BID OF_____

2013

PROPOSAL, CONTRACT, BOND AND SPECIFICATIONS

FOR

SOUTH POINT ROAD WARM STORAGE BUILDING

CONTRACT NO. 6962

IN

MADISON, DANE COUNTY, WISCONSIN

AWARDED BY THE COMMON COUNCIL
MADISON, WISCONSIN ON_____

CITY ENGINEERING DIVISION
1600 EMIL STREET
MADISON, WISCONSIN 53713

www.cityofmadison.com/business/pw

https://bidexpress.com/login

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

INDEX

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:	SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO.:	6962
SBE GOAL	11%
BID BOND	5%
PRE BID MEETING (1:00 P.M.)	JULY 5, 2013
Pre-Bid Conference (1:30pm, See instructions below)	JUNE 27, 2013
PREQUALIFICATION APPLICATION DUE (1:00 P.M)	JULY 5, 2013
BID SUBMISSION (1:00 P.M.)	JULY 12, 2013
BID OPEN (1:30 P.M.)	JULY 12, 2013
PUBLISHED IN WSJ	6/14/13 & 6/21/13, 6/28/13 & 7/5/13

PRE-BID CONFERENCE: A pre-bid conference will be conducted in the Madison Fire Station 12 Community Room located at 400 South Point Road at 1:30pm, Thursday June 27, 2013. Representatives from Angus Young and Associates, and City of Madison Staff will be on hand to take questions. A trip to the project site after the meeting may be conducted if necessary.

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.

Site Visit: Bidding contractors are encouraged to visit the project site on their own at any time during the bidding process. The project site is located at 402 South Point Road.

Questions, Clarification, & Requests for Alternates: Any questions or requests for clarifications regarding plans and specifications shall be submitted directly to the Architect. Any requests for alternate materials and equipment shall be submitted to the Architect in writing. All submittals shall include sufficient product information for the Architect and City Staff to make a proper evaluation of the requested alternate.

The deadline for questions, clarifications and requests for alternates to the Architect is 12:00PM Monday, July 1, 2013. The Architect and the City will publish an all inclusive addendum on or about July 8. The addendum will include all question/answers, requested clarifications, and approved equals through the deadline. No additional questions, requests for clarifications or requests for alternates will be entertained after the deadline.

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.

Plans and Specifications are also available at 1600 Emil St., Madison, WI, 53713; (608) 267-1197.

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)l. 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
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
255 ☐ Pavement Sealcoating and Crack Sealing
260 ☐ Petroleum Above/Below Ground Storank Tank Removal/Install
265 ☐ Retaining Walls, Precast Modular Units
270 ☐ Retaining Walls, Reinforced Concrete
275 ☐ Sanitary, Storm Sewer and Water Main Construction
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
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 ☐ Other_____
9 ☐ Other_____

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.

SOUTH POINT ROAD WARM STORAGE BUILDING
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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

SOUTH POINT ROAD WARM STORAGE BUILDING
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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: _____%.

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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

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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 102.4 PROPOSALS

This bid consists of a BASE BID (Bid Item 90001) and two (2) ALTERNATE BID ITEMS (Bid Items 90002 & 90003). The Contractor shall comply with these instructions when filling out the proposal form:

1. The bidder must completely fill in the LUMP SUM BASE BID and the LUMP SUM for each of the two (2) ALTERNATE BID items.
2. The bidder must completely fill in the SUB TOTAL value after each ALTERNATE Bid using the formulas provided on the proposal form.

The contract shall be awarded to the lowest bidding contractor in the following manner:

1. The City will establish a Construction Budget Dollar Value for the overall project.
2. The City will award the contract based on the sub totals of the base bid plus alternates in the order presented on the proposal form until the sub total exceeds the predetermined Construction Budget Dollar Value.

The City shall have the right to proceed or not proceed with any alternate regardless of how the bid was awarded. The City shall have the right to reject all bids regardless of the value of the bids submitted.

SECTION 102.10: MINIMUM RATE OF WAGE SCALE

For this project, payment of prevailing wages (white sheet) is not required if either: a single trade accounts for 85% or more of the total labor costs of the project and the bid is less than $48,000; or no single trade accounts for 85% or more of the total labor costs of the project and the bid is less than $100,000. For bids not meeting either of these conditions, prevailing wages shall be required.

If 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

All bidders are notified that all labor employed on City contracts must be paid in accordance with the minimum rate of wage scale included in the Contract Documents.

