
   3. Label each en closure-mounted control and pilot device.

END OF SECTION 262900

SECTION 264313 - SURGE PROTECTIVE DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work under this section includes Surge Protective Devices (SPD) as indicated on the project drawings and electrical diagrams.

1.2 SECTION INCLUDES

A. Surge Protective Devices (SPD)

B. Surge Suppressor Devices for Critical Branch Panelboards (2nd Tier Locations)

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.

1.4 SUBMITTALS

A. Include all SPD data necessary to show device is in compliance with all product specifications. Include product data sheets which show the device dimensions, weight, connections, and mounting requirements, along with installation instructions.

B. Provide verification the SPD is listed or recognized through Underwriters' Laboratories to the latest safety standards ANSI/UL 1449.

1.5 REFERENCE STANDARDS

A. UL 1449, Third Edition – Standard for Safety for Surge Protective Devices.

B. ANSI/IEEE C62.41.1 Guide on the Surge Environment in Low-Voltage AC Power Circuits.

C. ANSI/IEEE C62.41.2 Recommended Practice on Characterization of Surges in Low-Voltage AC Power Circuits.

D. ANSI/IEEE C62.45 Recommended Practice on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits.

E. IEEE C62.62 Standard Test Specification for Surge Protective Devices for Low-Voltage AC Power Circuits.

F. ANSI/UL 1283 - Standard for Electromagnetic Interference Filter.

G. Military Standard 220C

H. NFPA 70, NEC Article 285

1.6 QUALITY ASSURANCE

A. The manufacturer shall have been in the Surge Protective Device industry for a minimum of 5 years.

1.7 WARRANTY

A. The manufacturer shall provide a minimum of 10 years warranty from the date of shipment of the SPD.

1.8 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 SURGE PROTECTIVE DEVICES (SPD)

A. The Surge Protective Device (SPD) shall be suitable for use on service entrances (ANSI/IEEE Standard C62, Category C environments). The SPD shall be connected in parallel with the facility's electrical system.

B. The SPD shall be listed in accordance with UL 1449, Third Edition and correctly labeled as a Type 1 or Type 2 SPD for its application. All SPDs installed on the line side of the service entrance OCPD shall be of Type 1. All SPDs installed on the load side of the service entrance OCPD shall be either Type 1 or Type 2.

C. Type 2 SPDs shall be co-listed to UL1283.

D. The SPD shall be made up of metal oxide varistors (MOVs), selenium cells, silicon avalanche diodes, or a combination thereof, ensuring that all of the performance requirements are met. Gas tubes shall not be used. The entire unit shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. The SPD may be mounted external or integral to the piece of equipment. SPDs installed integral to the equipment shall be of the same manufacturer of the equipment.

E. The SPD shall have a maximum continuous operating voltage (MCOV) rating of not less than 115% of nominal voltage of the system it is protecting.

F. The SPD will provide all modes of protection (L-N,) (L-G), (N-G) for wye configured systems. For a delta configured system, the device shall have line to line (L-L) and line to ground (L-G) protection modes.

G. The SPD shall have a voltage protection rating (VPR) as assigned by UL 1449, Third Edition, which shall not exceed the following:
   1. 800V for L-N, L-G, N-G modes, 1200V for L-L in 120/208V wye system.

H. The SPD shall have surge current capability of 100 kA (minimum) per Mode, or 200kA (minimum) per Phase.

I. The SPD shall nave a Nominal Discharge Current Rating (In) or not less than 20kA.

J. The SPD shall have a Short Circuit Current Rating (SCCR) of not less than 200kA.

K. Each SPD shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit for each phase.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install SPD devices in accordance with manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.

B. The SPD units shall be installed at the locations shown on the drawings, or as indicated in the one-line diagram. They shall be parallel-connected to, and located adjacent to the switchboard or panelboard being protected. Locate as close as practical to the neutral bus, keeping lead length as short as possible (less than 5 feet preferred). SPD devices shall be connected through a multi-pole circuit breaker or fused disconnect switch, not into main lugs. Circuit breaker or fused disconnect switch shall be 60A minimum for main service device, 30A minimum for branch panelboard device or as recommended by the manufacturer (whichever is larger). Use schedule 40 PVC conduit between the SPD device and the switchboard or panelboard. To connect the SPD device to the circuit breaker or disconnect switch, use conductors appropriately sized or the manufacturer's recommended conductors (whichever is larger). Avoid sharp bends, excess length, and splices in the wires (where possible, use a close-nippled connection with wires going directly to a circuit breaker within the switchboard or panelboard).

C. Setup and test per the manufacturer's recommendations.

3.2 TRAINING

A. See Section 260500 for general training requirements.

B. In addition to the training provided in Section 260500, provide an additional 1 hour of training for each type of surge protection devices provided on the project.

END OF SECTION 264313

SECTION 265113 - INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Base Bid: The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts.

1.2 SECTION INCLUDES

A. Interior Luminaires and Accessories

B. Lamps

C. Fluorescent Ballasts

D. Compact Fluorescent Ballasts (Electronic)

E. Dimming Ballasts (Fluorescent)

F. Ballasts for Bi-Level Controlled Lighting Fixtures: Electronic Type (Fluorescent)

G. Emergency Fluorescent Power Unit

H. Exit Signs

I. Emergency Lighting Units

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this section.

B. Section 260923 – Lighting Controls

C. Section 260926 – Low Voltage Lighting Controls

1.4 SUBMITTALS

A. Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance and photometric data for each luminaire type.

B. For each luminaire type, submit luminaire information in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

LUMINAIRE		BALLAST	LAMP	ANSI INPUT WATTS
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

1.5 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficiency Lighting Products

B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with NFPA 70.

1.6 WARRANTY

A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.
   2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

B. Special Warranty for Ballasts: Manufacturer's standard form in which ballast manufacturer agrees to repair or replace ballasts that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Electronic Ballasts: Five years from date of Substantial Completion.
   2. Warranty Period for Electromagnetic Ballasts: Three years from date of Substantial Completion.

C. Special Warranty for T5 Fluorescent Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

D. Warranty Period: One year(s) from date of Substantial Completion.

1.7 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.8 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 EXTRA MATERIAL

A. Provide three (3) percent of each fixture type, but not less than one (1) fixture of each type.

B. Provide ten (10) percent of each lamp type, but not less than one (1) of each type.

C. Provide three (3) percent of each ballast type, but not less than one (1) ballast of each type.

PART 2 – PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES

A. See the Lighting Fixture Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.

B. Provide fluorescent fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

C. Fluorescent T5 lamps and ballasts shall be listed on CEE high-performance qualifying product list and approved by Focus–On–Energy.

D. Recessed fixtures shall comply with NEMA LE4 for ceiling compatibility for recessed fixtures.

E. Fluorescent fixtures shall comply with UL 1598.

F. Sheet metal components shall be steel unless otherwise noted, formed and supported to prevent warping or sagging. Metal shall be free of burrs, sharp corners, and edges.

G. Doors, Frames and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components form falling accidentally during relamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.
4. Laminated Silver Metallized Film: 90 percent.

I. Acrylic Lighting Diffusers shall be 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless different thickness is indicated.
2. UV stabilized.

2.2 LAMPS

A. Four Foot Fluorescent Lamps: High Performance T5 Lamps:
1. Minimum 3000 initial lumens and minimum of 2820 mean lumens.
2. Minimum 24,000 hour rated life at three-hour starts.
3. Color Rendering Index (CRI) of 81 or higher.
4. 4100°K color temperature.
5. Lamps shall be suitable for use with program start ballasts and occupancy sensors.
6. Lamps shall meet "TLCP" requirements for low mercury.
7. Mean system efficiency equal to 90MLPW minimum, with instant start ballasts.

B. Acceptable lamp manufacturers and catalog numbers are (or equal):
1. Philips - F28T5/841/ALTO - F54T5/841/HO/ALTO
2. GE - F28T5/841/ECO - F54W/T5/841/ECO
3. Sylvania - FP28/841/ECO - FP54/841/HO/ECO
4. Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Lamps manufactured by others will be accepted provided they meet or exceed the specifications.

C. Compact Fluorescent Lamps:
1. Compact fluorescent lamp temperature shall be 5000°K with a color rendering index (CRI) at or above 80. See lighting fixture schedule on drawings.

2.3 FLUORESCENT BALLASTS

A. All fluorescent ballasts shall be electronic type and shall meet the following specs:
1. UL Listed (Class P) sound rating A and CSA certified.
2. Comply with EMI and RFI limits set by the FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
3. Meet any applicable standards set forth by ANSI.
4. Be potted or conformal coated in a metallic case and not contain PCBs.
5. Provide normal rated lamp life as stated by lamp manufacturers (i.e. rated life at 3 hour burn time per start).
6. Provide independent test results from an approved testing laboratory for all of the specifications below. This is required for all submitted ballasts.
7. Nominal power factor of .90 or higher.

8. Total harmonic distortion of less than 10% at 120 or 277 volts (universal voltage).
9. Ballast factor 0.70 through 1.2, as shown on the lighting fixture schedule.
10. Frequency of operation shall be 40 kHz - 50 kHz and units shall operate without visible flicker.
11. Ballast efficiency factor shall meet Consortium of Energy Efficiency (www.cee1.org) specifications (adopted by Focus on Energy program).
12. Multi-lamp ballasts shall operate in parallel so that when one lamp burns out, the other lamps will continue to operate at full light output.
13. Ballast Efficiency Factor (BEF) shall be as shown in the table below.

Number of Lamps	Low (BF ≤ 0.85)	Normal (0.85 < BF ≤ 1)	High (BF > 1.0)
PROGRAMMED - START BALLASTS (T5 lamps)			
1	≥ 2.85	≥ 2.84	N.A.
2	≥1.48	≥1.47	≥ 1.51
3	≥ 0.97	≥ 1.00	≥ 1.00
4	≥ 0.76	≥ 0.75	≥ 0.75

14. Ballasts shall carry a minimum 5 year warranty with a $10 replacement labor allowance.
15. Ballasts shall not be affected by lamp failure.
16. Ballasts shall be a standard production item.
17. Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.
18. Ballasts shall withstand line transients as defined in IEEE 587, Category A.

B. Acceptable ballast manufacturer's names and product lines are as follows:
1. Osram Sylvania - Quicktronic High Efficiency and Quicktronic PROstart.
2. GE Lighting - Ultramax and UltraStart.
3. Maxlite - High Efficiency Ballast.
4. Advance - Optanium.
5. Universal Lighting Technologies - F25T8.
6. Manufacturer names are used to develop quality and performance requirements only. All manufacturers and their products shall meet the system performance requirements and this entire specification.

2.4 COMPACT FLUORESCENT BALLASTS (ELECTRONIC)

A. Ballasts shall be high power factor, class P, with voltage rating matching the branch circuit voltage.

B. Ballast factor shall be 0.85 or higher.

C. Ballast shall have lamp fault shut-off circuitry to prevent starting of a faulty lamp.

D. Cold-weather ballast must reliably start and operate the lamp in ambient temperatures down to 0°F for the rated life of the lamp.

2.5 DIMMING BALLASTS (FLUORESCENT)

A. Ballast shall provide continuous, flicker-free dimming from 100% to 5%.

B. Ballast shall have Total Harmonic Distortion of less than 10%.

C. Ballast power factor shall be greater than 0.95.

D. Ballast factor shall be 0.85 or higher for T8 lamps, 0.95 or higher for T5 lamps.

E. Ballast shall be high frequency electronic type and operate lamps at a frequency above 25 kHz for T5 lamps.

F. Ballast shall have built-in inrush current limiting circuitry, maximum of 7 amps for 120 volts and 3 amps for 277 volts.

G. Ballast shall have internal fusing.

H. Ballast shall have ultra-quiet operation.

I. Operating temperature shall not exceed 75° C on the case during normal operation.

J. Minimum lamp starting temperature shall be 10°C / 50° F.

2.6 LIGHT EMITTING DIODE (LED)

A. Comply with NEMA C78.377, 2008

B. Comply with LM-80

C. Shall have a minimum initial lumen rating of 628 per foot

D. Rated life of 50,000 hours at 70% light output

E. 5000k color temperature

F. Color Rendering Index (CRI) of 70 or higher

G. Dimmable with a 0-10V dimming system

2.7 LIGHT EMITTING DIODE (LED) DRIVER OR TRANSFORMER

A. Comply with NEMA C82.77, 2002

B. Input voltage of 120-277V

C. Rated to be enclosed in a NEMA type enclosure

D. Rated for use above accessible ceiling

E. Accepts 0-10V signals from a dimming system

F. Rated life equal to the LED its operating

2.8 BALLASTS FOR BI-LEVEL CONTROLLED LIGHTING FIXTURES: ELECTRONIC TYPE (FLUORESCENT)

A. Operating Modes: Ballast circuit and leads provide for remote control of the light output of the associated lamp between high- and low-level and off.
   1. High Level Operation: 100 percent of rated lamp lumens.

B. Ballast shall provide equal current to each lamp in each operating mode.

C. Compatibility: Certified by manufacturer for use with specific bi-level control system and lamp type indicated.

2.9 EMERGENCY FLUORESCENT POWER UNIT

A. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast. Comply with UL 924.
   1. Emergency Connection: Operate 1 or 2 fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery-inverter unit and switched circuited to fixture ballast.
   2. Test Push Button and Indicator Light: Visible and accessible without opening fixture or entering ceiling space.
      a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
      b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   3. Battery: Sealed, maintenance-free, nickel-cadmium type.
   4. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
   5. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
   6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

2.10 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:
   1. Lamps for AC Operation: Fluorescent, 2 for each fixture, 20,000 hours of rated lamp life.
   2. Lamps for AC Operation: LEDs, 70,000 hours minimum rated lamp life.
   3. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
      a. Battery: Sealed, maintenance-free, nickel-cadmium type.
      b. Charger: Fully automatic, solid-state type with sealed transfer relay.

c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
d. Test Push Button: Push-to—test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
f. Remote Test: Switch in hand-held remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
g. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and flashing red LED.

4. Master/Remote Sign Configurations:
   a. Master Unit: Comply with requirements above for self-powered exit signs, and provide additional capacity in LED power supply for power connection to remote unit.
   b. Remote Unit: Comply with requirements above for self-powered exit signs, except omit power supply, battery, and test features. Arrange to receive full power requirements from master unit. Connect for testing concurrently with master unit as a unified system.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.

C. Support luminaires larger than 2 x 4 foot (600 x 1 200 mm) size independent of ceiling framing.

D. Locate ceiling luminaires as indicated on reflected ceiling plan.

E. Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

F. The Contractor shall install fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

G. Install recessed luminaires to permit removal from below.

H. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Install code required hardware to secure recessed grid-supported luminaires in place.

J. Install wall mounted luminaires and exit signs at height as scheduled.

K. Install accessories furnished with each luminaire.

L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

M. Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

N. Install specified lamps in each luminaire and exit sign.

O. All lamps shall be delivered to the job in sealed cartons and protected from dirt and dust during storage on the project. Lamps shall be taken directly from the cartons and installed in the fixture with special care so that they do not become dusty and are not soiled in the operation.

P. Lamps installed in fixtures using dimming ballasts shall be burned in at 100% rated output by the contractor for a minimum of 100 hours as recommended by the ballast manufacturer.

Q. All new lamps shall be operational at the Substantial Completion of the project.

3.2 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

C. Touch up luminaire finish at completion of work.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ALL FIXTURE CONNECTIONS INCLUDING MASTER-SLAVE

A. Direct box or conduit connections for surface and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be minimum 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Flexible whip between master and slave fixtures may be supported off of the ceiling grid wires. Conduit length shall allow movement of the fixture for maintenance purposes. Minimum wire size shall be #18 AWG for single fixture or master-slave fixture.

B. The flexible connectors shall be all steel, galvanized, clamp type with locknut or snap-in connector including those used on the master-slave unit.

3.5 TRAINING

A. See Section 260500 for general training requirements.

B. In addition to the training provided in Section 260500, provide an additional 1 hour of training for each type of lighting fixture provided on the project.

END OF SECTION 265113

SECTION 283100 – FIRE DETECTION AND ALARM

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Fire Alarm System as shown on the drawings and as herein specified.

1.2 SECTION INCLUDES

A. Multiplex/Intelligent Fire Alarm Control Panel (FACP)

B. Operation: Multiplex/Intelligent Fire Alarm System

C. Central Monitoring

D. Remote Annunciator Panels

E. NAC Booster Panels (Remote Power Supplies)

F. Multiplex/Intelligent Peripheral Devices

G. Fault Isolator Module (FIM)

H. Conventional Peripheral Devices

I. Audio/Visual Notification Appliances

J. Printers and Terminals

K. Special Devices

1.3 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specifications Sections, apply to this Section.

B. Section 260500 - Common Work Results for Electrical

C. Section 260526 - Grounding and Bonding for Electrical Systems

D. Section 260529 - Hangers and Supports for Electrical Systems

E. Section 260533 - Raceway and Boxes for Electrical Systems

F. Section 260553 - Identifications for Electrical Systems

G. Section 262726 - Wiring Devices

1.4 SUBMITTALS

A. Under the provisions of Section 260500 and Division 1, submit the following for approval prior to ordering any equipment in accordance with requirements of Division 1, General Conditions. Submit a total of ten (10) sets.

B. Copies of CAD Files (AutoCAD, latest version, or DXF Format) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts.

C. Required Submittal Materials:
1. The following items, and any additional items required per Section 260500, shall be included within the submittal package:
   a. Although they may be submitted under separate cover, Submittal Brochures/Booklets/Binders and Shop Drawings shall be submitted together, and shall be treated as a complete set.
2. Cover Sheet:
   a. The submittals shall contain a cover sheet, which shall include the following information:
      1) Submittal Date
      2) Specification Section(s)
      3) Fire Alarm Contractor (Contact Name, name, address, and telephone number)
      4) Electrical Contractor (Contact Name, name, address, and telephone number)
      5) Project Name, Project City, Project State, and Project Address.
3. Tabs And Table Of Contents:
   a. The Table of Contents shall appear immediately behind the Cover Sheet, and shall contain a complete listing of all of the tabs contained within the binder/booklet.
      1) Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-divided into sections. Tabbed sections shall be provided, at minimum, for the following:
      2) One section for each building - ALL submittal data, which applies to any particular building, shall be located within the tabbed section for the corresponding building. All submittal data within each "building" section shall appear in the same order.
      3) One section for manufacturer's data sheets - divided into sub-sections for the following:
         a) Panel Equipment (Panels, Panel Components/Modules, Printers, Annunciators, etc.)
         b) Addressable Field Devices (Initiating and Control/Monitoring/Isolation)
         c) Non-Addressable Field Devices (Initiating Devices, relays, etc.)
         d) Notification Appliances
         e) Fire-Fighter Communications Equipment if applicable

4. Equipment List:
   a. A complete equipment list of all components, including the following: Quantity, Manufacturer, Part Number, and Description. If the supplier uses different part numbers from those of the actual manufacturer, the actual manufacturer and part numbers as they appear - marked on the shipping box/packages, shall also be identified on this list.
      1) Each Equipment List shall include a complete listing of the modules, components, and software included for each modular Fire Alarm Control Panel, Network Panel, Transponder, Outboard Gear Panel or Annunciator. Such items shall be listed in a manner that clearly indicates that such items are parts of/components of a larger unit. Simply stating a single part number and description for such panels shall be unacceptable.
      2) A separate list shall be included for each section, with items grouped by system.
      3) For projects involving multiple systems, separate equipment lists shall be provided - one for each system.
      4) Spare Parts shall also be listed separately, and shall be identified clearly as "Spare Equipment".
5. Product Data:
   a. Manufacturer's product data sheets and equipment description of all system components. These data sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data sheets that include multiple products, products that are not used shall be crossed out.
      1) Product Data Sheets shall be organized, in order, corresponding to the FIRST occurrence of the corresponding item on the equipment list
6. Sequence Of Operation:
   a. Complete sequence of operations of all functions of the system. This sequence of operation shall be custom-created for this particular job.
      1) In order to satisfy this submittal requirement, it shall be acceptable to include copies of the "Operation" portions of the specifications, including any applicable schedules/other supplementary information. Copied specification pages shall be marked and highlighted, where the programmed operation will differ from the specified operation. Copied specification pages shall be marked "no changes", where no significant deviation will occur. Other acceptable alternatives shall include written narratives, organized in a logical manner, and Matrix Charts.
      2) Where Matrix Charts are provided, such charts shall be organized and labeled clearly, and shall incorporate suitable levels of detail (refer to NFPA-72 (1999) A-7-5-2.2(9) for an example of an acceptable matrix chart). The Leftmost column of the Matrix Chart shall include groupings of initiating devices and other function switches. The Topmost Row shall include groupings of notification appliances and output devices.
7. Battery Calculations:
   a. These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field devices and panel components/modules. It is generally recommended to submit such calculations in a "spreadsheet" format. These calculations shall include any reserve/additional capacity, as required elsewhere within these specifications. Final results shall indicate both the minimum battery capacity required and the capacity actually provided.
8. Amplifier Capacity Calculations:
   a. For all speakers plus all required spare capacity.