For the information of the employees working on the project, a copy of the wage scale included in the contract documents and the provisions of Section 66.0903(8) of the Wisconsin Statutes shall be kept posted by the employer and in at least one conspicuous and easily accessible place at the site of the project.

The Contractor shall keep weekly payroll records setting forth the name, address, telephone number, classification, wage rate and fringe benefit package of each employee who worked on such City project and all other projects the employee worked in the same period, and the Contractor must keep records of the individual time each employee worked on the project and for each day of the project. Records shall include employee demographics or contractor can submit a one-time report of all employee

demographics that can be matched up with weekly payrolls. Reports shall only include last four social security digits. 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. Such records shall, in addition, set forth the full weekly wages earned by each such employee and the actual hourly wage paid to that employee. The Contractor shall submit payroll records to the Engineer every week for those periods when work is being done on the project. Said submittal shall be within twenty-one (21) calendar days of the end of the Contractor's weekly pay period.

The Contractor shall ensure that employees shall be paid unconditionally and shall receive the full amounts accrued at the time of payment, computed at rates not less than those stated in the City of Madison "Minimum Rate of Wage Scale" and that 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 such employee. Questions regarding an employee's classification or rate of pay within that classification, shall be resolved by the practice that predominates in the industry and on which the trade or occupation rate/classification is based. Therefore, rate of pay, classification and work jurisdiction disputes shall be resolved by relying upon practices established by collective bargaining agreements and guidelines used in such determinations by appropriate recognized trade unions operating within the City of Madison.

The Contractor shall agree that the normal rate of wage paid to the Contractor's employees on other projects shall not be reduced or otherwise diminished as a result of the requirement to pay no less than the minimum rate of wage scale on a City project. Mulcting of employees on City projects by contractors, such as by kickbacks or other such devices, is prohibited.

These contract provisions shall apply to all work performed on the contract by the Contractor with its own organization and with assistance of laborers under its immediate superintendency and to all work performed by piecework or by subcontract. No laborer, worker, or mechanic shall be employed directly upon the site of the work except on a wage basis, but this shall not be construed to prohibit the rental of equipment from individuals.

In the event of a refusal by the Contractor to submit payroll records as required by the contract, the City of Madison shall have the option to cancel this contract and request the Surety to perform or to re-let the balance of the work for bids, and in that event, to charge the Contractor for any loss which the City may incur thereby.

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).

ARTICLE 103 AWARD AND EXECUTION OF THE CONTRACT

The Contractor shall execute signing of the contract completely prior to **August 6, 2013**. No exceptions or extensions to the above date will be permitted.

ARTICLE 104 SCOPE OF WORK

This contract is for the construction of a Public Works Warm Storage Building. Work shall include but not be limited to the following:

- Site excavation and grading
- Utility construction as per the attached plans and specifications
- Site drainage
- Stormwater management features
- Exterior pavements and amenities
- Building construction and mechanicals per the attached plans and specifications
- Landscaping

The scope of work includes the furnishing of all labor, materials, equipment, tools, and services; and includes all costs of permits (except as indicated in these special provisions) and any other costs whatsoever which may be required for the installation of all components as specified in plans, details, and these special provisions.

Unless specifically noted in the plans and specifications as work done by owner or materials furnished by owner the contractor shall assume the responsibilities of work and materials for this contract. The Contractor shall furnish any apparatus, appliance, material, or labor that may be necessary to complete the work, in accordance with the intent of this contract. The Contractor shall use properly functioning equipment capable of performing the tasks required. The Contractor shall furnish workers who perform quality work and who are experienced and knowledgeable in the work proposed. The Contractor shall also coordinate work being done by others into the contract schedule. This includes but is not limited to work being done by other City agencies.

SECTION 104.1 LANDS FOR WORK

All lands for work shall be located at 402 South Point Road, also known as the Far West Public Works Facility. The project limits are identified on sheet C203 (Erosion Control Plan) of the plan set, the landscaping berm located along South Point Road (see sheet C101), and lands as needed for the installation of new utility infrastructure being installed as part of this contract. The construction limits for this contract are any reasonable work space requirements needed for the work being performed with the following restrictions:

1. All work shall be at 402 South Point Road (parcel 0708-282-0103-1).
2. Existing vegetation, trees, fencing, and other landscape items etc shall not be trimmed or removed during the execution of this contract unless designated in the plans or specifications.

SECTION 104.2 INTENT AND COORDINATION OF CONTRACT DOCUMENTS

The contract documents are complimentary of each other and consist of all of the following:

- The City Standard Specification, 2013 Edition
- The Plans and Specifications as provided by Angus-Young and Associates, Inc. shall be used for the construction, execution, and completion of this contract and shall be considered to be the Supplemental Plans and Specifications.
- These Special Provisions
- All Addendums to the bidding documents
- Any supplemental instructions, details, or specifications issued during the course of the contract.

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(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 105.3 AUTHORITY AND DUTIES OF THE INSPECTOR

The Contractor shall coordinate directly with the City of Madison Building Inspection Unit for all required building, plumbing, heating, electrical, and other related inspections associated with the Building Permit. The Contractor shall inform the Architect a minimum of 2 working days in advance of each planned inspection.

The contractor shall coordinate Quality Management Inspections (QMI's) through the Architect and the City Project Manager. QMI's shall be conducted by the Architect, Architects sub-consultants, and various City Staff as needed. Upcoming QMI's shall be discussed and scheduled beginning with the Pre-Construction Meeting and at each Bi-weekly Construction Progress Meeting thereafter. When applicable the standards in the Architects Specification or the City Standard Specification shall apply.

QMI's are typically conducted during milestone construction points and shall include but not be limited to the following:

- Buried site amenities (storm, pavement base, drain tile, etc)
- Pre-concrete inspections (reinforcing, insulation, vapor barrier, etc.)
- Post rough-in installations
- Pre & Post system installations
- Pre-Construction meeting with the Landscape Contractor

SECTION 105.6 CONTRACTORS RESPONSIBILITY FOR WORK

The Contractor shall not take advantage of any discrepancy in the plans or specifications. This shall include but not be limited to apparent errors, omissions, and interpretations involving codes, regulations, and standards.

Any Contractor who identifies such a discrepancy during the bidding process shall notify the Architect of the discrepancy prior to the "Questions, Clarifications & Requests for Alternates Deadline" as indicated in Section A of the bid documents.

Any Contractor who identifies such a discrepancy during the construction process shall immediately notify the Architect in writing and request clarification on how to proceed.

If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship, which is of the highest quality, largest, largest quantity or most closely fits the City's intent.

SECTION 105.12 COOPERATION BY CONTRACTOR

The Contractor shall be responsible for coordinating the following events as needed:

- Pre-Installation Meetings
- Performance Testing Dates
- Commissioning Milestones
- Other related construction milestones as needed

Whenever possible these events shall be planned and coordinated during the Bi-weekly Construction Progress meetings but in no case shall an event be scheduled with less than three (3) working days notice.

The contractor shall be responsible for coordinating these events with the following personnel:

- Architect and sub-consultants
- City Project Manager and other City Staff
- Commissioning Representatives
- Sub-contractors as needed, this shall include any follow-on sub-contractor who may not be in the work flow but has a vested interest in access and installation.

Any corrections, relocations, or retesting required because the contractor did not properly coordinate the event with the required attendees shall be at the expense of the contractor.

The Contractor shall be responsible for coordinating with the City Project Manager the delivery and installation of materials and equipment being provided or installed by other City related contracts.

SECTION 105.15 SUBSTANTIAL COMPLETION

For the purposes of this contract the term "Substantial Completion" shall be defined as that point in the contract where all contractural obligations are complete and all deliverables have been turned-in, reviewed-by, and accepted-by the appropriate agency. Deliverables shall include but not be limited to; O&M manuals, as-builts, punch list completion, test reports, owner training, attic stock, and other such deliverables as defined in Division 1 of the Architects General Requirements and other divisions within the Architects Technical Specifications.

SECTION 107.2 PROTECTION AND RESTORATION OF PROPERTY

The Contractor shall be allowed to grade, excavate, store materials or equipment within the reasonable limits needed for the execution of this contract. The Contractor shall be responsible for the restoration of all disturbed areas to original condition and shall ensure that all existing structures, landscape features, etc are protected unless noted for removal. Any damage shall be restored/replaced by the Contractor at his/her own expense to the original pre-contract state as designated by the City Project Manager.

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

Work shall begin only after the contract is completely executed and the start work letter is received.