9. Addressable Device/Descriptor List:
   a. Prior to programming the system, submit a chart or printout, listing every system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls. This printout shall include the corresponding device type and field programmable "custom labels", as they will be displayed on the New System – at the FACP and Local Annunciator. The addresses listed within this document shall directly correspond to the addresses marked on the submitted floor plan drawings. This list will be modified as needed by the Owner and returned to the contractor for final programming in to the system.
10. Nac Wire Drop Calculations:
   a. Calculations shall be provided for all Notification Appliance Circuits (NAC) in the building. It is recommended that this calculation should follow a "spreadsheet" format, and should clearly indicate the following:
      1) The name of the circuit
      2) Point of origin of the circuit
      3) Complete list of all devices served by the circuit, including location and type of each device
      4) Alarm Current Draw for each device, at the applied voltage
      5) Applied Voltage (Based on anticipated battery voltage after specified stand-by & alarm operation)
      6) Acceptable Operating Voltage for each type of device on circuit
      7) Calculated Voltage at each device on circuit
   b. These calculations should mathematically prove that all Notification Appliances on the circuit will receive acceptable power for proper operation, under "worst-case-scenario" conditions.
11. Shop Drawings:
   a. All submitted drawings shall be created using CAD, and shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated. CAD formatted fire alarm drawings may be made available from the A/E at a cost of $100 per sheet requested.
   b. Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP DRAWINGS – PREPARED BY: (insert name of contractor firm preparing the shop drawings)", and shall be clearly and visibly different from the Contract Documents/Bidding Drawings. As a minimum, the name and company logo for the Electrical Contractor and the Fire Alarm Equipment Vendor should be added to each sheet, and a revision date shall be inserted on each sheet.
   c. The submitted Shop Drawings shall include the following types of drawings:
      1) Project-Specific Drawings:
         a) Project-Specific Drawings. These drawings shall include the following:
         b) System Riser Drawing:
         c) A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate all fire alarm circuits, which serve the facility, and shall incorporate the following information, in a clear, concise format:
            - Point of origin of each circuit (usually a Panel, or a Module within a panel)
            - Circuit type and labeling

- Area served by each circuit
- Wire/cable type and size
- Locations of Panelboards where primary system power is obtained
- The following information for each Field Device:
  - Device Type
  - Circuit(s) to which device is connected
  - Locations of any End-Of-Line Resistor (EOLR)
  - (and the circuit terminated by any such EOLR)

12. Block Diagrams:
    a. Showing layout and operation of the entire system.
    b. Floor Plans:
        1) These drawings shall consist of edited versions of the Contract Documents, which shall include the following information:
            a) Fire Department Response Location(s)
            b) Annunciator Location(s)
            c) Panel Location(s)
            d) Device Addresses - The addresses shown on these drawings shall directly correspond to the chart or printout, as specified previously, which spells out specific information about each device, including the field programmable "custom label".

D. Typical Device/Module Wiring Details:
1. Component and module wiring diagrams - intended to illustrate terminations and wiring connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each typical panel component/module utilized within the system. This set of drawings shall only include diagrams for modules and components, which are actually used in the provided system(s).
2. These drawings shall incorporate clear labeling/nomenclature, which shall clearly indicate the corresponding field device or module, to which it corresponds.
3. OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the EC/FAC has any questions concerning the preparation of these materials, please contact the Engineer.

1.5 QUALITY ASSURANCE

A. Unless specifically stated otherwise, each and all items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

B. Notification Appliances may be products of a single, different manufacturer – provided that the Primary Equipment Provider or Manufacturer provides written documentation of compatibility, and agrees to assume any and all responsibility for compatibility with the Control Equipment.

C. In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:
1. UOJZ UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable.

2. UL 864 Transient protection
3. UL 497B Isolated Loop Circuit Protectors. Where fire alarm circuits leave the building, additional transient protection must be provided for each circuit.
4. UL 1481 Power Limited Applications.

1.6 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:
1. A material guide, which shall contain the replacement part numbers and description of all components used. If this information is included in an instruction section for any of the equipment, it will not be necessary to duplicate the list. In either case, the parts list shall be associated with its respective chassis, modules or kit wherein it is found. A total listing of parts without such grouping will not be acceptable.
2. Catalog data or literature
3. Manufacturer's operating instructions.
4. Manufacturer's maintenance instructions
5. Installation instructions
6. Name, address and telephone number of source for parts (i.e. keys, guards, etc.) not supplied by the Fire Alarm Manufacturer
7. Copies of all approved shop drawings
8. An updated copy of the submitted sequence of operation, revised to reflect any implemented changes

1.7 DELIVERY, STORAGE AND HANDLING

A. Receive equipment at job site; verify applicable components and quantity delivered.

B. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.

C. Do not install damaged equipment.

D. Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises.

1.8 DESCRIPTION OF WORK

A. A new complete fire alarm system at 5726 Raymond Road, Madison, WI shall be installed. This system will be serve the Meadowridge Library and the Meadwood Neighborhood Center. The system shall consist of speakers, strobes, duct detectors, flow and tamper switches.

B. The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

C. The New Fire Alarm System shall consist of a single Main Fire Alarm Control Panel (FACP), and Fire Alarm Annunciator Panel (FAAP) unless a different design is submitted and approved.

D. The New Fire Alarm System shall be configured as a local protective signaling system, as defined in NFPA-72, and shall use/incorporate the following features, as a minimum:
1. The latest intelligent digital, addressable technology (detectors/sensors and modular panel equipment) currently available from the manufacturer
2. A Single-Channel, selective [non-selective], One-Way Voice Communications (EVAC) Non-Coded, Speaker-type Audible Notification Appliances
3. Signaling Line Circuits (SLCs), connecting addressable field points to the associated Fire Alarm Control Panel, shall be configured as NFPA style 4 (Class B), with point supervision.
   a. Isolated SLC Circuits, or circuit branches shall be provided, such that as a minimum, the following areas are independently isolated (a single Short Circuit or Ground Fault, on the SLC wiring on any floor shall not affect the proper operation of the SLC serving any other floor):
   b. Floors with more than 25 Addressable Devices shall be split into isolated SLC sub-circuits where each circuit shall not have more 25 devices. Where this is done, the floor shall be "split" along a logical, physical boundary.
4. Network Connections, Data, Audio, and Signaling Line Circuits, which functionally link together multiple panels or Transponders shall be wired in an NFPA Style 6 (Class A) arrangement.
5. Initiating Device Circuits (IDCs) shall be limited to short runs from Monitor Modules to the connected device, unless specifically stated otherwise herein, and shall be configured as NFPA Style B (Class B), with individual zone supervision.
6. Notification Appliance Circuits (NACs) shall be configured as NFPA Style Y (Class "B"). Audible NACs serving Speakers shall be installed using shielded cable, such that the speakers do not generate unwanted noises, due to cross-talk with other circuits.
7. Data Circuits to Annunciators shall be configured as NFPA Style 4 (Class "B"). All annunciators shall be fully supervised.

E. The system shall be an intelligent/digital type, and shall consist of the following panels:

PANEL NAME:	PANEL TYPE:	PANEL LOCATION:
FACP	Main Fire Alarm Control Unit	See Plans
FAAP	Fire Alarm Annunciator Panel	See Plans

1.9 REGULATORY REQUIREMENTS

A. The complete installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:
1. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):
   a. NFPA-70 National Electrical Code (NEC) Generally, and Article 760 in particular
   b. NFPA-72 National Fire Alarm Code
   c. NFPA 101 Life Safety Code
   d. IBC International Building Code
   e. IFC International Fire Code
   f. IMC International Mechanical Code

2. NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)
3. UNDERWRITERS' LABORATORIES, INC. (UL)
   a. UL-864 Control Units for Fire Protective Signaling Systems
   b. UL-268 Smoke Detector for Fire Protective Signaling Systems
   c. UL-217 Smoke Detectors for Single and Multiple Station
   d. UL-521 Heat Detectors for Fire Protective Signaling Systems
   e. UL-464 Audible Signaling Appliances
   f. UL-1971 Visual Signaling Appliances
   g. UL-38 Manually Actuated Signaling Boxes
   h. UL-1481 Power Supplies for Fire Protective Signaling Systems

1.10 MANUFACTURER PROVIDED SERVICES

A. A manufacturer-trained service technician shall provide the following installation supervision. This Technician shall be certified by the equipment manufacturer, and shall have had a minimum of two (2) years of service experience in the fire alarm industry.

B. The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the project engineer. The manufacturer's service technician shall be responsible for the following items:
   1. Pre-installation visit to the job site to review equipment submittals and verify method by which the system should be wired.
   2. Periodic job site visits to verify installation and wiring of system, and to perform any partial system programming - required to permit portions of the existing system to be removed.
   3. Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.
   4. At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.
   5. All job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the Project Engineer any time during the project.

1.11 QUALIFICATIONS

A. All equipment shall be supplied by a firm, which specializes in fire alarm and smoke detection systems with a minimum of five (5) years-documented experience. The company shall be an authorized distributor of the proposed equipment

B. All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems. Proof of five (5) years documented experience and of factory authorization to furnish and install the equipment proposed shall be furnished prior to contract award, if required by Division of State Facilities.

C. Contractor shall be located within three (3) hours of travel time or less from the site of this project.

1.12 CITY OF MADISON – FIRE DEPARTMENT INSPECTION/FIRE ALARM WORK PERMIT:

A. PER A LOCAL ORDINANCE (City of Madison General Ordinance 34 – Fire Prevention Code) EFFECTIVE AS OF JULY 2, 2002 - THE FIRE ALARM AND FIRE PROTECTION SYSTEMS, AS INSTALLED WITHIN THIS FACILITY ARE SUBJECT TO PERMIT REQUIREMENTS AND INSPECTIONS OF THE INSTALLATION BY THE CITY OF MADISON – FIRE DEPARTMENT/FIRE PREVENTION BUREAU:

B. THE FAC SHALL BE RESPONSIBLE FOR SCHEDULING, COORDINATING, AND ATTENDING THIS INSPECTION, AND FOR PAYMENT OF ALL ASSOCIATED INSPECTION/PERMIT FEES.

C. This process normally involves both a plan review and inspections; however, for State-Owned Buildings, the City of Madison only performs the inspections, with the Plan Review being performed by COMM/Safety & Buildings as specified previously under "Submittals".

D. Copies of the applicable Code can be obtained on-line, via the following link:
   1. http://www.madisonfire.org/prevention/pdf/mgo34.pdf

E. Because of this Permit/Inspection process, the following procedure shall be followed by the Division 26 Electrical Contractor, (and by their sub-contractors, where particular arrangements have been made between the EC and their sub-contractor(s)):
   1. First, the Electrical Contractor shall obtain State-Approval of the Installation Drawings, per the process previously described under "Submittals – Plan Review Process", as found within this specification.
   2. Once the State-Approved Drawings are received by the contractor, and PRIOR TO STARTING ANY CONSTRUCTION, the Electrical Contractor shall completely fill-out submit the proper "City of Madison Fire Department – Fire Protection System Work Permit Application" form. If required, suitable fee payment shall accompany the form. Copies of this form may be obtained via the following link:
      a. http://www.madisonfire.org/prevention/fire_protection_engineering/pdf_files/master_plan_review_permit_application.pdf
   3. Once the form has been received, processed, and accepted by the Madison Fire Department (MFD), MFD will issue the proper permit, and construction may begin.
   4. The inspection program involves at least two inspections, as follows:
      a. A Rough-In Inspection shall be scheduled and performed, prior to installation of any new devices. In certain buildings (high-rises), multiple rough-in inspections may be required, as subsequent areas are completed. It is highly recommended that these inspections should be carefully scheduled and adhered to, since potentially costly mistakes can be prevented before the associated devices are completely installed.
      b. Final Inspection of the System – prior to this inspection, the Electrical Contractor shall have conducted all necessary pre-testing.
      c. Questions regarding this inspection program may be directed to:

      City of Madison – Fire Department – Fire Prevention Bureau
      325 West Johnson Street
      Madison, WI 53703
      Phone: (608) 266 – 4420 (Non-Emergency Number)

1.13 PROJECT RECORD DRAWINGS

A. Installing Electrical Contractor shall submit to the Owner Construction Superintendent the as-built drawings for the entire work done under this project prior to final payment.

B. Work shall be done on Auto CAD using the contract drawings provided to the Contractor by Owner in the form of Auto CAD files. A hard copy of same shall also be submitted.

C. These drawings shall show:
1. Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-monitoring devices, supervised signaling devices, and auxiliary control devices.
2. Circuit and Address information for each field device listed above.
3. Conduit layout and size
4. Number/size/type of conductors in each conduit run
5. Riser diagrams
6. Location of end-of-line devices

D. Riser diagrams shall include location of emergency 120VAC panel, panel designation and circuit number used to feed each fire alarm panel. Also, indicate if panel is backed up by an emergency generator.

E. Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices and addresses for all addressable field devices.

F. Also see requirements in Division 1, General Conditions.

1.14 SPARE PARTS

A. Contractor shall provide the following spare parts in quantities shown:

Quantity:	Type of Device
(2)	Monitor Module (of each type utilized in this project)
(2)	Control Modules
(1)	Duct detectors with housing, head, remote test station, and sample tubes.
(2)	Ceiling-Mount multi-candela Speaker/strobe Units.

1.15 SUPERVISION

A. The system shall report a TROUBLE condition when any supervised circuit becomes disarranged, disconnected, or is manually disabled or overridden. Each supervised circuit shall be independently protected for short-circuit conditions, and shall be arranged so that faults on any one circuit do not prevent the proper operation of any other circuit in the system.

B. The following devices/circuits shall be supervised, as a minimum:
1. ALL communications links.
2. ALL Signaling Line Circuits
3. ALL Initiating Device Circuits.
4. All sprinkler flow and tamper switches..

5. ALL Notification Appliance Circuits.
6. Auxiliary manual control circuits.
7. Remote Control Relays/Control Modules.
8. Primary, AC Incoming power to the system.
9. The system's batteries.
10. System Expansion Modules
11. Auxiliary module LED's.

C. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

D. Each independently supervised circuit shall include a discrete LCD readout, to indicate disarrangement conditions per circuit.

1.16 POWER REQUIREMENTS

A. Primary 120 VAC power, to all Fire Alarm equipment shall consist of dedicated branch circuits. These circuits shall be of a 3-conductor type, including a suitably sized green ground wire - SHARED NEUTRALS AND CONDUIT GROUNDS SHALL BE UNACCEPTABLE.

B. Each control panel shall receive 120 VAC power via a branch circuit in one of the building's emergency load panels. Each such branch circuit shall have a "breaker lock" to prevent accidentally de-energizing of the power to the fire alarm panel. Circuit breakers shall be painted red and labeled "FIRE ALARM". If more than one power circuit is used, each circuit shall be properly labeled as "FIRE ALARM", and shall also be labeled with additional information - in order to indicate which fire alarm equipment is powered from each such circuit.

C. All fire alarm power supplies, as well as any other supplemental power supplies, shall be installed in compliance with NFPA-70 - National Electrical Code (Latest Edition).

D. The panel shall include a disconnect switch for the AC power inside a locked enclosure near the panel or within the panel itself. This switch shall be labeled "Fire Alarm Power Disconnect".

E. Where the new control panel is to remain at same location as the existing panel, the contractor may re-use the existing branch circuit, if it meets the previously stated requirements stated above.

F. The control panel shall include 120 VAC electrical power surge and transient protection. If problems are anticipated, due to electrical transients associated with periodic generator testing, then the fire alarm equipment supplier shall provide suitable power filtering/suppression equipment, as recommended by the equipment manufacturer.

G. The system shall include sufficient back-up battery capacity to operate the entire system as follows, upon loss of normal 120 VAC power:

H. The panel shall include a power-limited, filtered and regulated battery charger. The charger shall charge a fully discharged battery to 70% in 12 hours. The panel shall monitor for AC fail/disconnect, low/no battery and high battery and shall distinctly display or annunciator any abnormality. The main panel power supply shall include sufficient power to power all

connected field devices and an additional 25% spare power for future additions without the need to add additional boards or booster power supplies. The charger shall be designed specifically for, or shall be properly configured for the provided batteries, which shall be of one of the following types:

1. Sealed, Immobilized Electrolyte Lead-Acid type ("Gel-Cells") - Types which require fluid level maintenance, or which vent significant amounts of Hydrogen shall be unacceptable.
2. Nickel-Cadmium (Ni-Cad) batteries.

I. All batteries used in conjunction with the fire alarm system shall be installed in accordance with NFPA-70 - National Electrical Code (Latest Edition).

J. If these batteries are not located within or immediately adjacent to the fire alarm equipment, the location of such batteries shall be clearly indicated within the fire alarm equipment served by them, and the batteries and their enclosure shall be clearly marked as "FIRE ALARM"

K. All external circuits requiring system-operating power shall be 24VDC and shall be individually supervised and fused at the control panel.

PART 2 – PRODUCTS

2.1 ENCLOSURES

A. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

B. Cabinet shall be equipped with locks and transparent door panel providing tamper proof enclosure yet allowing full view of the various lights and controls as required above.

2.2 MULTIPLEX/INTELLIGENT FIRE ALARM CONTROL PANEL (FACP):

A. A Multiplex intelligent fire alarm system shall be installed within the {A/E LIST NAME(s) OF FACILITY OR FACILITIES}. [Each] [This] building shall be provided with a minimum of one Fire Alarm Control Panel (FACP), as shown on the project drawings.

B. [The] [Each] control Panel shall be modular, expandable with solid state, microprocessor based electronics. It shall display through the front viewing window only those primary controls and displays essential to operation during a fire alarm condition.

C. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. Software programming shall allow for full flexibility for selective input/output control functions based on the Boolean programming functions AND, OR, NOT, as well as, timing, and special coded operations. The system shall be able to use all of the above programming functions in combination with any number of inputs and outputs. The systems shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

D. Simple Addressable systems, which do not support Analog Addressable or Intelligent Addressable detection technology shall also be unacceptable.

E. [The] [Each] control panel shall provide the following as standards:
   1. Analog Addressable or Intelligent Addressable Detection, supporting the following:
      a. Drift compensation
      b. Sensitivity display in %
      c. Sensitivity adjustment
      d. Day/night sensitivity adjustment
      e. Auto Detector test to meet NFPA 72
      f. Alarm verification with tally counter
      g. Maintenance alerts
   2. The number of Signaling Line Circuits (SLCs) required for the specified quantity of addressable field devices and peripherals, plus one (1) spare loop (SLC) for each five (5) active loops. Each active loop shall include 10% spare capacity or a minimum of 10 additional devices.
   3. The number of Audible Notification Appliance Circuits (Speaker NACs) required for the specified quantity of speakers plus one (1) spare circuit for each ten (10) active circuits. Each active circuit shall include 25% spare capacity
   4. The number of Visual Notification Appliance Circuits (Strobe NACs) required for the specified quantity of strobes plus one (1) spare circuit for each ten (10) active circuits. Each active circuit shall include 25% spare capacity or a minimum of (4) 110 cd devices that can be added in the future.
      a. 80-character liquid crystal display.
      b. Printer interface
      c. History log file with a minimum of 800 events
      d. Field programmability
      e. Silent walk test

F. The multiplex/intelligent system shall provide the ability to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history.

G. The LCD shall display the following information relative to the abnormal condition of a point in the system prior to acknowledgement:
   1. 40 characters for:
      a. Point address and loop number (i.e. 555-L5)
      b. Type of device (i.e. smoke sensor, pull station, water-flow)
      c. Point status (i.e. alarm, trouble)
   2. 40 characters for:
      a. Custom location label (i.e. 4th Floor - Room 444)

H. Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

I. The following software functions shall be provided, from the built-in system keyboard/display:
   1. Setting of time and date
   2. LED testing
   3. Alarm, trouble, and abnormal condition listing
   4. Enabling and disabling of each monitor point separately
   5. Activation and deactivation of each control point separately
   6. Changing operator access levels

7. Walk Test enable/disable
8. Running diagnostic functions
9. Displaying historical logs
10. Point listing

J. The following hardware switches/functions shall be provided within the main panel enclosure:
1. Acknowledge alarm or trouble
2. Silence alarm or trouble
3. Reset system after alarm
4. Connect/disconnect Central Monitoring tie
5. Provide manual evacuation (drill)
6. Bypass elevator interface
7. Bypass AHU/Fan Interface
8. Bypass door holders
9. Switches not applicable to this building shall still be provided in the stated quantity along with (2) additional switches for future expansion. These additional switches as well as any switches not utilized would not be initially programmed and would be label unused.