The contract shall be completed to a level of **OWNER OCCUPANCY NO LATER THAN February 14, 2014**. This shall include any final inspections by the City of Madison Building Inspection Unit, a final Certificate of Occupancy, any major construction issues on punch list items, and any Commissioning Inspections that would delay owner occupancy. The following items shall not be required for owner occupancy:

- All Bituminous paving
- Final grading, seeding, and plantings

The contract shall be completed to a level of **SUBSTANTIAL COMPLETION** (see section 105.15 above) **NO LATER THAN MAY 1, 2014**. This shall include the following:

- All items listed above not required to be installed for owner occupancy
- Minor punch list items
- Final Commissioning Inspections
- All final copies of contract deliverables being submitted to the appropriate agency.

SECTION 109.9 LIQUIDATED DAMAGES

The fixed, agreed and liquidated damages for failure to complete Owner Occupancy by the above specified date shall be **$1155.00** per calendar day for each calendar day in which the work remains incomplete.

The fixed, agreed and liquidated damages for failure to complete Substantial Completion by the above specified date shall be **$400.00** per calendar day for each calendar day in which the work remains incomplete.

In no case shall the total fixed, agreed and liquidated damages exceed **$1155.00** per calendar day.

ARTICLE 402 PAVEMENTS

The Contractor shall review the City Engineering Patching Criteria as posted on the City Engineering web site http://www.cityofmadison.com/engineering/patchingCriteria.cfm. The eastern 12" and 18" RCP storm culvert crossings shall be in one (1) eighty (80) foot wide patch and the sanitary lateral crossing shall be incorporated with the new building entrance apron as one (1) sixty (60) foot wide patch. Final patch limits shall be coordinated with the assigned site inspector from City Engineering.

NON STANDARD BID ITEMS

BID ITEM 90001 – BASE BID

DESCRIPTION: The BASE BID shall include the complete installation of all building, mechanical, site, and utility components; the accepted testing, and commissioning of all systems; and the completion and turn-in of all deliverables as outlined in the plans and specifications.

- The BASE BID **shall** include the installed concrete footings required to support the mezzanine steel structure of BID ITEM 90002 – ALTERNATE BID ITEM 1 – MEZZANINE.
- The BASE BID **shall** include the structural loading requirements to be included in the pre-engineered building design and components installed for BID ITEM 90003 – ALTERNATE BID ITEM 2 – BRIDGE CRANE.

METHOD OF MEASUREMENT: The BASE BID shall be measured as Lump Sum of the required construction and installations described in the plans and specifications. Partial Payments shall be requested as follows:

The Contractor shall supply the Architect with the standard AIA Application and Certificate for Payment. The application shall indicate the percentage complete of all work and materials installed or delivered to the work site by description of work. The Architect shall verify the Contractors completion information for accuracy.

The Contractor shall also provide the required City of Madison Application and Certificate for Payment indicating all contractors and sub-contractors who worked on site during the partial payment period, and indicate the TOTAL percentage (based on the AIA document) to date of the completed work or materials on site.

BASIS OF PAYMENT: The BASE BID shall be paid at the contract unit price. Partial payments shall be authorized as follows:

The Architect shall use the AIA Application and Certificate for Payment to verify the percentage of work complete is accurate and advise the City Project Manager accordingly.

The City Project Manager shall sign the City of Madison Application and Certificate for Payment and turn in requesting the partial payment.

All disputes in percentages shall be resolved between the Contractor, Architect, and City Project Manager prior to the Partial Payment final submission.

BID ITEM 90002 – ALTERNATE BID ITEM 1 – MEZZANINE

DESCRIPTION: The ALTERNATE BID ITEM 1 - MEZZANINE shall include all materials, labor, and equipment required for a complete installation of the precast plank mezzanine including but not limited to the support structure, precast planks and concrete topping, stairways, toe kicks, railings, under mezzanine lighting, and all other components and incidentals required for a complete installation as described in the plans and specifications.

METHOD OF MEASUREMENT: The ALTERNATE BID ITEM 1 - MEZZANINE shall be measured as Lump Sum of the required materials, construction, and installation described in the plans and specifications.

BASIS OF PAYMENT: The ALTERNATE BID ITEM 1 - MEZZANINE shall be paid at the contract unit price. Partial Payments shall be authorized in the same manner as described in the Base Bid above.

BID ITEM 90003 – ALTERNATE BID ITEM 2 – BRIDGE CRANE

DESCRIPTION: The ALTERNATE BID ITEM 2 – BRIDGE CRANE shall include all materials, components, incidentals, labor, and equipment required for a complete installation of the bridge crane as described in the plans and specifications.

METHOD OF MEASUREMENT: The ALTERNATE BID ITEM 2 – BRIDGE CRANE shall be measured as Lump Sum of all the required materials, construction, and installation described in the plans and specifications.