K. STATUS INDICATORS AND DISPLAYS
1. A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall also sound during each key-press to provide an audible feedback to ensure that the key has been pressed properly.
2. The 2-line by 40-character liquid crystal display shall be backlit for enhanced readability.
3. A cursor shall be visible on the LCD when entering information.
   a. Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user

L. CONTROLS
1. The following controls shall be accessible with the front door open.
   a. Manual evacuation (drill)
   b. EVAC Microphone, and associated Audio Controls and Indicators
   c. LED/LCD Test Switch
   d. Key pad for data input and microprocessor control
   e. Bypass Function Switches and LEDs for the following. Mark unused future if not applicable:
      1) Central Monitoring Bypass
      2) Elevator Interface bypass
      3) HVAC/Fan Interface bypass
      4) Door holder release bypass
      5) Future Programmable Switch #1
      6) Future Programmable Switch #2

M. LED SUPERVISION
1. All slave modules LEDs shall be supervised for burnout or disarrangement

N. ACKNOWLEDGMENT
1. Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements.

2. First method - Acknowledge one event at a time from an unacknowledged list of events:

a. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only the displayed point.
b. After all points have been acknowledged, the LEDs shall glow steadily and the Sonalert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".

O. SILENCING
1. If an alarm condition exists and the "Alarm Silence" button is pressed, all alarm audio and visual notifications appliances shall cease operation.
2. If trouble conditions exist in the system and the "Trouble Silence" button has been pressed, the aural trouble signal shall cease, but shall resound at time intervals to act as a reminder that the fire alarm system is not in a normal operating mode. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.

P. RESET
1. The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied.
2. Should the Alarm Silence Inhibit function be active, the system shall ignore all key presses. An indication of enabling and disabling the inhibit state shall be provided as a feedback to the operator.

Q. BYPASS FUNCTIONS
1. Provide a switch for each item as shown below. Switches not applicable to this building would be provided, but left non programmed and labeled and unused.
2. Bypass Switches shall be configured such that whenever any bypass function is active, a Trouble status condition shall be reported by the system, per the Trouble Sequence. The trouble message shall indicate the active function(s). Bypass LEDs shall be configured such that LEDs corresponding to the active function(s) shall illuminate, and shall remain lit until the associated bypass function is de-activated (until the system is restored to normal operating status). Switches and LEDs shall be provided for the following functions
   a. Central Monitoring Bypass - When this bypass function is active; reporting of various status conditions to the reporting system shall be disabled.
   b. Elevator Interface bypass - When this bypass function is active; actuation of the Control Modules or Supervised Relays, which interface to the Elevator Controls and to the Shunt-Trip Circuit Breaker(s) shall be prevented.
   c. HVAC/Fan Interface bypass - When this bypass function is active; actuation of the Control Modules or Supervised Relays, which interface to the AHU/Fan starters/Temperature Controls, and to any Smoke Dampers shall be prevented. (Smoke Control System bypass shall be accomplished via the separate, previously specified manual controls).
   d. Door holder release bypass - When this bypass function is active; actuation of the Control Modules or Relays, which cause release of the Door Holders shall be prevented.

R. Access To Operator Functions:
1. The following Operator Function Access Restrictions shall be adhered to as closely as possible. Where system limitations do not allow for the restrictions to be configured exactly as listed, alternate methods will be considered, and shall be brought to the attention of the Engineer prior to bidding:
   a. Access Level 1 - Basic Operator Functions:
      1) ACKNOWLEDGE - allows Basic Operators to acknowledge ALARM, TROUBLE, and SUPERVISORY conditions, and to view the lists/logs associated with these functions.
      2) SIGNAL SILENCE - allows Basic Operators to silence the audible and visual signals. The system shall not permit signals to be silenced during "alarm silence inhibit mode" (if "Inhibit Mode" is utilized).
      3) SYSTEM RESET - allows Basic Operators to Reset the Fire Alarm System. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English language messages.
   b. Access Level 2 - High Security Functions:
      1) Changes to the linkage of Operator Functions to Access Level/Pass-Code Profiles may affect the ability of individuals to access required functions. Because of this, access to this linking function shall also be appropriately secured.
   c. Access Level 3 - Other Functions:
      1) These functions shall include, but shall not be limited to:
         a) Enable/Disable Points
         b) Perform "Override" Functions/Features
         c) Generate Hard-Copy, Printed Reports
         d) Add/Delete/Change Pass codes, and associated links to system features
         e) Set/Change System Clock
         f) Set/Change Sensitivity of Detectors
         g) Clear History Logs

S. Point Listing
1. All points list by address
2. Monitor point list
3. Signal/speaker list
4. Auxiliary control list
5. Feedback point list

T. History Logging
1. The system shall be capable of logging and storing the last 800 events (alarm & trouble) in a history log. These events shall be stored in a battery protected random access memory.
2. The following historical alarm/trouble log events shall be stored:
   a. Alarms
   b. Alarm Acknowledgment
   c. Alarm Silence
   d. System Reset
   e. Alarm Historical log cleared

f. Trouble conditions
g. Supervisory alarms
h. Trouble acknowledgment
i. Supervisory acknowledgment
j. Alarm Verification tallies
k. Walk Test results
l. Trouble Historical log cleared

U. Silent Walk Test With History Logging
1. The system shall be capable of being tested by one person. While in testing mode the alarm activation of an alarm-initiating device shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after the logging of the alarm.
2. The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.
3. Should the silent walk-test feature be on for an inappropriate amount of time (30 minutes max.) it shall revert to the normal mode automatically.
4. The panel shall have the capability of dividing the system into distinctive walk test groups, a minimum of 8 groups.
5. Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described above.
6. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

V. Watch-Dog Timers
1. The system shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

W. Field Programming
1. The system shall be fully programmable, configurable, and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory IC's. All programming may be accomplished through the standard control panel keyboard or a keyboard at the printer, or the use of a PC. All programs shall be stored in non-volatile memory.
2. All programming or reprogramming shall be done by the supplier at no charge until the owner accepts the system.

X. Software Modifications
1. The system shall be capable of being programmed by means of a Field Configuration Program (FCP) allowing programming to be downloaded via portable computer from any node on the network.
2. Provide the services of a factory trained and authorized Technician to perform all system software modifications, upgrades, or changes. Response time of the Technician to the site shall not exceed 4 hours.
3. Should the Owner have a factory trained and authorized technician on staff, provide all hardware, software, programming tools, access codes, and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require

power-down of the system or loss of system fire protection while modifications are being made.

4. If the system access code is either a hardware key or a software key, the Contractor/Vendor shall provide the proper key to meet the above requirements."

Y. Terminal/Printer Interface
1. Fire Alarm Control Panel shall be capable of operating remote Command Center and printers.
2. Each output shall be ASCII, from an EIA RS-232-C serial data connection with an adjustable baud rate.
3. A minimum of one such RS-232 port shall be provided.
4. Each RS-232-C port shall be capable of being configured for either a CRT or a printer.
   a. One such port shall be configured for a supervised connection to the Fire Alarm System printer.
   b. One such port shall be configured for non-supervised connection to the CRT or Laptop.

Z. Signaling Line Circuits:
1. The system must provide communications with intelligent addressable initiating and control devices individually. These devices shall be individually annunciated at the control panel [and FAAP] [and RFCC]. Annunciation shall include the following conditions for each point:
   a. Alarm
   b. Trouble
   c. Open
   d. Short
   e. Device missing/failed
2. All intelligent addressable initiation and control devices shall have the capability of being disabled or enabled individually.
3. Systems that require factory pre-programming or EPROMs to add or delete devices shall be unacceptable.
4. The communication format must be a completely digital poll/response protocol to allow t-tapping of the Signaling Line Circuit wiring. Systems that do not utilize full digital transmission protocol are not acceptable.
5. Special-purpose Isolator devices shall be used to provide further isolation/protection of sections of the Signaling Line Circuits. Areas served by Signaling Line Circuits shall be isolated as specified within the "scope" portion of this specification. The following Isolation devices shall be acceptable for use in performing this function:
   a. Isolator Modules - Field Mounted.

2.3 OPERATION: MULTIPLEX/INTELLIGENT FIRE ALARM SYSTEM

A. Priority:
1. Fire Alarm status conditions shall have the highest priority.
2. Supervisory status conditions shall have the second highest priority.
3. Trouble status conditions shall have the lowest priority.

B. Stand-By Mode:
1. Under normal condition the front panel shall display a "System is Normal" message and the current time and date

C. System Response
1. The time delay between the Alarm activation of an initiating device, and the automatic activation of the Notification Appliances and the annunciation of the Alarm status condition at the FACP and annunciators shall not exceed 5 seconds.
2. For response-time purposes, the manual actuation of an Audio Control Switch - associated with the one-way voice communications system - shall be instantaneous and shall be treated as if it were manual alarm activation.

D. Alarm Sequence:
1. The following events are not required to occur in the stated order. However, ALL automatic responses must be initiated within the time interval allotted by UL and NFPA codes and standards.
2. This "Fire Alarm Sequence" shall be initiated upon receipt of one of the following, valid Fire Alarm status conditions:
   a. Actuation of any Manual Pull Station, any Fire Protective Sprinkler System, any other Automatic Fire Suppression System, from any Smoke Detector, any addressable Heat Detector, any beam-type Smoke Detectors, any non-addressable Heat Detector
3. The system alarm operation, subsequent to the activation of any of the conditions listed above, shall be as follows:
   a. The EVAC System shall automatically initiate "EVAC" Mode. All audible notification appliances (Speakers) within the building shall sound, using a sequence that is compliant with NFPA-72 – including an Alert Tone and a Digital Voice Message. The Alert Tone and Digital Message shall be repeated a minimum of three times, and shall continue to be repeated until the Audible Notification Appliances are Silenced, until a Manual Announcement is Made, or until the system is Reset.
   b. All visual notification appliances within the building shall flash continuously until the system is reset.
   c. Any subsequent alarm shall reactivate the alarm audible and visual notification appliances within the building.
   d. Alarm outputs connected to the facility reporting system shall be activated.]
   e. The system Alarm LED shall flash on the FACP and the FAAP, until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on.
   f. A subsequent alarm received from another device shall flash the system alarm LED on the FACP and the FAAP. The LCD display shall show the new alarm information.
   g. A pulsing alarm tone shall occur within the FACP and the FAAP until the event has been acknowledged.
   h. The system shall have a single key that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time and date of each occurrence.
   i. A programmed Alarm Message shall appear on the FACP and the FAAP LCD displays. These field programmable messages shall be revised, as directed by the Owner, during shop drawing review. The alarm shall be displayed on an 80-character LCD display as follows:
   j. 40 characters for:
      1) Point address and loop number
      2) Type of device
      3) Point status

k. 40 characters for:
1) Custom location label

E. Automatic Alarm Verification:
1. The initial Alarm activation of any system smoke detector shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, after (20) seconds and within (30) seconds after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within (30) seconds, the system shall resume normal operation. The alarm verification shall operate only on single smoke detector alarm. Other activated initiating devices or multiple smoke detector alarms shall be processed and reported immediately.
2. The alarm verification operation shall be selectable by device or by group for addressable detectors and by IDC for non-addressable smoke detectors. Automatic Alarm Verification shall be enabled for all smoke detectors [including resident room smoke detectors if they are connected to the fire alarm system].

F. Self-Test And Automatic Drift Compensation:
1. The control panel shall continuously perform an automatic self-test routine on each Smoke Detector, which will functionally check detector electronics and ensure the accuracy of the values being transmitted to the control panel. Any detector that fails this test shall indicate a "SELF TEST FAILED" trouble condition with the detector location at the control panel.
2. All Intelligent Addressable Smoke Detectors used on this project shall incorporate automatic drift compensation/automatic sensitivity monitoring and adjustment, as described within the "definitions" portion of this specification section.

G. AHU System Interface
1. Duct Smoke Detectors and Addressable Control Modules, or Supervised Remote Relays shall be provided as specified below. Duct Smoke Detectors shall be installed in compliance with the manufacturer's recommendations. Each Addressable Control Module or Supervised Remote Relay for AHU and/or Fan shutdown shall be installed within 3 feet of the Temperature Control Panel to which it is connected. The Division 26 EC shall provide all wiring and terminations required for shutdown of the specified AHUs/Fans.
2. The Addressable Control Modules or Supervised Remote Relays provided for this purpose shall be provided with DPDT output contacts. One SPDT set of the DPDT contacts shall be utilized for the specified shutdown function. The second SPDT set of the DPDT contacts shall be available for connection to the temperature controls, to indicate that unit shutdown – due to Duct Smoke – has occurred.
3. The control panel shall provide an output alarm interface to the air handling/energy management system controllers, which in turns shall perform automatic function as specified in the applicable sections of Division 23.
4. An override feature/control switch shall be provided which shall prevent shutdown of AHUs when this function is active.
5. The associated Fan shall be shut down only upon actuation of the Duct Smoke Detector associated with the particular unit.
6. All such AHUs/Fans shall remain shut down, until a valid System Reset occurs.

H. Sprinkler System Supervisory Service
1. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge switch.
2. The activation of any standpipe or sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the control panel [and FAAP] [and the RFCC]. The panel shall provide differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring.
   a. The Fire Pump shall be monitor for presence of power, loss of power and phase reversal
3. Pressing the supervisory service acknowledge key will silence the supervisory audible signal while maintaining the supervisory service LED "on" indicating the off-normal condition.
4. Restoring the valve to the normal position shall automatically reset the tamper indication.

I. Trouble Sequence:
1. Disarrangement, disconnection, Power Failure, or malfunction of any supervised feature(s)/components of the System shall cause actuation of the following sequence of events:
   a. A SYSTEM TROUBLE or POINT TROUBLE status condition shall be both audibly and visually indicated at the Fire Alarm Control Panel (FACP) [and FAAP] [and the RFCC] in a way which differentiates the TROUBLE status clearly from an ALARM. Audible indication shall cease, once the TROUBLE has been acknowledged.
   b. In addition, a programmed message, similar in nature to the ALARM "Custom Labels", shall appear on the FACP [and FAAP] [and the RFCC]. (Default messages, if TROUBLE Detector/Sensor/Module Point Messages are associated with ALARM messages, shall be acceptable.)

J. Manual Drill
1. A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated.

K. Led And Lcd Test
1. Activation of the Lamp Test switch shall turn on all LED indicators, LCD display, and the local sounder and then return to the previous condition.

L. System Diagnosis
1. The system shall include special software to detect, diagnose and report failures and isolate such failures to a printed circuit board level.

2.4 CENTRAL MONITORING

A. The new Fire Alarm System shall be interfaced to the following systems utilizing new copper dialer connection, for remote reporting of the various conditions listed below:
1. To the Owner-provided Security System. See below for required relay outputs.

B. The interface between the reporting system(s) listed above and the new Fire Alarm System shall be configured as follows:

C. Required relay (contact) outputs:
1. Fire Alarm: This contact shall actuate in response to any Fire Alarm status condition, other than Sprinkler Water Flow.
2. Water Flow Alarm: This contact shall actuate only in response to Fire Alarm status Conditions, which are due to Sprinkler Water Flow.
3. Sprinkler Supervisory: This contact shall actuate in response to actuation of any Valve Tamper Switch associated with the Fire Protective Sprinkler System.
4. System Trouble: This contact shall actuate in response to the occurrence of any Trouble status condition on the Fire Alarm System.

D. The Contractor installing the new Fire Alarm Systems shall be responsible for coordination of the Fire Alarm System connections to these system(s), for all wiring and conduit between these system(s), and for all terminations at the Fire Alarm end of such interface wiring. All such wiring, raceway, and terminations shall be included per the Base Bid.

2.5 REMOTE ANNUNCIATOR

A. Where shown on the plans, provide and install Annunciator FAAP.

B. Each panel shall incorporate an Alphanumeric LCD Annunciator, which shall functionally duplicate the FACP display, as well as standard controls for Acknowledge, Silence, and Reset.

C. Annunciation Features
1. The Annunciator portion of each panel shall consist of the standard, compact-size LCD Alphanumeric Annunciator, as manufactured by the Fire Alarm System Manufacturer. This unit shall mimic the display assembly of the FACP, and shall incorporate the following features:
   a. LCD Display
   b. Multi-function, integrated sounder – duplicates the FACP sounder
      1) LEDs for:
         a) Power (Green)
         b) Fire Alarm (Red)
         c) [Resident Unit/Dorm Room Smoke Detection/Priority 2 Alarm]
         d) Supervisory (Amber or Orange) [May also be used for Resident Unit/Dorm Room Smoke Detection]
         e) Trouble (Yellow)
   c. Secured Switches (Secured under keyed door, or enabled via key switch) for:
      1) Acknowledge
      2) Signal Silence
      3) System Reset

D. General Requirements
1. FAAP incorporate the following features:
   a. Mar-resistant painted enamel or a stainless steel finish.

b. FAAP Panel shall communicate with the Fire Alarm Control Panel by means of a supervised serial data link, as well as any required audio buss connections. The operating power shall be 24VDC and shall be fused at the control panel. LED annunciators and point-wired (non-serial) annunciators are not considered equal and shall be unacceptable.
c. All wiring between the FAAPpanel and the fire alarm control panel shall be supervised for opens, grounds and shorts.
d. Under normal operating conditions, the LCD display shall indicate the time, date and "SYSTEM IS NORMAL" label.
e. During abnormal conditions, the LCD shall operate in the same manner as the FACP LCD Display.

2.6 NAC BOOSTER PANELS (REMOTE POWER SUPPLIES):

A. Where they are used, "NAC Power Booster Panels" shall be individually supervised. Interconnecting NAC Booster Panels in a manner, which prevents identification of individual panel TROUBLE conditions, shall not be approved. NAC Booster Panels shall be wired to dedicated Emergency Power Branch Circuits where available.

B. If NAC Booster Panels are needed at locations other than those identified on the construction drawings, the Electrical Contractor shall obtain approval for their proposed installation locations. At such locations, the EC shall provide any required circuit breakers, associated power wiring, and local smoke detection at the approved location. Power shall be obtained from the nearest available emergency panel. The cost of such equipment and installation shall be included within the base Electrical Bid.

2.7 MULTIPLEX/INTELLIGENT PERIPHERAL DEVICES

A. All devices shall be supervised for trouble conditions. The system control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder the operation of other system devices.

B. Device Identification
1. Each intelligent device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address shall not be acceptable.
2. Device addressing schemes which use permanently-imbedded, electronically-identifiable "serial number" which is similar to the address imbedded within Personal Computer Network Interface Cards shall be acceptable.
3. Fire Alarm Systems utilizing hand-held or briefcase-style programming tools. Which are used to electronically assign addresses and/or programming parameters to devices shall be acceptable. However one such programmer tool shall be provided to the Owner at no additional cost.
4. The address along with the loop number and end-of-line device if present shall be indicated, and be visible from the ground, on the device in the field using machine generated marking. Contractor shall provide a sample of such labeling scheme before using it.
5. End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the device.

6. Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. These systems cannot accommodate t tapping and the addition of an intelligent device between existing devices requires re-programming all existing devices beyond added device.
7. The system must verify that proper type device is in place and matches the desired software configuration.

C. Intelligent Duct Smoke Detectors
1. Duct detectors shall be of the photoelectric type specified above. It shall be possible to alarm the duct detector by using a remote or local test switch.
2. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housings front cover.
3. Detector shall include remote keyed test switch and alarm LED indicator.
4. In mechanical rooms, alarm LED indicators for duct detectors shall be grouped on a stainless steel cover plate mounted adjacent to the main mechanical room door. Each LED shall be labeled with the detectors loop and address. A floor plan of the room showing the detectors and addresses shall be located adjacent to the cover plate. Provide Plexiglas cover over the plan.

D. Addressable Pull Stations
1. Pull stations shall contain circuits that communicate the station's status (alarm, normal or trouble) to the control panel over two wires, which also provide power to the pull station. The address shall be field programmable on the station.
2. Manual stations shall be [single-action] [double-action] type, constructed of metal or of high impact, red Lexan with raised white lettering and a smooth high gloss finish.
3. Station shall mechanically latch upon operation and remain so until manually reset by means of a key common to all system locks. Stations that require Allen wrenches or special tools to reset them shall not be accepted.
4. Manual stations shall be fitted with screw terminals or wire leads for field wire attachment.

E. Interface Modules - General
1. If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be derived from a supervised fire alarm power supply.
2. Addressable Interface Modules may be provided in either a Class B or Class A supervision version.
3. In the Class B version the wiring shall be supervised by an end-of-line device.
4. In the Class A version the wiring shall be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break.
5. The interface modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions.

F. Interface Modules - Supervised Control
1. Supervised Control Modules shall be utilized where needed, for control of Notification Appliances.
2. For Notification Appliances, speakers, and other device control with Class B or Class A wiring supervision, the interface module shall provide a double-pole/double-throw relay output, with supervision.

3. These interface modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and shall receive from the fire alarm control panel a command to transfer the relay.

G. Interface Modules - Supervised Monitoring
1. Addressable Monitor Modules shall be suited for monitoring of water-flow, valve tamper, Fire Suppression Control Panels, and other non-intelligent detectors and systems.
2. Addressable Monitor Modules shall be provided in any needed configuration, and may be used to interface any of the following initiation devices to a Signaling Line Circuit, as follows:
   a. Conventional 2-wire smoke detectors, including providing suitable power to the IDC.
   b. Normally Open, dry contact type devices - with class B or class A wiring supervision:
      1) These interface modules shall communicate the Initiating Device Circuit status (normal, alarm, trouble) to the control panel.

H. Interface Modules - Non-Supervised Control
1. This interface module shall provide double-pole/double-throw relay switching for loads up to 120VAC. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.

2.8 FAULT ISOLATOR MODULE (FIM)

A. The system shall employ Fault Isolator Modules (FIM) on the Signaling Line Circuits. These FIM units shall be utilized in order to isolate portions of SLCs, in the event of short circuit conditions. The SLC segment protected by each FIM shall be separated from the SLC in a manner such that a single short-circuit condition may not affect more than 25 Addressable Field Devices/Detectors, which are served by the isolated SLC segment.

B. The FIM shall be located as close as practical to the point where the isolated SLC sub-circuit branches, and shall also be located at an accessible location.

2.9 CONVENTIONAL PERIPHERAL DEVICES

A. Non-Addressable Heat Detectors
1. Non-Addressable Heat Detectors shall of the fixed temp type and only to be used at locations where the ambient conditions are unsuitable for Analog Addressable units, or where the required operation (set point/response index, etc.) cannot be achieved with Analog Addressable units. Where used, these devices shall be UL listed for their intended purpose. These heat detectors do not have to be made by the same manufacturer supplying the other fire alarm equipment for the project.

B. Sprinkler Waterflow Switches – Wet Systems
1. Waterflow switches shall be individually monitored, via individual IDCs, Monitor Modules, or Mini Monitor Modules. The point corresponding to each Waterflow switch shall be programmed such that when activated, the suitable Fire Alarm sequence shall be initiated.

2. If the flow switch incorporates an internal "cover tamper switch", which actuates whenever the flow switch assembly cover is removed, the Trouble sequence shall be initiated in response to the removal of this cover.

C. Sprinkler Valve Tamper Switches - Wet Systems
1. Tamper switches shall be individually monitored by individual IDCs, Monitor Modules, or Mini Monitor Modules (Where two Valves, with Tamper Switches, are provided on both sides of a backflow preventer/double check valve assembly, such tamper switches may be monitored as a single point). The point corresponding to each Tamper Switch shall be programmed such that whenever the valve is partially closed, the Supervisory sequence shall be initiated.
2. If the tamper switch incorporates an internal "cover tamper switch", which actuates whenever the flow switch assembly cover is removed, the Trouble sequence shall be initiated in response to the removal of this cover.

2.10 AUDIO VISUAL NOTIFICATION APPLIANCES

A. Speakers
1. Speakers shall have a metal or Lexan housing with field adjustable output taps ranging from 1/4 watt to 2 watts. Speakers selected for this project shall produce a Sound Pressure Level, at the 1 watt tap of at least 86 dBA at 10 feet - as tested per UL Standard 1480. Speakers shall have vandal resistant Lexan or metal grilles and shall be have sealed backs to protect the phenolic impregnated cone.

B. Strobes
1. ALL strobes, and the strobe portion of audible/strobe combination units, shall be of the Xenon type.
2. All strobes shall be designed for synchronized flash operation at one flash per second (1 Hz) minimum over the device's listed input voltage range. Strobes shall be synchronized such that all strobe units within the building shall flash simultaneously (As a minimum, all devices on each floor shall flash simultaneously, with flash timing within the limits established by current UL standards.).

2.11 PRINTERS AND TERMINALS

A. A printer shall be provided adjacent to the fire alarm control panel as shown on the plans.

B. Printer
1. A desktop 80-column, impact dot matrix printer shall provide a hard copy record of system events.
2. The printer shall receive English language text from the control panel in industry standard ASCII format via an EIA RS-232-C connection.
3. All printed information shall include time, date, status, point number, label, and the device type identifier.
4. The printer shall have the following features:
   a. 120 VAC input power
   b. 180 characters per second printing speed
   c. 3 kilobytes buffer capacity
   d. Cartridge type ribbon

e. Friction feed for cut forms
f. Tractor feed for continuous 9 1/2" wide pin-to-pin fanfold paper
g. UL 864 listed (UOXX)

5. Contractor shall supply one box of 2,300 (minimum) continuous-feed Sheets, 9 1/2" x 11", 20 Lb., Clean Edge, White Bond computer paper suitable for use the supplied printer.

C. Terminal
1. A desktop terminal unit shall be provided. This terminal shall include a PC, LCD color monitor, keyboard and mouse. This terminal shall serve as an auxiliary annunciator, and as a convenient user interface for maintenance purposes.
2. Contractor shall supply a dust-proof lockable cabinet with a see-through front cover to house the terminal and printer. Key shall be same as fire alarm control panel.

2.12 SPECIAL DEVICES

A. Tools/Keys
1. Contractor shall provide two (2) keys per pull station. Keys shall be identical and usable in all keyways associated with this project - including, but not limited to Manual Pull Stations, the FACP, [and FAAP] [and RFCC] Panel(s).
2. Provide one device programmer tool and case for fire alarm systems utilizing hand-held or briefcase-style programming tools used to electronically assign addressees and/or programming parameters.

PART 3 – EXECUTION

3.1 GENERAL

A. The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

B. Smoke detectors shall not be mounted until the construction is completed, unless they are covered with plastic bags or fitted covers immediately after installation to maintain cleanliness.

3.2 RACEWAYS

A. All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceway and Boxes for Electrical Systems for specifications.

B. All wiring shall be in minimum ½" steel raceway.

C. 40% fill factor shall be applied to all conduit sizes.

D. The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make calculation to follow NEC Chapter 9 Tables and Annex C for box and conduit fill.

E. There shall be no sharp edges with installed materials.

F. Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components/batteries). Cabinet shall be grounded to either a cold water pipe or grounding rod.

G. Existing conduit and surface metal raceway that is ½" in size or larger may be reused if found to have adequate space provided that it only serves the Fire Alarm system and doesn't contain any AC wiring. All existing conduit that is reused MUST be brought up to the current State of Wisconsin Electrical Code and Approved for usage by the Engineer prior to work being done.

3.3 FREE AIR WIRING

A. A/E shall identify all plenum areas on the drawings for install the proper wiring type.

B. All wiring shall be run "free-air", in conduit or in surface raceway. "Free-air" wiring for horizontal cable runs of Power Limited Fire Alarm (PLFA) DC circuits as approved by the Engineer shall be the method of installation only in the following areas:
1. Finished accessible ceiling
2. Rooms designated as 'mechanical' rooms

C. All other wiring shall be installed in conduit.

D. Where installed "free-air", installation shall consider the following:
1. Cable shall run at right angles and be kept clear of other trades work.
2. All cable run as "Free-Air" shall be Tray Cable rated.
3. All splices shall be done in approved junction boxes. Junction boxes shall be red with FA inscribed on the cover.
4. Cables shall be supported according to code utilizing "Bridal-type" mounting rings or J hooks anchored to ceiling concrete, piping supports or structural steel beams. Rings shall be designed to maintain cables bend to larger than the minimum bend radius (typically 4 x cable diameter).
5. Supports should be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 12-inches, another support shall be used.
6. Cable shall never be laid directly on the ceiling grid.
7. Cables shall not be attached to or supported by, existing cabling, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.

E. A coil of 4 feet in each cable shall be placed in the ceiling at each "free-air" wired fire alarm device. These "service loops" shall be secured at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

F. Devices wired with conduit shall be provided with an 8-inch wire tail at each device box and 36-inch wire tails at the FACP and FAAP.

G. To reduce or eliminate EMI, the following minimum separation distances from ≤480V Power lines shall be adhered to:
1. Twelve (12) inches from power lines of <5-kVa.

2. Eighteen (18) inches from high voltage lighting (including fluorescent).
3. Thirty-nine (39) inches from power lines of 5-kVa or greater.
4. Thirty-nine (39) inches from transformers and motors.

H. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellom grips may be used to spread the strain over a longer length of cable.

I. Manufacturers minimum bend radius specifications shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the fire alarm cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.

J. All vertical cable extensions to fire alarm devices located below the finished ceiling shall be in conduit.

K. It is the contractors' responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

L. Beginning installation means contractor accepts existing conditions.

M. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

N. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to insure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away" or other approved method.

O. The contractor will be responsible for identifying and reporting to the Site Coordinator(s) any existing damage to walls, flooring, tiles and furnishings in the work area prior to start of work. The Contractor must repair all damage to interior spaces caused by the installation of cable; raceway or other hardware. Repairs must match preexisting color and finish of walls, floors and ceilings. Any contractor-damaged ceiling tiles are to be replaced to match color, size, style and texture.

P. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

Q. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as the feed cable and operate pulling machinery.

R. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

S. Avoid abrasion and other damage to cables during installation.

T. Pulling Lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

U. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.]

3.4 CONDUCTORS

A. All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.

B. Type FPL wiring is required if the system is run in conduit or 'free-air.

C. All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance with NEC article 760."

D. All cables and wires #14 AWG and larger shall be stranded.

E. Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).

F. All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.

G. All conductors shall be color-coded. Coding shall be consistent throughout the facility. Green wire shall be used only for equipment ground.

H. Each Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall be connected to separate dedicated branch circuit from the building emergency panel, maximum 20 amperes. Circuit shall be labeled as "FIRE ALARM". The breaker shall be painted red and cap-locked.

I. Power wiring for Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall be #12 AWG.

J. Fire Alarm Control Panel, [Annunciator Panel], [and Remote Fire Command Center] shall have #6 AWG green equipment ground wire.

K. Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall have a minimum 2Hr fire alarm rating. All notification appliance circuits shall be protected from the fire alarm panel of origination to the signaling zone they serve.

L. Where fire alarm circuits enter or leave a building, additional transient 75 to 90 volt gas tube protection shall be provided for each conductor.

M. Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control Panel [and Remote Annunciator Panel(s)], [and Remote Fire Command Center].

N. Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket or per manufacturers recommendations installed in ½" conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.

O. SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.

P. Cable for RS 232-c devices (CRT, PRINTER) shall be dual pair twisted- shielded.

Q. Cable for RS 485 devices (Remote Annunciators) shall be twisted-shielded pair (Belden 9841 or equivalent) for the data signal. Power wiring shall be 12 AWG.

R. All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or "FA" by decal or other approved markings.

S. Speaker and strobe circuits shall have separate conductors, and shall operate independently of each other.

T. [Mini horn wiring shall be #14 AWG minimum.]

U. Speaker wiring shall be #18 AWG twisted-shielded cable or per manufacturers recommendations.

V. Strobe wiring shall be #14 AWG minimum.

W. Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.

3.5 DEVICE MOUNTING

A. Unless otherwise noted on the drawings, plans, specifications or by the Architect or Engineer; the recommended mounting heights, and requirements are as follows:

B. Fire Alarm Control Panels
   1. Mount control panels such that all visual indicators and controls are located at 60 inches above floor level.

C. Annunciator/Remote Fire Command Center Panels

1. Mount FAAP/RFCC panels such that all visual indicators and controls are located at 60 inches above floor level.

D. Visual and Audio/Visual Notification Appliances
1. In Public-Mode Areas, as defined within NFPA-72, install flush, semi-flush or surface between 80 inches and 96 inches or 6 inches below finished ceiling or at 80 inches from the bottom of the device to the highest level of the finished floor. No devices protruding 4 inches or more shall be installed lower than 80 inches. If these requirements are not achievable, consult with the Engineer before installation.
2. Audio/visual devices may be installed on the ceilings only where indicated, or where approved in writing by the Engineer. (In such cases, these devices shall be installed in accordance with current NFPA 72 standards).
3. Except as noted in the previous paragraph, all audio/visual devices shall be installed at the same height throughout the facility.
4. For surface mounting, use manufacture-supplied back boxes and trim plates, which shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its circuit number.

E. Manual Stations
1. The operable part of the manual stations shall be installed not less than 3 ½ ft. (42") and not more than 4 ft. (48") above finished floor. All Manual Stations shall be in unobstructed locations. Mark the unit's address on the inside and outside of housing.
2. All manual pull stations shall be installed at the same height throughout the facility.
3. For surface mounting, use manufacture-supplied back boxes and trim plates. Back boxes shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its loop and address.
4. During the installation of the new fire alarm systems, new pull stations should be covered or identified as not being operable so building occupants will not be confused as to which fire alarm pull station should be pulled during an alarm condition. Likewise, after the new system is installed, tested and accepted, the existing pull stations should be identified as not being operable (or permanently removed as soon as possible).

F. Duct Mounted Smoke Detectors
1. Each duct smoke detector indicated on the contract documents shall be installed in cooperation with the Division 23 and Division 26 contractors. Duct detector locations shown are diagrammatic only and require pressure differential testing to insure proper smoke detector operation. Each duct detector housing and sampling tube kit installed shall be mounted and tested prior to the installation of the duct smoke detector. Air sampling tube installation shall be tested per the manufacturers written instructions.
2. Division 26 contractor shall furnish the duct detector assembly and sampling tube kits sized for the installation locations indicated on the mechanical ductwork drawings. This contractor shall maintain possession of the duct detector smoke detection device.
3. Division 26 contractor shall provide smoke detector installation, interconnecting cabling, and testing of the smoke detection system in accordance with specification section 16721.
4. Division 23 contractor shall install detector housing and sampling tubes in accordance with the listing manufacturers' installation instructions, project documentation, and provide differential pressure testing and adjustments as described in Section 3 - Execution.
5. Duct smoke detector assemblies shall be tested and installed in accordance with the following:

a. Post air system balancing - testing and adjusting for proper operation shall be done by the installing contractor with a pressure differential manometer.
b. The differential pressure readings taken across the duct detector housing inlet and return tube shall be between 0.06 minimum and 1.28 maximum inches of water. Provide adjustment to sampling tube as needed to accomplish required pressure differential.
c. Provide a written record of readings. Submit to the project engineer for review and acceptance prior to the final installation of the duct smoke detector.
d. Initial tests shall be conducted to qualify installation location suitability. If initial testing concludes appropriate pressure differential may be available, contractor shall install the duct detector assembly complete in accordance with the installation details.
e. If acceptable differential pressure readings are not obtained, the inlet sampling tube may be rotated until the proper differential pressure readings are obtained. If inlet sampling tube rotation does not yield the proper differential pressure reading, the duct detector assembly shall be relocated further downstream at no additional cost to the owner.

6. Final installation wiring of the duct smoke detector shall not be completed by the Division 26 contractor until after the proper differential pressure reading has been obtained, documented, and approved.
7. Installation Requirements: In addition to the manufactures instructions the following guidelines will be enforced:
   a. Duct detector may be installed in any wall of the duct unless otherwise restricted by the manufacturer's instructions.
   b. Cut inlet sampling tube length to suite dimension of duct. If duct is more than 18" wide drill an appropriate diameter hole directly opposite to support inlet sampling tube of lengths longer than 18". Sampling tube shall protrude no longer than 1" outside of duct wall.
   c. Contractor to note that air inlet sampling tubes are designed for differing duct widths employing air inlet holes in a quantity matching the duct width. Verify each inlet tube is appropriately sized for the duct width (typically 10 to 12 holes, each 0.193" diameter holes [#11 drill bit]).
   d. Angle cut return tube at a length as recommended by manufacturer if required. Support in accordance with manufacturers recommendations.
   e. Position inlet holes facing upstream of airflow. This initial installation position shall be used as the starting point for differential pressure testing. If required adjust as stated in the testing/adjusting procedure above. Angle cut of return tube shall be orientated downstream of airflow.
   f. Once acceptable differential pressure readings are obtained, tubes shall be locked in place in accordance with the manufacturer's installation instructions.
   g. Duct detector assembly and sampling tubes shall be mounted rigidly to prevent noise, chatter, and mechanical fatigue. Any installation found unacceptable will be corrected at the installing contractor's expense.
   h. Inlet tubes installed protruding through duct walls greater in width of 18" shall have the sampling tube end plugged with the manufacturer furnished air stopper.
   i. Air leaks are unacceptable, the installing contractor shall provide gaskets, or duct sealant around inlet and outlet air tubes. Sealing around detector housing perimeter is not acceptable. Seal all duct wall penetration to pressure class rating of duct assembly.
   j. Once the detector is installed, verify correct differential pressure readings across sampling tubes and record. Install manufacturer furnished sampling tube filters.

k. If duct is insulated, provide detector housing standoffs, equivalent in depth of the duct wall insulation, to rigidly support detector assembly. Seal any sampling tube air holes that are not inside duct wall and duct sealant and tape.

l. At each duct detector installation location provide a service opening. Include a minimum 12" x 12" access door as specified in division 15.

8. After assembly is installed and tested, coordinate with division 16 contractor for smoke detector installation.

3.6 IDENTIFICATION

A. Attach the label containing the address and SLC designation to:
1. Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum character size (¼" is recommended).
2. Each manual pull station. Label shall be placed on the top part
3. Each Addressable Module. Label shall be attached to the faceplate

B. Label shall consist of black writing on white or clear background.

C. All junction boxes shall be painted red and labeled "Fire Alarm" or "FA".

D. All circuits must be labeled with the name of circuit and the area being served by the circuit.

E. Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and where it is going.

F. All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.

G. All audio visual devices shall be labeled by each circuit and the order of the device on that circuit such as "Circuit No. 2, strobe No. 05 of 10".

H. All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.

I. Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the cable (sheath). Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

J. Adhesive type labels not permitted except for phase and wire identification.

3.7 TESTING

A. Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.

B. The manufacturer's authorized representative shall provide on-site supervision of installation of the complete fire alarm system installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system prior to final inspection.

C. Contractor shall pre-test each and every device in the system before the system is considered ready for final inspection.

D. The completed and pre-tested fire alarm system shall be fully tested in accordance with NFPA-72 by the Contractor in the presence of the Engineer, Owner's representative and the local Fire Marshal.

E. The Engineer or his authorized representative may suspend or discontinue the tests at any time performance is considered unsatisfactory. Resumption of testing will cover untested elements and any replaced elements. The contractor shall furnish all test personnel, test instruments and equipment of the accuracy necessary to perform the test. Arrangements for testing must be made with the Owner and the Engineer at least two weeks before the proposed testing date.

F. Upon the completion of a successful test, and prior to the final request for payment the Contractor shall:
1. Certify the system to the Owner in writing
2. Complete the NFPA 72 record of completion form
3. Provide as builts and O&M manuals.
4. Provide a signed statement that the Owner had received the specified system operation and maintenance training

G. The final payment will not be processed unless these documents are complete and are on hand.

3.8 WARRANTY

A. The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of substantial completion of the project.

B. At the end of the project, the Contractor shall post the warranty period along with the company's name and telephone number inside the fire alarm panel.

C. Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm system for a period longer than two (2) hours. Emergency response shall be provided within two (2) hours of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA standards. Non-emergency service calls shall be responded to within twenty-four (24) hours of the notification to the contractor.

D. Emergency situations may include, but not limited to
1. System can't be acknowledged or reset
2. System is non-responsive to commands
3. System in non-responsive to actuated alarm devices
4. Malfunction of notification/initiating circuit(s)
5. System going into alarm/trouble without indicating the source

6. System is dead (no power), etc.

E. Repairs and/or replacement arising from emergency situations shall be completed within twenty-four (24) hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided within seventy two (72) hours of the time of notification during normal working hours, Monday through Friday, excluding holidays. If the repairs involve parts that are not shelve items and require lead time, the contractor shall inform the Owner within twenty-four (24) hours from the time of notification of the exact time when the repairs will be completed.

F. If repair and/or replacement cannot be made within the prescribed time, then other means and methods of protection shall be provided to insure the safety of the building's occupants during which time the system is not in compliance with the standards. This may involve up to and include hiring Owner approved qualified personnel to stand a fire watch, all at the contractor's expense.

G. Warranty service for the equipment shall be provided by the system supplier's factory trained representative. Further, Warranty shall include all parts, labor and necessary travel.

3.9 SPECIAL CONSIDERATIONS

A. Contractor shall refer to Division 1, General Requirements, "SPECIAL SITE CONDITIONS".

3.10 TRAINING

A. All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section Division 1. The Contractor through his/her supplier shall provide, as part of this contract, a minimum of 6 hours system operation training for owner, the Architect/Engineer, and fire department personnel. The training session shall consist of the following sessions:
   1. Two 2 hour sessions for the purpose of training personnel who will need to operate the system – primarily, Level 1 and Level 2 system operators/users.
   2. A single 2 hour session for the purpose of training personnel who will need to administrate and maintain the system. This training session shall familiarize these "power-users" with High-Level functions, and shall also familiarize Electrical Department personnel with an overview of the as-built drawings and equipment configuration/basic troubleshooting.

B. All training sessions shall be coordinated and scheduled by the EC, and shall be conducted at a time to be stipulated by the owner. All training and other indoctrination shall be completed prior to final inspection.

C. The contractor shall record all training and instructional sessions on DVD. Provide a separate DVD for each system and label for the system demonstrated and turnover to the Owner.

D. Training shall not take place until all systems are 100% operational as determined by the Owner. The purpose of training is to fully prepare the facility maintenance staff for complete operational responsibility of the fire alarm system.

E. The facility maintenance staff shall be fully trained and be given the capability by the product Vendor and installing Contractor to modify, to program, to fully repair, to service, and to maintain the system after (and if desired, during) the warranty period.

F. The above training shall include, but not be limited to, providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points (i.e.: The mapping of devices), and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or software key). If the Vendor cannot meet this requirement, the product is not acceptable.

END OF SECTION 283100

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City Engineering Division

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Financial Officer
Steven B. Danner-Rivers

Hydrogeologist
Brynn Bemis

12/27/2013

NOTICE OF ADDENDUM

ADDENDUM NO. 1
MEADOWRIDGE BRANCH LIBRRAY & MEADOWOOD
NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

Revise and amend the contract document(s) for the above project as stated in this addendum, otherwise, the original document shall remain in effect:

The City will test for asbestos and lead paint materials, and abate if required, prior to the construction start in February 2014.

The Madison Public Library will remove and recycle all steel shelving in the existing Library space prior to the construction start for Phase 2.

It is strongly recommended that contractors attend the SBE pre-bid meeting at 1:00pm, January 3, 2014, at the Larry D. Nelson Engineering Operations Facility at 1600 Emil Street, Madison WI. Questions shall be directed to Norman Davis, Affirmative Action/Department of Civil Rights (608) 266-4082.

Please acknowledge this addendum on page E1 of the contract documents and/or in Section E: Bidder's Acknowledgement on Bid Express.

Electronic version of these documents can be found on Bid Express at https://www.bidexpress.com/.

If you are unable to download plan revisions associated with the addendum, please contact the Engineering office at 608-266-4751 receive the material by another route.

FOR Robert F. Phillips, City Engineer

ADDENDUM NO. 1

DECEMBER 27, 2013

To City of Madison

From Engberg Anderson, Inc.
1 North Pinckney Street
Madison, WI 53703

Re Meadowridge Branch Library &
Meadowood Neighborhood Center
Madison, Wisconsin
Engberg Anderson Project No. 132273.00

The information contained in this Addendum modifies, explains, corrects, supplements or replaces information contained in the Construction Documents.

This Addendum consists of 6 pages and seven (7) attached documents as referenced under Attachments.

ANSWERS TO QUESTIONS FROM BIDDERS

1. Question: Are the sub-contractors required to pay for the approval fees?

   Answer: The building, HVAC and plumbing plans have been conditionally approved by the City of Madison. All remaining fees including but not limited to the construction permit and fire protection review to be covered by the general contractor.

2. Question: Are the bids required to be broken down by phases?

   Answer: That is not a requirement.

3. Question: Item one on page D101 calls for masonry and drywall removal for future openings. There is no height shown on the structural or demolition drawings are we to assume 7'?

   Answer: Refer to interior elevations, frame schedule and detail pages for opening heights in the wall that separates the library from the shared space (this is similar for the wall between the neighborhood center and shared space). SD-02 has been issued with a header detail for the typical openings in the existing cmu wall between the library and shared space - refer to plan details 3/A904, 8/A905 & 15/A905.

4. Question: The Fire Protection plans call for the use of dry upright sprinkler heads fed from the wet system below to protect this space. At this time I know of no specifically listed dry upright heads that meet this requirement. How would you like to see this space protected?

   Answer: The drawings and specifications have been revised to allow for the contractor to provide a complete and operable wet system or pre action dry system in the heated area and a complete and operable pre action dry system in the non heated truss space above the insulation. Refer to the following changes in this addendum and the attached documents for complete information.

ALLOWED SUBSTITUTIONS

1. Interior Painting: specification section 099123

   Manufacturer: Diamond Vogel

CHANGES TO PROJECT MANUAL - BID PACKAGE 1

SECTION TOC – TABLE OF CONTENTS
Page TOC-06; Division 26 Electrical, Section 263100 – Fire Detection and Alarm, revise:

Revise to **Division 28 - Electronic Safety and Security**, section number 283100 - Fire Detection and Alarm the page numbers from 1 thru 9 to read, 1 thru 38.

SECTION 012500 - PAYMENT PROCEDURES
PART 2 – PRODUCTS
Page 012500-3, section 1.2 Substitutions, item B delete and replace sentence:

B. Substitutions for Convenience: **For Division 2 through Division 17 sections** the Architect will consider requests for substitutions if received within 30 days after Notice of Award. Requests received after that time may be considered or rejected at the discretion of the Architect.

SECTION 012900 - PAYMENT PROCEDURES
PART 1 – GENERAL
Page 012900-1, section 1.4 Schedule of Values, replace item 2 with:

2. Within 10 days after Notice to Proceed, the successful bidder will submit a schedule of values to the Architect and the City of Madison.

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS
PART 2 – PRODUCTS
Page 015000-6, section 3.4 Security and Protection Facilities Installation, item H:

Delete Item 2

SECTION 099123– INTERIOR PAINTING
PART 1 – GENERAL
Page 099123-2, add the following section:

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION
PART 1 - GENERAL

Page 210500-5, section 1.7 Design Criteria, item B2; delete and replace with following:

1. Preaction dry pipe sprinkler systems.

SECTION 211000 - WATER BASED FIRE-SUPPRESSION SYSTEMS
PART 1 - GENERAL

Page 211000-1, section 1.1 Section Includes; add the following after item 11:

12. Specialty Valves
13. Preaction Control
14. Air Compressor

Page 211000-2, section 1.3 Submittals; add the following after item 12:

13. Specialty Valves
14. Preaction Control
15. Air Compressor

PART 2 - PRODUCTS

Page 211000-4, section 2.1 Fire Protection Piping, item 6; after the words "shall be used" insert the following: in dry sprinkler systems, preaction systems.

Page 211000-4, section 2.1 Fire Protection Piping, item 6; after the words "shall be used" delete the word "for".

Page 211000-5, section 2.4 Sprinklers; delete item B3 and replace with the following:

2. Combustible concealed space upright: Brass Finish

Page 211000-7, after section 2.11; insert the following:

2.12 SPECIALTY VALVES
A. Manufacturer: Reliable, Tyco, Victaulic, Viking
B. Dry Pipe Valves

1. Cast or ductile iron body, flanged or grooved ends, 175 psig, bronze grooved seat with o-ring seal, single hitch pin and latch design. Provide trim for air supply, drain, priming level, alarm connections, pressure gages, priming chamber attachment, ball drip valves, drip cup assembly piped to floor or hub drain, fill line attachment with strainer.

C. Air Pressure Maintenance Device
   1. Automatic control capable of maintaining system air pressure, rated for 175 psig, adjustable air pressure range of 15 to 60 psig, complete with isolation valves, bypass fill valve, pressure regulator or pressure switch and strainer.

D. Preaction System
   1. Preaction system valve and all trim shall be a package system equal to Tyco Integrated Preaction Fire Protection package Model DV-5 RED-E cabinet with locking doors, dry valve, air maintenance compressor, air controls and panel.

2.13 PREACTION CONTROL

A. Single area type in NEMA 1 enclosure with detector, alarm, power supply, battery charge, standby battery, electrically supervised solenoid valves, polarized fire alarm, lamp test, wiring terminal strip, auxiliary alarm contacts.

2.14 AIR COMPRESSOR

A. Manufacturer: Gast, Quincy, Ingersoll Rand, Viking

B. Multi-zone and large systems: Simplex electric motor belt driven oil lubricated compressor mounted on ASME rated galvanized receiver tank, pressure operated electric switch, motor, magnetic motor starter with three phase overload protection, fused disconnect switch, safety relief valve, check valve, shutoff valve, pressure gauge, automatic tank drain, intake muffler-filter, belt guard and adjustable operating pressure control.

C. Single zone and small systems: Riser pipe mounted air compressor installation. Electric motor driven, air cooled, oil-less, adjustable, single stage compressor with check valve, pressure switch, pressure relief valve, mounting bracket kit and air filter assembly. Equal to Viking Model E-1.

PART 3 – EXECUTION

Page 211000-10, section 3.6 Installation of Fire Suppression System Components, after item H; insert the following:

I. Specialty Valves: Install in vertical position in system riser. Install trim recommended by manufacturer including drain and test valves. Pipe drains to hub or floor drains. Test and adjust operation of valves, alarms, pressure maintenance devices, emergency pull boxes and deluge-preaction controls.

J. Air Compressor: Attached to system riser or install on concrete housekeeping pad, leveled and bolted in place. Pipe automatic drain discharge piping to floor drain. Install line size ball valve and check valve in discharge line. Install pressure gauge upstream of ball valve.

CHANGES TO DRAWINGS

SHEET D101, D102, D103
DEMOLITION PLANS

Add to "General Notes" section and add the following: "9. All existing toilet accessories to be removed."

SHEET D101
DEMOLITION PLAN - PHASE 1

Add to "Demolition Keynote Ledged" section and add the following to note #4: "Height of area is approximately 12'-0" aff. field verify."

SHEET D103
DEMOLITION PLAN - PHASE 3

Add to "Demolition Keynote Ledged" section and add the following to note #14 & #20: "General Contractor to protect all finished surfaces constructed in previous phases. GC to patch and repair all surfaces damaged in the removal of the temporary partitions."

SHEET A101
FLOOR PLAN - PHASE 1

- On drawing 1/A101 a partial plan has been issued with changes to the door location that opens to the receiving room #308 that is to be constructed in phase 3 - see issued SD-01 The door location has been moved down to accommodate an added fire protection cabinet. The cabinet is to be installed in phase 1 and GC to coordinate schedule and work with tenant prior to construction.

- Add note to Keyed Notes - Phase 1: "Note #14" - see issued SD-01.

SHEET F100
FIRST FLOOR FIRE PROTECTION NEW WORK PLAN

1. Provide a dry valve preaction fire protection package system and cabinet in room 308.
2. Revise key notes and add key note 4.

SHEET P100
FIRST FLOOR UNDERFLOOR PLUMBING NEW WORK PLAN

1. Add hub drain (HD-1) in room 308.

SHEET P110
FIRST FLOOR PLUMBING NEW WORK PLAN

1. Add hub drain (HD-1) in room 308.
2. Add key note 3.

SHEET P300
PLUMBING RISERS

1. Add hub drain (HD-1) in room 308.

SHEET E110
FIRST FLOOR ELECRTRICAL NEW WORK PLAN

1. Provide power to air compressor using (2) 10#, (1)#12 ground, ¾" in liquid tight flex conduit from controller to motor and ¾" EMT from panel to controller. Provide (1) 30 A/1P at 115 v, 1 Phase.
   EC coordinate with Fire Protection contractor on the exact size and requirements of the air compressor.

ATTACHMENTS

Walk Thru sign up sheet
SD-01
SD-02
Drawings Full Size: FP100, P100, P110, and P300

Issued by:
Mike Zuehlke, AIA

Distribution list:
Jeanine Zwart - City of Madison
Joe Huberty – Engberg Anderson
Dan Green - Henneman Engineering Inc.

File

Meadowridge Branch Library/Meadowood Neighborhood Center
Site Walk-thru
December 17, 2013 10:00am

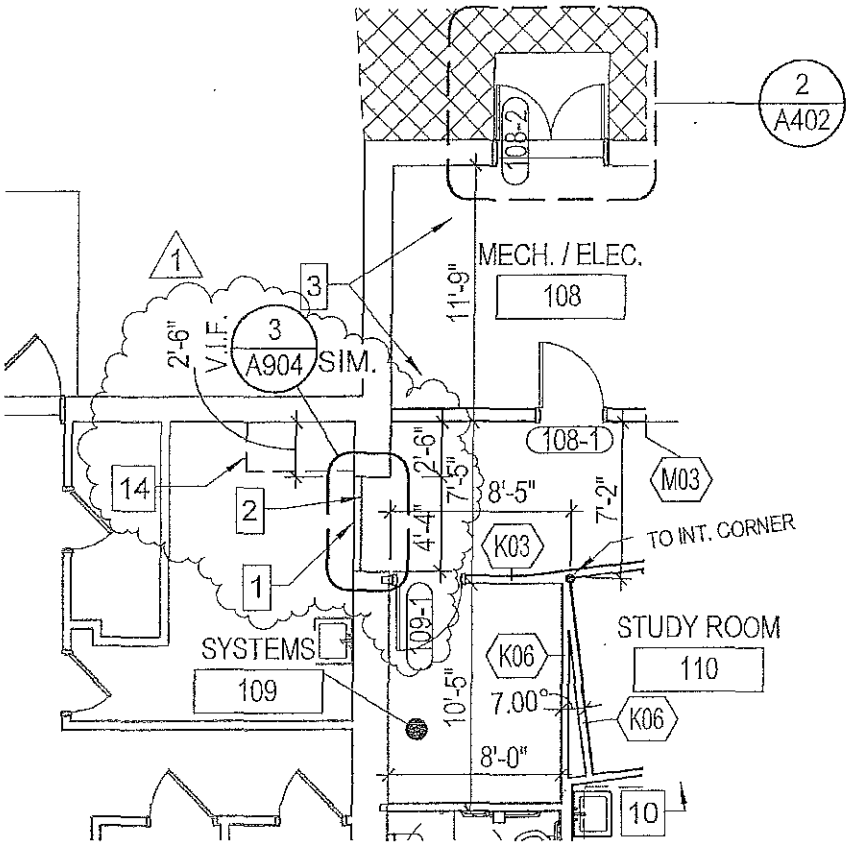
SIGN-IN SHEET (use two lines!)

Name/Company	Email/Phone
Jeanine Zwart	jzwart@cityofmadison.com
City of Madison	608-267-8749
Mike Zuehlke	mikez@engberganderson.com
Engberg Anderson	608-250-7511
Dan Green	dgreen@henneman.com
Henneman Engineering	608-833-7000
Seth Madsen	920-886-7829
Miron Construction	estimating@miron-construction.com
NCI - Jace Jantz	jace@ncirobertz.com
Jerry Roach / TRI-NORTH	JROACH@tri-NORTH.com
Steve Robinson / CG Schmidt	steve.robinson@cgschmidt.com
JAY SCHLICHER BEERJ. PLB	JAY@BEERJAMIN PLUMBING.com
AL FISCHER MONONA PIP	afischer@mononapp.com
STEVE HANSEN / DANIELS	shansen@danielsco.com
Kevin R Wipperfurth	KWIPPER@GYPSUM SUPPLY CO.COM
ADAM HATEMAN	adamha@imael-bailds.com / 920 406 0149
CANDY CREEK	cgschmidt.com 414 577 117-7
Matt Hamilton	USA Fire Protection 608-209-6319

1

14. LOCATION FOR FIRE PROTECTION CABINET TO BE INSTALLED IN PHASE 1 COORDINATE INSTALLATION WITH TENANT.

ADDITION TO KEYED NOTES - PHASE 1



1 PARTIAL PLAN - PHASE 1

SCALE: 1/8" = 1'-0"

Engberg Anderson

MILWAUKEE • MADISON • TUCSON

Meadowridge Branch Library & Meadowood Neighborhood Center

Madison, Wisconsin

Project number 132273.00

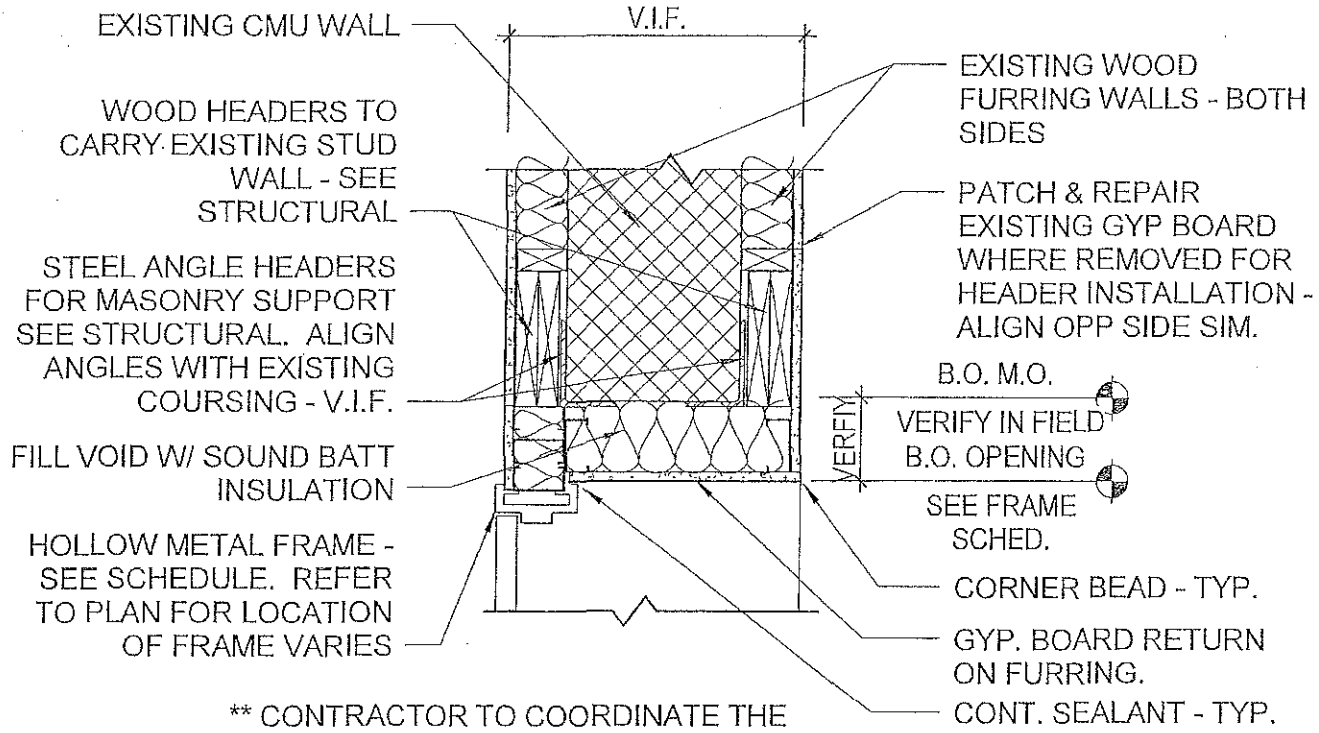
Drawn by MZ

Checked by Checker

Date 12-27-13

REVISIONS TO SHEET A101

SD-01



** CONTRACTOR TO COORDINATE THE TIMING OF THE CONSTRUCTION AND DEMOLITION TO ALIGN WITH THE PHASING OF THE PROJECT.

1

1 TYP. HEADER DETAIL @ EXISTING CMU WALL

SCALE: 1" = 1'-0"

Engberg Anderson

MILWAUKEE • MADISON • TUCSON

Meadowridge Branch Library & Meadowood Neighborhood Center

Madison, Wisconsin

Project number 132273.00

Drawn by MZ

Checked by MZ

Date 12-27-13

TYP. HEADER DETAIL @ EXISTING CMU WALL WEST SIDE OF LIBRARY

SD-02

SECTION E: BIDDERS ACKNOWLEDGEMENT

CONTRACT TITLE MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING

CONTRACT NO. 7202

Bidder must state a Unit Price and Total Bid for each item. The Total Bid for each item must be the product of quantity, by Unit Price. The Grand Total must be the sum of the Total Bids for the various items. In case of multiplication errors or addition errors, the Grand Total with corrected multiplication and/or addition shall determine the Grand Total bid for each contract. The Unit Price and Total Bid must be entered numerically in the spaces provided. All words and numbers shall be written in ink.

1. The undersigned having familiarized himself/herself with the Contract documents, including Advertisement for Bids, Instructions to Bidders, Form of Proposal, City of Madison Standard Specifications for Public Works Construction - 2013 Edition thereto, Form of Agreement, Form of Bond, and Addenda issued and attached to the plans and specifications on file in the office of the City Engineer, hereby proposes to provide and furnish all the labor, materials, tools, and expendable equipment necessary to perform and complete in a workmanlike manner the specified construction on this project for the City of Madison; all in accordance with the plans and specifications as prepared by the City Engineer, including Addenda to the Contract Nos. 1 through 2 issued thereto, at the prices for said work as contained in this proposal. (Electronic bids submittals shall acknowledge addendum under Section E and shall not acknowledge here)
2. If awarded the Contract, we will initiate action within seven (7) days after notification or in accordance with the date specified in the contract to begin work and will proceed with diligence to bring the project to full completion within the number of work days allowed in the Contract or by the calendar date stated in the Contract.
3. The undersigned Bidder or Contractor certifies that he/she is not a party to any contract, combination in form of trust or otherwise, or conspiracy in restraint of trade or commerce or any other violation of the anti-trust laws of the State of Wisconsin or of the United States, with respect to this bid or contract or otherwise.
4. I hereby certify that I have met the Bid Bond Requirements as specified in Section 102.5. *(IF BID BOND IS USED, IT SHALL BE SUBMITTED ON THE FORMS PROVIDED BY THE CITY. FAILURE TO DO SO MAY RESULT IN REJECTION OF THE BID).*
5. I hereby certify that all statements herein are made on behalf of Scherrer Construction Company, Inc. (name of corporation, ~~partnership, or person~~ submitting bid) a corporation organized and existing under the laws of the State of Wisconsin ~~xxxxxxxxxxpartnershipxxxxxxxxxxconsistingxxxxxxxxxxof xxxxxxxxxxx

Bidders shall not add any conditions or qualifying statements to this Proposal.

Contract #7202 - Scherrer Construction

Section F: Disclosure of Ownership and BVC

This section is a required document for the bid to be considered complete. There are two methods for completing the Disclosure of Ownership and BVC form. Method one: The form can be filled out online and submitted to this site to be included with your electronic bid. Method two: The form can be downloaded from the site and submitted by hand to the City of Madison.

Method of Submittal for Disclosure of Ownership and BVC (click in box below to choose) *
I will submit Bid Express fillable online form (Disclosure of Ownership and BVC).

Section F: Disclosure of Ownership and Best Value Contracting

Notice required under Section 15.04(1)(m), Wisconsin Statutes. The statutory authority for the use of this form is prescribed in Sections 66.0903(12)(d), Wisconsin Statutes. The use of this form is mandatory. The penalty for failing to complete this form is prescribed in Section 103.005(12). Personal information you provide may be used for secondary purposes.

(1) On the date a contractor submits a bid to or completes negotiations with a state agency or local governmental unit, on a project subject to Section 66.0903 or 103.49, Wisconsin Statutes, the contractor shall disclose to such state agency or local governmental unit the name of any "other construction business", which the contractor, or a shareholder, officer or partner of the contractor, owns or has owned within the preceding three (3) years.

(2) The term "other construction business" means any business engaged in the erection, construction, remodeling, repairing, demolition, altering or painting and decorating of buildings, structures or facilities. It also means any business engaged in supplying mineral aggregate, or hauling excavated material or spoil as provided by Sections 66.0903(3), 103.49(2) amd 103.50(2), Wisconsin Statues.

(3) This form must ONLY be filed, with the state agency or local governmental unit that will be awarding the contract, if both (A) and (B) are met.

(A) The contractor, or a shareholder, officer or partner of the contractor:

1. Owns at least a 25% interest in the "other construction business", indicated below,on the date the contractor submits a bid or completes negotiations.

2. Or has owned at least a 25% interest in the "other construction business" at any time within the preceding three (3) years.

(B) The Wisconsin Department of Workforce Development (DWD) has determined that the "other construction business" has failed to pay the prevailing wage rate or time and one-half the required hourly basic rate of pay, for hours worked in excess of the prevailing hours of labor, to any employee at any time within the preceding three (3) years.

Other Construction Business

☑ Not Applicable

Name of Business

Street Address or PO Box
City
State and Zip Code

Best Value Contracting
1. The Contractor shall indicate the non-apprenticeable trades used on this contract.

2. Madison General Ordinance (M.G.O.), 33.07(7), does provide for some exemptions from the active apprentice requirement. Apprenticeable trades are those trades considered apprenticeable by the State of Wisconsin. Please check applicable box if you are seeking an exemption.

☐ Contractor has a total skilled workforce of four or less individuals in all apprenticeable trades combined.

☐ No available trade training program; The Contractor has been rejected by the only available trade training program, or there is no trade training program within 90 miles.

☑ Contractor is not using an apprentice due to having a journey worker on layoff status, provided the journey worker was employed by the contractor in the past six months.

☐ First time contractor on City of Madison Public Works contract requests a onetime exemption but intends to comply on all future contracts and is taking steps typical of a "good faith" effort.

☐ Contractor has been in business less than one year.

☐ Contractor doesn't have enough journeyman trade workers to qualify for a trade training program in that respective trade.

3. The Contractor shall indicate on the following section which apprenticeable trades are to be used on this contract. Compliance with active apprenticeship, to the extent required by M.G.O. 33.07(7), shall be satisfied by documentation from an applicable trade training body; an apprenticeship contract with the Wisconsin Department of Workforce Development or a similar agency in another state; or the U.S Department of Labor. This documentation is required prior to the Contractor beginning work on the project site.

☐ The Contractor has reviewed the list and shall not use any apprenticeable trades on this project.

LIST APPRENTICABLE TRADES (check all that apply to your work to be performed on this contract)

- ☑ BRICKLAYER
- ☑ CARPENTER
- ☑ CEMENT MASON / CONCRETE FINISHER
- ☐ CEMENT MASON (HEAVY HIGHWAY)
- ☑ CONSTRUCTION CRAFT LABORER
- ☐ DATA COMMUNICATION INSTALLER
- ☐ ELECTRICIAN
- ☐ ENVIRONMENTAL SYSTEMS TECHNICIAN / HVAC SERVICE TECH/HVAC INSTALL / SERVICE
- ☐ GLAZIER
- ☐ HEAVY EQUIPMENT OPERATOR / OPERATING ENGINEER
- ☐ INSULATION WORKER (HEAT and FROST)
- ☐ IRON WORKER
- ☐ IRON WORKER (ASSEMBLER, METAL BLDGS)
- ☐ PAINTER and DECORATOR
- ☐ PLASTERER
- ☐ PLUMBER
- ☐ RESIDENTIAL ELECTRICIAN
- ☐ ROOFER and WATER PROOFER
- ☐ SHEET METAL WORKER
- ☐ SPRINKLER FITTER
- ☐ STEAMFITTER
- ☐ STEAMFITTER (REFRIGERATION)
- ☐ STEAMFITTER (SERVICE)
- ☐ TAPER and FINISHER
- ☐ TELECOMMUNICATIONS (VOICE, DATA and VIDEO) INSTALLER-TECHNICIAN
- ☐ TILE SETTER

MEADOWRIDGEBRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODLEING
CONTRACT NO. ERROR! REFERENCE SOURCE NOT FOUND. 7202

Small Business Enterprise Compliance Report

This information may be submitted electronically through Bid Express or submitted with bid in sealed envelope.

Cover Sheet

Prime Bidder Information

Company: Scherrer Construction Company, Inc.

Address: 601 Blackhawk Drive, Burlington, WI 53105

Telephone Number: (262) 539-3100 Fax Number: (262) 539-3101

Contact Person/Title: Kevin Theissen, Project Manager

Prime Bidder Certification

I, James E. Scherrer (Name), President & CEO (Title) of

Scherrer Construction Company, Inc. (Company) certify that the information contained in this SBE Compliance Report is true and correct to the best of my knowledge and belief.

Witness' Signature

Bidder's Signature

January 10, 2014
Date

MEADOWRIDGEBRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODLEING

CONTRACT NO. ERROR! REFERENCE SOURCE NOT FOUND. ERROR! REFERENCE SOURCE NOT FOUND. 7202

Small Business Enterprise Compliance Report

Summary Sheet

SBE Subcontractors Who Are NOT Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
Byco, Inc.	Resilent, Carpet	3 %
		%
All-American Electric	Electrical	18 %
		%
		%
		%
		%
		%
		%
		%
		%
		%
Subtotal SBE who are NOT suppliers:		21 %

SBE Subcontractors Who Are Suppliers

Name(s) of SBEs Utilized	Type of Work	% of Total Bid Amount
		%
		%
		%
		%
		%
		%

Subtotal Contractors who are suppliers: _____ % x 0.6 = _____ % (discounted to 60%)

Total Percentage of SBE Utilization: 21 %.

Contract #7202 - Scherrer Construction

Section B: Proposal Page

Item Code	Description	Quantity	Units	Unit Price	Extension
90001	LUMP SUM BID	1.0000	Lump Sum	$1,599,000.00	$1,599,000.00
90002	Introduction of Neighborhood Residents into the Construction Workforce through the Employment of Two (2) Constrction Craft Labor Apprentices	1.0000	Lump Sum	$60,000.00	$60,000.00

2 Items
Total: $1,659,000.00

Section B: Alternate 1

Item Code	Description	Quantity	Units	Unit Price	Extension
Alternate: Owner-agency may award independently from entire bid.					
90003	ALTERNATE 1: Addition of Folding Panel Partition, required trims and hanging rods as indicated on Drawings A103, A203, A802 and related engineering documents and related specification sections.	1.0000	Lump Sum	$15,325.00	$15,325.00

1 Item
Total: $15,325.00

Grand Total - $1,674,325

Bid Date: 01-10-14

SECTION G: BID BOND

KNOW ALL MEN BY THESE PRESENT, THAT Scherrer Construction Co., Inc. (a corporation of the State of Wisconsin) (individual, partnership), hereinafter referred to as the "Principal") and *** , a corporation of the State of Connecticut (hereinafter referred to as the "Surety") and licensed to do business in the State of Wisconsin, are held and firmly bound unto the City of Madison, (hereinafter referred to as the "Obligee"), in the sum of five per cent (5%) of the amount of the total bid or bids of the Principal herein accepted by the Obligee, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that, whereas the Principal has submitted, to the City of Madison a certain bid, including the related alternate, and substitute bids attached hereto and hereby made a part hereof, to enter into a contract in writing for the construction of:

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

1. If said bid is rejected by the Obligee, then this obligation shall be void.

2. If said bid is accepted by the Obligee and the Principal shall execute and deliver a contract in the form specified by the Obligee (properly completed in accordance with said bid) and shall furnish a bond for his/her faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

   If said bid is accepted by the Obligee and the Principal shall fail to execute and deliver the contract and the performance and payment bond noted in 2. above executed by this Surety, or other Surety approved by the City of Madison, all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to forfeit to the Obligee as liquidated damages the sum mentioned above, it being understood that the liability of the Surety for any and all claims hereunder shall in no event exceed the sum of this obligation as stated, and it is further understood that the Principal and Surety reserve the right to recover from the Obligee that portion of the forfeited sum which exceed the actual liquidated damages incurred by the Obligee.

   The Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Obligee may accept such bid, and said Surety does hereby waive notice of any such extension.

*** TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, on the day and year set forth below.

Seal

SCHERRER CONSTRUCTION CO., INC. — 1/10/14
Principal — Date

By: _____

TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA
Name of Surety

By: _____ — January 10, 2014
Dennis M. Barton, Attorney-In-Fact — Date

TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA HARTFORD, CONN

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. 125401 for the year 2014, and appointed as attorney in fact with authority to execute this bid bond and the payment and performance bond referred to above, which power of attorney has not been revoked.

January 10, 2014
Date

Agent Dennis M. Barton

17035 West Wisconsin Avenue - Suite 135
Address

Brookfield, Wisconsin 53005
City, State and Zip Code

262-792-2212
Telephone Number

NOTE TO SURETY & PRINCIPAL

The bid submitted which this bond guarantees may be rejected if the following instrument is not attached to this bond:

Power of Attorney showing that the agent of Surety is currently authorized to execute bonds on behalf of the Surety, and in the amounts referenced above.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 219817

Certificate No. 005575696

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Elizabeth M. Fedyn, Joseph L. Vigna, Dennis M. Barton, Daniel G. Johnson, and Michael T. Burg

of the City of Brookfield, State of Wisconsin, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 25th day of July, 2013.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 25th day of July, 2013, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC CONNECTICUT

Marie C. Tetreault
Marie C. Tetreault, Notary Public

58440-8-12 Printed in U.S.A.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, Kevin E. Hughes, the undersigned, Assistant Secretary, of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which is in full force and effect and has not been revoked.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed the seals of said Companies this 10th day of January, 20 14.

Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, call 1-800-421-3880 or contact us at www.travelersbond.com. Please refer to the Attorney-In-Fact number, the above-named individuals and the details of the bond to which the power is attached.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

SECTION H: AGREEMENT

THIS AGREEMENT made this 5th day of February in the year Two Thousand and Fourteen between **SCHERRER CONSTRUCTION CO., INC.** hereinafter called the Contractor, and the City of Madison, Wisconsin, hereinafter called the City.

WHEREAS, the Common Council of the said City of Madison under the provisions of a resolution adopted **FEBRUARY 4, 2014**, and by virtue of authority vested in the said Council, has awarded to the Contractor the work of performing certain construction.

NOW, THEREFORE, the Contractor and the City, for the consideration hereinafter named, agree as follows:

1. **Scope of Work.** The Contractor shall, perform the construction, execution and completion of the following listed complete work or improvement in full compliance with the Plans, Specifications, Standard Specifications, Supplemental Specifications, Special Provisions and contract; perform all items of work covered or stipulated in the proposal; perform all altered or extra work; and shall furnish, unless otherwise provided in the contract, all materials, implements, machinery, equipment, tools, supplies, transportation, and labor necessary to the prosecution and completion of the work or improvements:

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CONTRACT NO. 7202

2. **Completion Date/Contract Time.** Construction work must begin within seven (7) calendar days after the date appearing on mailed written notice to do so shall have been sent to the Contractor and shall be carried on at a rate so as to secure full completion SEE SPECIAL PROVISIONS, the rate of progress and the time of completion being essential conditions of this Agreement.

3. **Contract Price.** The City shall pay to the Contractor at the times, in the manner and on the conditions set forth in said specifications, the sum of **ONE MILLION SIX HUNDRED SEVENTY-FOUR THOUSAND THREE HUNDRED TWENTY-FIVE ($1,674,325.00)** Dollars being the amount bid by such Contractor and which was awarded to him/her as provided by law.

4. **Wage Rates for Employees of Public Works Contractors**

General and Authorization. The Contractor shall compensate its employees at the prevailing wage rate in accordance with section 66.0903, Wis. Stats., DWD 290 of the Wisconsin Administrative Code and as hereinafter provided unless otherwise noted in Section D: Special Provisions, Subsection 102.10 – Minimum Rate of Wage Scale.

"Public Works" shall include building or work involving the erection, construction, remodeling, repairing or demolition of buildings, parking lots, highways, streets, bridges, sidewalks, street lighting, traffic signals, sanitary sewers, water mains and appurtenances, storm sewers, and the grading and landscaping of public lands.

"Building or work" includes construction activity as distinguished from manufacturing, furnishing of materials, or servicing and maintenance work, except for the delivery of mineral aggregate such as sand, gravel, bituminous asphaltic concrete or stone which is incorporated into the work under contract with the City by depositing the material directly in final place from transporting vehicle.

"Erection, construction, remodeling, repairing" means all types of work done on a particular building or work at the site thereof in the construction or development of the project, including without limitation, erecting, construction, remodeling, repairing, altering, painting, and decorating, the transporting of materials and supplies to or from the building or work done by the employees of the Contractor, Subcontractor, or Agent thereof, and the manufacturing or furnishing of

materials, articles, supplies or equipment on the site of the building or work, by persons employed by the Contractor, Subcontractor, or Agent thereof.

"Employees working on the project" means laborers, workers, and mechanics employed directly upon the site of work.

"Laborers, Workers, and Mechanics" include pre-apprentices, helpers, trainees, learners and properly registered and indentured apprentices but exclude clerical, supervisory, and other personnel not performing manual labor.

Establishment of Wage Rates. The Department of Public Works shall periodically obtain a current schedule of prevailing wage rates from DWD. The schedule shall be used to establish the City of Madison Prevailing Wage Rate Schedule for Public Works Construction (prevailing wage rate). The Department of Public Works may include known increases to the prevailing wage rate which can be documented and are to occur on a future specific date. The prevailing wage rate shall be included in public works contracts subsequently negotiated or solicited by the City. Except for known increases contained within the schedule, the prevailing wage rate shall not change during the contract. The approved wage rate is attached hereto.

Workforce Profile. The Contractor shall, at the time of signature of the contract, notify the City Engineer in writing of the names and classifications of all the employees of the Contractor, Subcontractors, and Agents proposed for the work. In the alternative, the Contractor shall submit in writing the classifications of all the employees of the Contractor, Subcontractors and Agents and the total number of hours estimated in each classification for the work. This workforce profile(s) shall be reviewed by the City Engineer who may, within ten (10) days, object to the workforce profile(s) as not being reflective of that which would be required for the work. The Contractor may request that the workforce profile, or a portion of the workforce profile, be submitted after the signature of the contract but at least ten (10) days prior to the work commencing. Any costs or time loss resulting from modifications to the workforce profile as a result of the City Engineer's objections shall be the responsibility of the Contractor.

Payrolls and Records. The Contractor shall keep weekly payroll records setting forth the name, address, telephone number, classification, wage rate and fringe benefit package of all the employees who work on the contract, including the employees of the Contractor's subcontractors and agents. Such weekly payroll records must include the required information for all City contracts and all other contracts on which the employee worked during the week in which the employee worked on the contract. The Contractor shall also keep records of the individual time each employee worked on the project and for each day of the project. Such records shall also set forth the total number of hours of overtime credited to each such employee for each day and week and the amount of overtime pay received in that week. The records shall set forth the full weekly wages earned by each employee and the actual hourly wage paid to the employee.

The Contractor shall submit the weekly payroll records, including the records of the Contractor's subcontractors and agents, to the City Engineer for every week that work is being done on the contract. The submittal shall be within twenty-one (21) calendar days of the end of the Contractor's weekly pay period.

Employees shall receive the full amounts accrued at the time of the payment, computed at rates not less than those stated in the prevailing wage rate and each employee's rate shall be determined by the work that is done within the trade or occupation classification which should be properly assigned to the employee.

An employee's classification shall not be changed to a classification of a lesser rate during the contract. If, during the term of the contract, an employee works in a higher pay classification than the one which was previously properly assigned to the employee, then that employee shall be considered to be in the higher pay classification for the balance of the contract, receive the appropriate higher rate of pay, and she/he shall not receive a lesser rate during the balance of the

contract. For purposes of clarification, it is noted that there is a distinct difference between working in a different classification with higher pay and doing work within a classification that has varying rates of pay which are determined by the type of work that is done within the classification. For example, the classification "Operating Engineer" provides for different rates of pay for various classes of work and the Employer shall compensate an employee classified as an "Operating Engineer" based on the highest class of work that is done in one day. Therefore, an "Operating Engineer's" rate may vary on a day to day basis depending on the type of work that is done, but it will never be less than the base rate of an "Operating Engineer". Also, as a matter of clarification, it is recognized that an employee may work in a higher paying classification merely by chance and without prior intention, calculation or design. If such is the case and the performance of the work is truly incidental and the occurrence is infrequent, inconsequential and does not serve to undermine the single classification principle herein, then it may not be required that the employee be considered to be in the higher pay classification and receive the higher rate of pay for the duration of the contract. However, the Contractor is not precluded or prevented from paying the higher rate for the limited time that an employee performs work that is outside of the employee's proper classification.

Questions regarding an employee's classification, rate of pay or rate of pay within a classification, shall be resolved by reference to the established practice that predominates in the industry and on which the trade or occupation rate/classification is based. Rate of pay and classification disputes shall be resolved by relying upon practices established by collective bargaining agreements and guidelines used in such determination by appropriate recognized trade unions operating within the City of Madison.

The Contractor, its Subcontractors and Agents shall submit to interrogation regarding compliance with the provisions of this ordinance.

Mulcting of the employees by the Contractor, Subcontractor, and Agents on Public Works contracts, such as by kickbacks or other devices, is prohibited. The normal rate of wage of the employees of the Contractor, Subcontractor, and Agents shall not be reduced or otherwise diminished as a result of payment of the prevailing wage rate on a public works contract.

Hourly contributions. Hourly contributions shall be determined in accordance with the prevailing wage rate and with DWD. 290.01(10), Wis. Admin. Code.

Apprentices and Subjourney persons. Apprentices and sub journeypersons performing work on the project shall be compensated in accordance with the prevailing wage rate and with DWD 290.02, and 290.025, respectively, Wis. Admin. Code.

Straight Time Wages. The Contractor may pay straight time wages as determined by the prevailing wage rate and DWD 290.04, Wis. Admin. Code.

Overtime Wages. The Contractor shall pay overtime wages as required by the prevailing wage rate and DWD 290.05, Wis. Admin. Code.

Posting of Wage Rates and Hours. A clearly legible copy of the prevailing wage rate, together with the provisions of Sec. 66.0903(10)(a) and (11)(a), Wis. Stats., shall be kept posted in at least one conspicuous and easily accessible place at the project site by the Contractor and such notice shall remain posted during the full time any laborers, workers or mechanics are employed on the contract.

Evidence of Compliance by Contractor. Upon completion of the contract, the Contractor shall file with the Department of Public Works an affidavit stating:

a. That the Contractor has complied fully with the provisions and requirements of Sec. 66.0903(3), Wis. Stats., and Chapter DWD 290, Wis. Admin. Code; the Contractor has received evidence of compliance from each of the agents and subcontractors; and the

names and addresses of all of the subcontractors and agents who worked on the contract.

b. That full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records will be kept and the name, address and telephone number of the person who will be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

Evidence of Compliance by Agent and Subcontractor. Each agent and subcontractor shall file with the Contractor, upon completion of their portion of the work on the contract an affidavit stating that all the provisions of Sec. 66.0903(3), Wis. Stats., have been fully complied with and that full and accurate records have been kept, which clearly indicate the name and trade or occupation of every laborer, worker or mechanic employed by the Contractor in connection with work on the project. The records shall show the number of hours worked by each employee and the actual wages paid therefore; where these records shall be kept and the name, address and telephone number of the person who shall be responsible for keeping them. The records shall be retained and made available for a period of at least three (3) years following the completion of the project of public works and shall not be removed without prior notification to the municipality.

Failure to Comply with the Prevailing Wage Rate. If the Contractor fails to comply with the prevailing wage rate, she/he shall be in default on the contract.

5. **Affirmative Action.** In the performance of the services under this Agreement the Contractor agrees not to discriminate against any employee or applicant because of race, religion, marital status, age, color, sex, disability, national origin or ancestry, income level or source of income, arrest record or conviction record, less than honorable discharge, physical appearance, sexual orientation, gender identity, political beliefs, or student status. The Contractor further agrees not to discriminate against any subcontractor or person who offers to subcontract on this contract because of race, religion, color, age, disability, sex, sexual orientation, gender identity or national origin.

The Contractor agrees that within thirty (30) days after the effective date of this agreement, the Contractor will provide to the City Affirmative Action Division certain workforce utilization statistics, using a form to be furnished by the City.

If the contract is still in effect, or if the City enters into a new agreement with the Contractor, within one year after the date on which the form was required to be provided, the Contractor will provide updated workforce information using a second form, also to be furnished by the City. The second form will be submitted to the City Affirmative Action Division no later than one year after the date on which the first form was required to be provided.

The Contractor further agrees that, for at least twelve (12) months after the effective date of this contract, it will notify the City Affirmative Action Division of each of its job openings at facilities in Dane County for which applicants not already employees of the Contractor are to be considered. The notice will include a job description, classification, qualifications and application procedures and deadlines. The Contractor agrees to interview and consider candidates referred by the Affirmative Action Division if the candidate meets the minimum qualification standards established by the Contractor, and if the referral is timely. A referral is timely if it is received by the Contractor on or before the date started in the notice.

Articles of Agreement

Article I

The Contractor shall take affirmative action in accordance with the provisions of this contract to insure that applicants are employed, and that employees are treated during employment without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national original and that the employer shall provide harassment free work environment for the realization of the potential of each employee. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation and selection for training including apprenticeship insofar as it is within the control of the Contractor. The Contractor agrees to post in conspicuous places available to employees and applicants notices to be provided by the City setting out the provisions of the nondiscrimination clauses in this contract.

Article II

The Contractor shall in all solicitations or advertisements for employees placed by or on behalf of the Contractors state that all qualified or qualifiable applicants will be employed without regard to race, religion, color, age, marital status, disability, sex, sexual orientation, gender identity or national origin.

Article III

The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a notice to be provided by the City advising the labor union or worker's representative of the Contractor's equal employment opportunity and affirmative action commitments. Such notices shall be posted in conspicuous places available to employees and applicants for employment.

Article V

The Contractor agrees that it will comply with all provisions of the Affirmative Action Ordinance of the City of Madison, including the contract compliance requirements. The Contractor agrees to submit the model affirmative action plan for public works contractors in a form approved by the Affirmative Action Division Manager.

Article VI

The Contractor will maintain records as required by Section 39.02(9)(f) of the Madison General Ordinances and will provide the City Affirmative Action Division with access to such records and to persons who have relevant and necessary information, as provided in Section 39.02(9)(f). The City agrees to keep all such records confidential, except to the extent that public inspection is required by law.

Article VII

In the event of the Contractor's or subcontractor's failure to comply with the Equal Employment Opportunity and Affirmative Action Provisions of this contract or Section 39.03 and 39.02 of the Madison General Ordinances, it is agreed that the City at its option may do any or all of the following:

1. Cancel, terminate or suspend this Contract in whole or in part.

2. Declare the Contractor ineligible for further City contracts until the Affirmative Action requirements are met.

3. Recover on behalf of the City from the prime Contractor 0.5 percent of the contract award price for each week that such party fails or refuses to comply, in the nature of liquidated damages, but not to exceed a total of five percent (5%) of the contract price, or five thousand dollars ($5,000), whichever is less. Under public works contracts, if a subcontractor is in noncompliance, the City may recover liquidated damages from the prime Contractor in the manner described above. The preceding sentence shall not be construed to prohibit a prime Contractor from recovering the amount of such damage from the non-complying subcontractor.

Article VIII

The Contractor shall include the above provisions of this contract in every subcontract so that such provisions will be binding upon each subcontractor. The Contractor shall take such action with respect to any subcontractor as necessary to enforce such provisions, including sanctions provided for noncompliance.

Article IX

The Contractor shall allow the maximum feasible opportunity to small business enterprises to compete for any subcontracts entered into pursuant to this contract. (In federally funded contracts the terms "DBE, MBE and WBE" shall be substituted for the term "small business" in this Article.)

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CONTRACT NO. 7202

IN WITNESS WHEREOF, the Contractor has hereunto set his/her hand and seal and the City has caused these presents to be sealed with its corporate seal and to be subscribed by its Mayor and City Clerk the day and year first above written.

Countersigned:

SCHERRER CONSTRUCTION CO., INC.
Company Name

2/24/14
Witness Date

2/21/14
President Date

2-24-14
Witness Date

2/21/14
Secretary Date

CITY OF MADISON, WISCONSIN

Provisions have been made to pay the liability that will accrue under this contract.

Approved as to form:

Finance Director

for City Attorney

Signed this 24th day of March, 2014

Witness

24 Mar 2014
Mayor Date

Witness

2-27-14
City Clerk Date

Bond No. 105945454
Executed in Three Copies

SECTION I: PAYMENT AND PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we SCHERRER CONSTRUCTION CO., INC. as principal, and TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA Company of Hartford, Connecticut as surety, are held and firmly bound unto the City of Madison, Wisconsin, in the sum of ONE MILLION SIX HUNDRED SEVENTY-FOUR THOUSAND THREE HUNDRED TWENTY-FIVE ($1,674,325.00) Dollars, lawful money of the United States, for the payment of which sum to the City of Madison, we hereby bind ourselves and our respective executors and administrators firmly by these presents.

The condition of this Bond is such that if the above bounden shall on his/her part fully and faithfully perform all of the terms of the Contract entered into between him/herself and the City of Madison for the construction of:

MEADOWRIDGE BRANCH LIBRARY/MEADOWOOD NEIGHBORHOOD CENTER REMODELING
CONTRACT NO. 7202

in Madison, Wisconsin, and shall pay all claims for labor performed and material furnished in the prosecution of said work, and save the City harmless from all claims for damages because of negligence in the prosecution of said work, and shall save harmless the said City from all claims for compensation (under Chapter 102, Wisconsin Statutes) of employees and employees of subcontractor, then this Bond is to be void, otherwise of full force, virtue and effect.

Signed and sealed this 5th day of February, 2014

Countersigned:

SCHERRER CONSTRUCTION CO., INC.
Company Name (Principal)

Witness

President

Seal

Secretary

Approved as to form:

TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA
Surety

☐ Salary Employee ☒ Commission

Seal

TRAVELERS CASUALTY AND SURETY COMPANY OF AMERICA HARTFORD, CONN

for City Attorney

By

Attorney-in-Fact Dennis M. Barton

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. 125401 for the year 20 14, and appointed as attorney-in-fact with authority to execute this payment and performance bond which power of attorney has not been revoked.

February 5, 2014
Date

Agent Signature Dennis M. Barton

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

TRAVELERS

POWER OF ATTORNEY

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

Attorney-In Fact No. 219817 **Certificate No.** 005575741

KNOW ALL MEN BY THESE PRESENTS: That Farmington Casualty Company, St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company are corporations duly organized under the laws of the State of Connecticut, that Fidelity and Guaranty Insurance Company is a corporation duly organized under the laws of the State of Iowa, and that Fidelity and Guaranty Insurance Underwriters, Inc., is a corporation duly organized under the laws of the State of Wisconsin (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint

Elizabeth M. Fedyn, Joseph L. Vigna, Dennis M. Barton, Daniel G. Johnson, and Michael T. Burg

of the City of Brookfield, State of Wisconsin, their true and lawful Attorney(s)-in-Fact, each in their separate capacity if more than one is named above, to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed and their corporate seals to be hereto affixed, this 25th day of July, 2013.

Farmington Casualty Company
Fidelity and Guaranty Insurance Company
Fidelity and Guaranty Insurance Underwriters, Inc.
St. Paul Fire and Marine Insurance Company
St. Paul Guardian Insurance Company

St. Paul Mercury Insurance Company
Travelers Casualty and Surety Company
Travelers Casualty and Surety Company of America
United States Fidelity and Guaranty Company

State of Connecticut
City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the 25th day of July, 2013, before me personally appeared Robert L. Raney, who acknowledged himself to be the Senior Vice President of Farmington Casualty Company, Fidelity and Guaranty Insurance Company, Fidelity and Guaranty Insurance Underwriters, Inc., St. Paul Fire and Marine Insurance Company, St. Paul Guardian Insurance Company, St. Paul Mercury Insurance Company, Travelers Casualty and Surety Company, Travelers Casualty and Surety Company of America, and United States Fidelity and Guaranty Company, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of the corporations by himself as a duly authorized officer.

In Witness Whereof, I hereunto set my hand and official seal.
My Commission expires the 30th day of June, 2016.

MARIE C. TETREAULT NOTARY PUBLIC CONNECTICUT

Marie C. Tetreault
Marie C. Tetreault, Notary Public

58440-8-12 Printed in U.S.A.

WARNING: THIS POWER OF ATTORNEY IS INVALID WITHOUT THE RED BORDER

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 1/6/2014

DETERMINATION NUMBER:	201400001
EXPIRATION DATE:	Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2014. If NOT, You MUST Reapply.
PROJECT NAME:	ALL PUBLIC WORKS PROJECTS UNDER SEC 66.0903, STATS - CITY OF MADISON
PROJECT LOCATION:	MADISON CITY, DANE COUNTY, WI
CONTRACTING AGENCY:	CITY OF MADISON-ENGINEERING

CLASSIFICATION:	Contractors are responsible for correctly classifying their workers. Either call the Department of Workforce Development (DWD) with trade or classification questions or consult DWD's Dictionary of Occupational Classifications & Work Descriptions on the DWD website at: dwd.wisconsin.gov/er/prevailing_wage_rate/Dictionary/dictionary_main.htm.
OVERTIME:	Time and one-half must be paid for all hours worked: - over 10 hours per day on prevailing wage projects - over 40 hours per calendar week - Saturday and Sunday - on all of the following holidays: January 1; the last Monday in May; July 4; the 1st Monday in September; the 4th Thursday in November; December 25; - The day before if January 1, July 4 or December 25 falls on a Saturday; - The day following if January 1, July 4 or December 25 falls on a Sunday. Apply the time and one-half overtime calculation to whichever is higher between the Hourly Basic Rate listed on this project determination or the employee's regular hourly rate of pay. Add any applicable Premium or DOT Premium to the Hourly Basic Rate before calculating overtime. A DOT Premium (discussed below) may supersede this time and one-half requirement.
FUTURE INCREASE:	When a specific trade or occupation requires a future increase, you MUST add the full hourly increase to the "TOTAL" on the effective date(s) indicated for the specific trade or occupation.
PREMIUM PAY:	If indicated for a specific trade or occupation, the full amount of such pay MUST be added to the "HOURLY BASIC RATE OF PAY" indicated for such trade or occupation, whevenever such pay is applicable.
DOT PREMIUM:	This premium only applies to highway and bridge projects owned by the Wisconsin Department of Transportation and to the project type heading "Airport Pavement or State Highway Construction." DO NOT apply the premium calculation under any other project type on this determination.
APPRENTICES:	Pay apprentices a percentage of the applicable journeyperson's hourly basic rate of pay and hourly fringe benefit contributions specified in this determination. Obtain the appropriate percentage from each apprentice's contract or indenture.
SUBJOURNEY:	Subjourney wage rates may be available for some of the trades or occupations indicated below with the exception of laborers, truck drivers and heavy equipment operators. Any employer interested in using a subjourney classification on this project MUST complete Form ERD-10880 and request the applicable wage rate from the Department of Workforce Development PRIOR to using the subjourney worker on this project.

This document **MUST BE POSTED** by the **CONTRACTING AGENCY** in at least one conspicuous and easily accessible place **on the site of the project** . A local governmental unit may post this document at the place normally used to post public notices if there is no common site on the project. This document **MUST** remain posted during the entire time any worker is employed on the project and **MUST** be physically incorporated into the specifications and all contracts and subcontracts. If you have any questions, please write to the Equal Rights Division, Labor Standards Bureau, P.O. Box 8928, Madison, Wisconsin 53708 or call (608) 266-6861.

The following statutory provisions apply to local governmental unit projects of public works and are set forth below pursuant to the requirements of s. 66.0903(8), Stats.

s. 66.0903 (1) (f) & s. 103.49 (1) (c) "PREVAILING HOURS OF LABOR" for any trade or occupation in any area means 10 hours per day and 40 hours per week and may not include any hours worked on a Saturday or Sunday or on any of the following holidays:

1. January 1.
2. The last Monday in May.
3. July 4.
4. The first Monday in September.
5. The 4th Thursday in November.
6. December 25.
7. The day before if January 1, July 4 or December 25 falls on a Saturday.
8. The day following if January 1, July 4 or December 25 falls on a Sunday.

s. 66.0903 (10) RECORDS; INSPECTION; ENFORCEMENT.
(a) Each contractor, subcontractor, or contractor's or subcontractor's agent performing work on a project of public works that is subject to this section shall keep full and accurate records clearly indicating the name and trade or occupation of every person performing the work described in sub. (4) and an accurate record of the number of hours worked by each of those persons and the actual wages paid for the hours worked.

s. 66.0903 (11) LIABILITY AND PENALTIES.
(a) 1. Any contractor, subcontractor, or contractor's or subcontractor's agent who fails to pay the prevailing wage rate determined by the department under sub. (3) or who pays less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor is liable to any affected employee in the amount of his or her unpaid wages or his or her unpaid overtime compensation and in an additional amount as liquidated damages as provided under subd. 2., 3., whichever is applicable.
2. If the department determines upon inspection under sub. (10) (b) or (c) that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the department shall order the contractor to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages within a period specified by the department in the order.
3. In addition to or in lieu of recovering the liability specified in subd. 1. as provided in subd. 2., any employee for and in behalf of that employee and other employees similarly situated may commence an action to recover that liability in any court of competent jurisdiction. If the court finds that a contractor, subcontractor, or contractor's or subcontractor's agent has failed to pay the prevailing wage rate determined by the department under sub. (3) or has paid less than 1.5 times the hourly basic rate of pay for all hours worked in excess of the prevailing hours of labor, the court shall order the contractor, subcontractor, or agent to pay to any affected employee the amount of his or her unpaid wages or his or her unpaid overtime compensation and an additional amount equal to 100 percent of the amount of those unpaid wages or that unpaid overtime compensation as liquidated damages.
5. No employee may be a party plaintiff to an action under subd. 3. unless the employee consents in writing to become a party and the consent is filed in the court in which the action is brought. Notwithstanding s. 814.04 (1), the court shall, in addition to any judgment awarded to the plaintiff, allow reasonable attorney fees and costs to be paid by the defendant.

BUILDING OR HEAVY CONSTRUCTION

Includes sheltered enclosures with walk-in access for the purpose of housing persons, employees, machinery, equipment or supplies and non-sheltered work such as canals, dams, dikes, reservoirs, storage tanks, etc. A sheltered enclosure need not be "habitable" in order to be considered a building. The installation of machinery and/or equipment, both above and below grade level, does not change a project's character as a building. On-site grading, utility work and landscaping are included within this definition. Residential buildings of four (4) stories or less, agricultural buildings, parking lots and driveways are NOT included within this definition.

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	30.48	15.90	46.38
102	Boilermaker Future Increase(s): Add $1.50/hr on 1/01/2015; Add $1.50/hr. on 01/01/2016	32.05	28.04	60.09
103	Bricklayer, Blocklayer or Stonemason Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.01	17.35	49.36
104	Cabinet Installer	30.48	15.90	46.38
105	Carpenter	30.48	15.90	46.38
106	Carpet Layer or Soft Floor Coverer	30.48	15.90	46.38
107	Cement Finisher	31.58	16.13	47.71
108	Drywall Taper or Finisher	24.80	16.60	41.40
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	34.07	19.25	53.32
110	Elevator Constructor	42.86	23.84	66.70
111	Fence Erector	24.72	0.00	24.72
112	Fire Sprinkler Fitter	36.07	18.73	54.80
113	Glazier	38.03	13.42	51.45
114	Heat or Frost Insulator	33.68	24.31	57.99
115	Insulator (Batt or Blown)	15.00	9.50	24.50
116	Ironworker	31.25	19.46	50.71
117	Lather	30.48	15.90	46.38

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
118	Line Constructor (Electrical)	38.25	17.31	55.56
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	32.01	17.35	49.36
121	Metal Building Erector	22.00	10.00	32.00
122	Millwright	32.11	15.95	48.06
123	Overhead Door Installer	20.95	4.94	25.89
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
127	Pipeline Fuser or Welder (Gas or Utility)	30.79	19.74	50.53
129	Plasterer	31.03	17.71	48.74
130	Plumber Future Increase(s): Add $1/hr on 6/1/2014.	36.42	16.87	53.29
132	Refrigeration Mechanic	41.60	16.71	58.31
133	Roofer or Waterproofer	29.40	6.25	35.65
134	Sheet Metal Worker	34.45	22.57	57.02
135	Steamfitter Future Increase(s): Add $1.70/hr on 6/1/2014.	42.95	17.81	60.76
137	Teledata Technician or Installer Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	22.25	12.24	34.49
138	Temperature Control Installer	32.94	18.80	51.74
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.85	17.18	41.03
142	Tile Setter	29.81	17.18	46.99
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
146	Well Driller or Pump Installer	25.32	15.65	40.97
147	Siding Installer	25.92	18.04	43.96

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	28.74	17.27	46.01

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	32.39	18.46	50.85
203	Three or More Axle	18.00	22.88	40.88
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	18.00	22.88	40.88
207	Truck Mechanic	18.00	22.88	40.88

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $1.00/hr for certified welder; Add $.25/hr for mason tender	24.21	14.63	38.84
302	Asbestos Abatement Worker	24.36	14.44	38.80
303	Landscaper	21.01	9.37	30.38
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	21.01	13.63	34.64
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased) Premium Increase(s): DOT PREMIUMS: Pay two times the hourly basic rate on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	18.33	13.65	31.98
314	Railroad Track Laborer	23.46	3.30	26.76
315	Final Construction Clean-Up Worker	16.00	0.00	16.00

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
501	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Milling Machine; Boring Machine (Directional, Horizontal or Vertical); Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Backhoe (Track Type) Having a Mfgr's Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Crane, Shovel, Dragline, Clamshells; Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Grader or Motor Patrol; Master Mechanic; Mechanic or Welder; Robotic Tool Carrier (With or Without Attachments); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Tractor (Scraper, Dozer, Pusher, Loader); Trencher (Wheel Type or Chain Type Having Over 8 Inch Bucket).	33.42	18.96	52.38
502	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Environmental Burner; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Jeep Digger; Screed (Milling Machine); Skid Rig; Straddle Carrier or Travel Lift; Stump Chipper; Trencher (Wheel Type or Chain Type Having 8 Inch Bucket & Under).	32.89	18.96	51.85
503	Air Compressor (&/or 400 CFM or Over); Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Greaser; High Pressure Utility Locating Machine (Daylighting Machine); Mulcher; Oiler; Post Hole Digger or Driver; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.82	18.96	49.78
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	18.98	57.78
505	Work Performed on the Great Lakes Including Crane or Backhoe Operator; Assistant Hydraulic Dredge Engineer; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder; 70 Ton & Over Tug Operator.	38.80	18.98	57.78
506	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	18.98	53.48

507	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	18.98	53.48

HEAVY EQUIPMENT OPERATORS EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
508	Boring Machine (Directional); Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50/hr at 400 Ton / Add $2/hr at 500 Ton & Over.	35.62	18.96	54.58
509	Backhoe (Track Type) Having a Mfgr's Rated Capacity of 130,000 Lbs. or Over; Boring Machine (Horizontal or Vertical); Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Pile Driver; Versi Lifts, Tri-Lifts & Gantrys (20,000 Lbs. & Over).	36.35	6.95	43.30
510	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Dredge (NOT Performing Work on the Great Lakes); Forklift (Machinery Moving or Steel Erection, 25 Ft & Over); Gradall (Cruz-Aire Type); Hydro-Blaster (10,000 PSI or Over); Milling Machine; Skid Rig; Traveling Crane (Bridge Type).	33.42	18.96	52.38
511	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Bulldozer or Endloader (Over 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Environmental Burner; Gantrys (Under 20,000 Lbs.); Grader or Motor Patrol; High Pressure Utility Locating Machine (Daylighting Machine); Manhoist; Material or Stack Hoist; Mechanic or Welder; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tining or Curing Machine; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
512	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Grout Pump; Hoist (Tugger, Automatic); Industrial Locomotives; Jeep Digger; Lift Slab Machine; Mulcher; Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames.	30.82	18.96	49.78
513	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Boatmen (NOT Performing Work on the Great Lakes); Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Elevator; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Forklift; Generator (&/or 150 KW or Over); Greaser; Heaters (Mechanical); Loading Machine (Conveyor); Oiler; Post Hole Digger or Driver; Prestress Machine; Pump (3 Inch or Over) or Well Points; Refrigeration Plant or Freeze Machine; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	24.19	17.89	42.08
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment).	36.34	21.14	57.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015.	32.32	18.55	50.87
516	Fiber Optic Cable Equipment Future Increase(s): Add $1.75/hr on 02/01/2014.	27.89	17.20	45.09

SEWER, WATER OR TUNNEL CONSTRUCTION

Includes those projects that primarily involve public sewer or water distribution, transmission or collection systems and related tunnel work (excluding buildings).

SKILLED TRADES

CODE	TRADE OR OCCUPATION Fringe Benefits Must Be Paid On All Hours Worked	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	35.10	18.40	53.50
105	Carpenter Future Increase(s): Add $1.25/hr on 6/2/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	33.68	19.81	53.49
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	33.51	16.13	49.64
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	32.82	22.61	55.43
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
125	Pavement Marking Operator	16.00	7.35	23.35
126	Piledriver	30.98	15.90	46.88
130	Plumber	33.75	14.07	47.82
135	Steamfitter	42.45	16.71	59.16
137	Teledata Technician or Installer	21.89	11.85	33.74

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	18.98	57.78
146	Well Driller or Pump Installer	25.32	15.65	40.97
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.16	14.34	43.50
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00
203	Three or More Axle	16.00	7.35	23.35
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	16.00	7.35	23.35
207	Truck Mechanic	16.00	7.35	23.35

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Premium Increase(s): Add $.20 for blaster, bracer, manhole builder, caulker, bottomman and power tool; Add $.55 for pipelayer; Add $1.00 for tunnel work 0-15 lbs. compressed air; Add $2.00 for over 15-30 lbs. compressed air; Add $3.00 for over 30 lbs. compressed air.	25.60	14.62	40.22
303	Landscaper	25.28	11.46	36.74
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
521	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Master Mechanic; Pile Driver. Premium Increase(s): Add $.25/hr for all >45 Ton lifting capacity cranes	34.62	18.96	53.58
522	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump (Over 46 Meter), Concrete Conveyor (Rotec or Bidwell Type); Concrete Spreader & Distributor; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Dredge (NOT Performing Work on the Great Lakes); Milling Machine; Skid Rig; Telehandler; Traveling Crane (Bridge Type).	33.42	18.96	52.38
523	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Boring Machine (Horizontal or Vertical); Bulldozer or Endloader (Over 40 hp); Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Concrete Pump (46 Meter & Under), Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Manhoist; Material or Stack Hoist; Mechanic or Welder; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yd or More Capacity; Screed (Milling Machine); Sideboom; Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type Having Over 8-Inch Bucket).	32.89	18.96	51.85

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
524	Backfiller; Broom or Sweeper; Bulldozer or Endloader (Under 40 hp); Compactor (Self-Propelled 85 Ft Total Drum Width & Over, or Tractor Mounted, Towed & Light Equipment); Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Finishing Machine (Road Type); Environmental Burner; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Hoist (Tugger, Automatic); Grout Pump; Jeep Digger; Lift Slab Machine; Mulcher; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Screw or Gypsum Pumps; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Stump Chipper; Tining or Curing Machine; Trencher (Wheel Type or Chain Type Having 8-Inch Bucket & Under); Winches & A-Frames. Future Increase(s): Add $1.05/hr on 6/2/2014; Add $1.55/hr on 6/1/2015. Premium Increase(s): Add $.25/hr for operating tower crane.	35.11	19.45	54.56
525	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Compactor (Self-Propelled 84 Ft Total Drum Width & Under, or Tractor Mounted, Towed & Light Equipment); Crusher, Screening or Wash Plant; Farm or Industrial Type Tractor; Fireman (Asphalt Plant NOT Performing Work on the Great Lakes); Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Loading Machine (Conveyor); Post Hole Digger or Driver; Refrigeration Plant or Freeze Machine; Rock, Stone Breaker; Skid Steer Loader (With or Without Attachments); Vibratory Hammer or Extractor, Power Pack.	30.19	20.94	51.13
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	24.19	17.89	42.08
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	18.98	57.78
528	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	18.98	57.78
529	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	18.98	53.48
530	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under), Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	18.98	53.48

AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Includes all airport projects (excluding buildings) and all projects awarded by the Wisconsin Department of Transportation (excluding buildings).

SKILLED TRADES

CODE	TRADE OR OCCUPATION Fringe Benefits Must Be Paid On All Hours Worked	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.01	17.35	49.36
105	Carpenter	30.48	15.90	46.38
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/14; Add $1.87 on 6/1/15; Add $1.75 on 6/1/16. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.40/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	33.51	16.13	49.64
109	Electrician Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	34.07	19.25	53.32
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	21.87	11.37	33.24
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	29.40	6.25	35.65
137	Teledata Technician or Installer	21.89	11.85	33.74
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	34.48	15.90	50.38
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	35.50	15.89	51.39

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	34.22	19.90	54.12
203	Three or More Axle Future Increase(s): Add $1.30/hr on 6/1/2014. Premium Increase(s): DOT PREMIUM: Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day.	24.52	17.77	42.29
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1.75/hr on 6/1/14; Add $1.25/hr on 6/1/15; Add $1.30/hr on 6/1/16; Add $1.25/hr on 6/1/17. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	29.27	20.40	49.67
205	Pavement Marking Vehicle	23.31	17.13	40.44
206	Shadow or Pilot Vehicle	34.22	19.90	54.12
207	Truck Mechanic	23.31	17.13	40.44

LABORERS

CODE	TRADE OR OCCUPATION Fringe Benefits Must Be Paid On All Hours Worked	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer Future Increase(s): Add $1.60/hr on 6/1/2014. Premium Increase(s): Add $.10/hr for topman, air tool operator, vibrator or tamper operator (mechanical hand operated), chain saw operator and demolition burning torch laborer; Add $.15/hr for bituminous worker (raker and luteman), formsetter (curb, sidewalk and pavement) and strike off man; Add $.20/hr for blaster and powderman; Add $.25/hr for bottomman; Add $.35/hr for line and grade specialist; Add $.45/hr for pipelayer. / DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.32	14.63	43.95
302	Asbestos Abatement Worker	24.36	14.44	38.80
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.32	14.63	43.95
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.60/hr on 6/1/2014. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr when the Wisconsin Department of Transportation or responsible governing agency requires that work be performed at night under artificial illumination with traffic control and the work is completed after sunset and before sunrise.	25.67	14.63	40.30
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
531	Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Traveling Crane (Bridge Type). Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	36.72	20.40	57.12
532	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With A Lifting Capacity Of 4,000 Lbs., & Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
533	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boatmen (NOT Performing Work on the Great Lakes); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.72	20.40	56.12

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
534	Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.46	20.40	55.86
535	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.17	20.40	55.57
536	Fiber Optic Cable Equipment.	26.69	16.65	43.34
537	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	18.98	57.78
538	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	18.98	57.78

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
539	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or More); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	18.98	53.48
540	Work Performed on the Great Lakes Including Deck Equipment Operator, Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks-Great Lakes ONLY.	34.50	18.98	53.48

LOCAL STREET OR MISCELLANEOUS PAVING CONSTRUCTION

Includes roads, streets, alleys, trails, bridges, paths, racetracks, parking lots and driveways (except residential or agricultural), public sidewalks or other similar projects (excluding projects awarded by the Wisconsin Department of Transportation).

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	32.01	17.35	49.36
105	Carpenter	32.93	19.93	52.86
107	Cement Finisher	31.48	15.68	47.16
109	Electrician	31.27	22.81	54.08
111	Fence Erector	24.72	0.00	24.72
116	Ironworker	31.25	19.46	50.71
118	Line Constructor (Electrical)	38.25	17.31	55.56
124	Painter	24.50	16.60	41.10
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.98	15.90	46.88
133	Roofer or Waterproofer	29.40	6.25	35.65
137	Teledata Technician or Installer	21.89	11.85	33.74
143	Tuckpointer, Caulker or Cleaner	35.25	13.15	48.40
144	Underwater Diver (Except on Great Lakes)	38.80	18.98	57.78
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	34.43	15.24	49.67
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	30.60	14.86	45.46
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	26.78	13.63	40.41
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.86	12.97	37.83
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	12.70	34.45

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	30.00	15.00	45.00

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	32.89	18.96	51.85
205	Pavement Marking Vehicle	17.00	0.00	17.00
206	Shadow or Pilot Vehicle	30.00	15.00	45.00
207	Truck Mechanic	17.00	0.00	17.00

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	28.07	13.25	41.32
303	Landscaper Future Increase(s): Add $1.60/hr on 6/1/14. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.25/hr for work on projects involving temporary traffic control setup, for lane and shoulder closures, when work under artificial illumination conditions is necessary as required by the project provisions (including prep time prior to and/or cleanup after such time period).	29.04	14.63	43.67
304	Flagperson or Traffic Control Person	24.70	10.72	35.42
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
314	Railroad Track Laborer	23.46	3.30	26.76

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
541	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self-Erecting Tower Crane With a Lifting Capacity Of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	36.72	20.40	57.12
542	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity of 4,000 Lbs. & Under; Crane, Tower Crane Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
543	Air Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Automatic Subgrader (Concrete); Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Boring Machine (Directional, Horizontal or Vertical); Bridge (Bidwell) Paver; Bulldozer or Endloader; Concrete Batch Plant, Batch Hopper; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Straddle Carrier or Travel Lift; Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.72	20.40	56.12
544	Backfiller; Belting, Burlap, Texturing Machine; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler; Tining or Curing Machine.	33.96	19.79	53.75
545	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Concrete Proportioning Plant; Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack.	30.32	18.46	48.78
546	Fiber Optic Cable Equipment.	26.69	16.65	43.34

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	38.80	18.98	57.78
548	Work Performed on the Great Lakes Including 70 Ton & Over Tug Operator; Assistant Hydraulic Dredge Engineer; Crane or Backhoe Operator; Hydraulic Dredge Leverman or Diver's Tender; Mechanic or Welder.	38.80	18.98	57.78
549	Work Performed on the Great Lakes Including Deck Equipment Operator or Machineryman (Maintains Cranes Over 50 Tons or Backhoes 115,000 Lbs. or more); Tug, Launch or Loader, Dozer or Like Equipment When Operated on a Barge, Breakwater Wall, Slip, Dock or Scow, Deck Machinery.	34.50	18.98	53.48
550	Work Performed on the Great Lakes Including Deck Equipment Operator; Machineryman or Fireman (Operates 4 Units or More or Maintains Cranes 50 Tons or Under or Backhoes 115,000 Lbs. or Under); Deck Hand, Deck Engineer or Assistant Tug Operator; Off Road Trucks - Great Lakes ONLY.	34.50	18.98	53.48

HEAVY EQUIPMENT OPERATORS
ASPHALT PAVEMENT OR OTHER WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
551	Crane, Tower Crane, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of Over 100 Tons, Self Erecting Tower Crane With a Lifting Capacity of Over 4,000 Lbs., Crane With Boom Dollies; Crane, Tower Crane, Pedestal Tower or Derrick, With Boom, Leads and/or Jib Lengths Measuring 176 Ft or Over; Master Mechanic.	35.12	18.46	53.58
552	Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of 130,000 Lbs. or Over; Caisson Rig; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With or Without Attachments, With a Lifting Capacity of 100 Tons or Under, Self-Erecting Tower Crane With a Lifting Capacity Of 4,000 Lbs. & Under; Crane, Tower Crane, Portable Tower, Pedestal Tower or Derrick, With Boom, Leads &/or Jib Lengths Measuring 175 Ft or Under; Dredge (NOT Performing Work on the Great Lakes); Licensed Boat Pilot (NOT Performing Work on the Great Lakes); Pile Driver. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	36.22	20.40	56.62

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
553	Air, Track, Rotary or Percussion Drilling Machine &/or Hammers, Blaster; Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type) Having a Mfgr.'s Rated Capacity of Under 130,000 Lbs., Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Conveyor System; Concrete Laser/Screed; Concrete Slipform Placer Curb & Gutter Machine; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Gradall (Cruz-Aire Type); Grader or Motor Patrol; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Post Hole Digger or Driver; Railroad Track Rail Leveling Machine, Tie Placer, Extractor, Tamper, Stone Leveler or Rehabilitation Equipment; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Sideboom; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Trencher (Wheel Type or Chain Type); Tube Finisher; Tugger (NOT Performing Work on the Great Lakes); Winches & A-Frames.	32.89	18.96	51.85
554	Backfiller; Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Environmental Burner; Farm or Industrial Type Tractor; Fireman (Asphalt Plant, Pile Driver & Derrick NOT Performing Work on the Great Lakes); Forklift; Greaser; Hoist (Tugger, Automatic); Jeep Digger; Joint Sawer (Multiple Blade); Launch (NOT Performing Work on the Great Lakes); Lift Slab Machine; Mechanical Float; Mulcher; Power Subgrader; Robotic Tool Carrier (With or Without Attachments); Roller (Rubber Tire, 5 Ton or Under); Self-Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Telehandler.	33.67	19.48	53.15
555	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Augers (Vertical & Horizontal); Automatic Belt Conveyor & Surge Bin; Boiler (Temporary Heat); Crusher, Screening or Wash Plant; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Mudjack; Oiler; Prestress Machine; Pug Mill; Pump (3 Inch or Over) or Well Points; Rock, Stone Breaker; Screed (Milling Machine); Stump Chipper; Tank Car Heaters; Vibratory Hammer or Extractor, Power Pack. Future Increase(s): Add $1.75/hr on 6/1/2014; Add $1.25/hr on 6/1/2015; Add $1.30/hr on 6/1/2016; Add $1.25/hr on 6/1/2017. Premium Increase(s): DOT PREMIUMS: 1) Pay two times the hourly basic rate on Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day & Christmas Day. 2) Add $1.50/hr night work premium. See DOT's website for details about the applicability of this night work premium at: http://roadwaystandards.dot.wi.gov/hcci/labor-wages-eeo/index.shtm.	35.17	20.40	55.57
556	Fiber Optic Cable Equipment.	26.69	16.65	43.34

RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

Includes single family houses or apartment buildings of no more than four (4) stories in height and all buildings, structures or facilities that are primarily used for agricultural or farming purposes, excluding commercial buildings. For classification purposes, the exterior height of a residential building, in terms of stories, is the primary consideration. All incidental items such as site work, driveways, parking lots, private sidewalks, private septic systems or sewer and water laterals connected to a public system and swimming pools are included within this definition. Residential buildings of five (5) stories and above are NOT included within this definition.

SKILLED TRADES

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer Future Increase(s): Add $1.25/hr on 6/2/2014.	33.68	19.81	53.49
102	Boilermaker	26.00	4.73	30.73
103	Bricklayer, Blocklayer or Stonemason	32.01	13.26	45.27
104	Cabinet Installer	22.00	1.05	23.05
105	Carpenter	30.48	3.24	33.72
106	Carpet Layer or Soft Floor Coverer	23.68	3.20	26.88
107	Cement Finisher	20.93	5.94	26.87
108	Drywall Taper or Finisher	22.50	0.88	23.38
109	Electrician	27.50	7.47	34.97
110	Elevator Constructor	42.86	23.84	66.70
111	Fence Erector	18.52	4.89	23.41
112	Fire Sprinkler Fitter	52.82	5.54	58.36
113	Glazier	38.03	13.42	51.45
114	Heat or Frost Insulator	30.00	0.00	30.00
115	Insulator (Batt or Blown)	19.00	14.33	33.33
116	Ironworker	31.25	19.46	50.71
117	Lather	30.48	3.24	33.72
119	Marble Finisher	26.89	19.18	46.07
120	Marble Mason	32.01	13.26	45.27
121	Metal Building Erector	17.00	3.82	20.82
123	Overhead Door Installer	12.00	0.00	12.00
124	Painter	20.00	4.22	24.22

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
125	Pavement Marking Operator	30.00	0.00	30.00
129	Plasterer	25.00	0.00	25.00
130	Plumber	30.00	10.62	40.62
132	Refrigeration Mechanic	19.75	8.56	28.31
133	Roofer or Waterproofer	17.00	3.72	20.72
134	Sheet Metal Worker	21.03	3.40	24.43
135	Steamfitter	31.72	16.10	47.82
137	Teledata Technician or Installer	24.75	8.09	32.84
138	Temperature Control Installer	22.50	0.70	23.20
139	Terrazzo Finisher	26.89	19.18	46.07
140	Terrazzo Mechanic	30.20	18.42	48.62
141	Tile Finisher	23.77	16.50	40.27
142	Tile Setter	21.00	0.00	21.00
143	Tuckpointer, Caulker or Cleaner	32.50	3.21	35.71
146	Well Driller or Pump Installer	27.60	5.80	33.40
147	Siding Installer	20.18	0.00	20.18

TRUCK DRIVERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
201	Single Axle or Two Axle	28.05	4.16	32.21
203	Three or More Axle	18.00	2.37	20.37
205	Pavement Marking Vehicle	18.00	2.37	20.37
207	Truck Mechanic	19.00	1.85	20.85

LABORERS

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
301	General Laborer	18.14	10.16	28.30
302	Asbestos Abatement Worker	17.00	3.86	20.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
303	Landscaper	30.00	0.00	30.00
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	18.31	12.67	30.98
315	Final Construction Clean-Up Worker	16.00	0.00	16.00

HEAVY EQUIPMENT OPERATORS
RESIDENTIAL OR AGRICULTURAL CONSTRUCTION

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
557	Asphalt Heater, Planer & Scarifier; Asphalt Milling Machine; Asphalt Screed; Backhoe (Track Type); Backhoe (Mini, 15,000 Lbs. & Under); Bituminous (Asphalt) Plant & Paver, Screed; Boring Machine (Directional, Horizontal or Vertical); Bulldozer or Endloader; Concrete Breaker (Large, Auto, Vibratory/Sonic, Manual or Remote); Concrete Bump Cutter, Grinder, Planing or Grooving Machine; Concrete Conveyor System; Concrete Laser/Screed; Concrete Paver (Slipform); Concrete Pump, Concrete Conveyor (Rotec or Bidwell Type); Concrete Slipform Placer Curb & Gutter Machine; Concrete Spreader & Distributor; Crane (Carry Deck, Mini) or Truck Mounted Hydraulic Crane (10 Tons or Under); Crane With a Lifting Capacity of 25 Tons or Under; Crane, Shovel, Dragline, Clamshells; Forestry Equipment, Timbco, Tree Shear, Tub Grinder, Processor; Grader or Motor Patrol; Grout Pump; Hydro-Blaster (10,000 PSI or Over); Loading Machine (Conveyor); Manhoist; Material or Stack Hoist; Mechanic or Welder; Milling Machine; Roller (Over 5 Ton); Scraper (Self Propelled or Tractor Drawn) 5 cu yds or More Capacity; Shoulder Widener; Skid Rig; Stabilizing or Concrete Mixer (Self-Propelled or 14S or Over); Tractor (Scraper, Dozer, Pusher, Loader); Tractor or Truck Mounted Hydraulic Backhoe; Tractor or Truck Mounted Hydraulic Crane (10 Tons or Under); Trencher (Wheel Type or Chain Type); Winches & A-Frames.	29.70	20.08	49.78
558	Air Compressor (&/or 400 CFM or Over); Air, Electric or Hydraulic Jacking System; Backfiller; Belting, Burlap, Texturing Machine; Boiler (Temporary Heat); Broom or Sweeper; Compactor (Self-Propelled or Tractor Mounted, Towed & Light Equipment); Concrete Finishing Machine (Road Type); Farm or Industrial Type Tractor; Forklift; Generator (&/or 150 KW or Over); Heaters (Mechanical); High Pressure Utility Locating Machine (Daylighting Machine); Jeep Digger; Lift Slab Machine; Mulcher; Oiler; Post Hole Digger or Driver; Power Subgrader; Pump (3 Inch or Over) or Well Points; Robotic Tool Carrier (With or Without Attachments); Rock, Stone Breaker; Roller (Rubber Tire, 5 Tons or Under); Screed (Milling Machine); Self Propelled Chip Spreader; Shouldering Machine; Skid Steer Loader (With or Without Attachments); Stump Chipper; Telehandler; Vibratory Hammer or Extractor, Power Pack.	29.70	16.00	45.70

********** END OF RATES **********