BASIS OF PAYMENT: The ALTERNATE BID ITEM 2 – BRIDGE CRANE shall be paid at the contract unit price. Partial Payments shall be authorized in the same manner as described in the Base Bid above.

POINTS OF CONTACT

The Project Manager for City Engineering, Facility Management for this contract is:

Randy Wiesner
PH: (608) 267-8679
Email: rwiesner@cityofmadison.com
210 Martin Luther King Jr Blvd
Room 115
Madison, WI 53703

The Architect Project Manager for Angus Young Associates, Inc. for this contract is:

Bradley Werginz, AAIA
PH: (608) 756-2326
Email: BradW@ANGUSYOUNG.com
555 South River St
Janesville, WI 53548

The City Engineering West Side Erosion Control Engineer is:

Tim Troester
PH: (608) 267-1995
Email: ttroester@cityofmadison.com
210 Martin Luther King Jr Blvd
Room 115
Madison, WI 53703

PROJECT MANUAL FOR

South Point Road Public Works Storage Building
City of Madison
402 South Point Road
Project Number: 53W1165
Contract Number: 6962

June 14th, 2013

Angus Young
Balance in Creativity

Angus-Young Associates
555 South River Street
Janesville, WI 53548-4783
www.angusyoung.com

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South Point Road Public Works Storage Building
City of Madison
402 South Point Road
Project Number: 53W1165
Contract Number: 6962

A/E Project No. 48150

June 14, 2013

ARCHITECT

Angus-Young Associates, Inc.
555 South River Street
Janesville, Wisconsin 53548-4783
608.756.2326
www.angusyoung.com

Angus Young
Balance in Creativity
Architecture
Engineering
Interior Design

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SECTION 00 01 05
PROJECT CONTACTS

PART 1 - GENERAL

A. The following contacts are listed as staff responsible for answering questions to various parts of the contract.

The Project Manager for City Engineering, Facility Management for this contract is:

Randy Wiesner
PH: (608) 267-8679
Email: rwiesner@cityofmadison.com
210 Martin Luther King Jr Blvd
Room 115
Madison, WI 53703

The Architect Project Manager for Angus Young Associates, Inc. for this contract is:

Bradley Werginz, AAIA
PH: (608) 756-2326
Email: BradW@ANGUSYOUNG.com
555 South River St
Janesville, WI 53548

The City Engineering West Side Erosion Control Engineer is:

Tim Troester
PH: (608) 267-1995
Email: ttroester@cityofmadison.com
210 Martin Luther King Jr Blvd
Room 115
Madison, WI 53703

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SECTION 00 01 10
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SECTION 00 26 00
SUBSTITUTION LIST

TO: Brad Werginz
Angus Young and Associates
555 South River Street
Janesville, WI 53548

Pursuant to bidding requirements for the Work:

The Contract sum proposed by the undersigned on the Bid Form is for the Work as shown on the Drawings, described in the Project Manual, and otherwise defined in the Contract Documents. The undersigned proposes the following substitutions for the Owner's consideration. Should the Owner accept any or all the proposed substitutions, the bidder's proposed contract sum will be reduced or added to be the amount shown.

Specified Product or Material	Drawing or Spec. Section	Proposed Substitution	Proposed Add/Deduct in Contract Sum

END OF SECTION

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

A. For determining the Scope of the Work, this Section shall be used in conjunction with the Drawings and with corresponding Sections of the Technical Specifications, Conditions of the Contract, and issued Addenda. This Project is being bid as a single bid package.

B. Under this bid package, Contractor shall provide the necessary trades, for which bids are asked including, but not necessarily limited to, furnishing all labor, materials, tools, and equipment necessary for the construction of a South Point Road Public Works Storage Building to be located at 424 South Point Road in Madison, WI 53593. Base Bid will include approximately 20,500 square feet of interior storage space as well as 5,000 S.F. of exterior covered storage space. The Work which bids are asked includes, but is not necessarily limited to, earthwork, exterior improvements, utilities, cast-in-place concrete, reinforced concrete, metal fabrication, masonry, aluminum windows, steel doors, sectional overhead doors, hollow metal frames, painting, precast concrete planks, pre-engineered metal building, plumbing, mechanical, electrical, bridge cranes and others. To assure proper coordination and completion of each bid package under this Project, the Contractor shall collaborate with all trades and material suppliers. The alternates are described under Technical Specification Section 01 23 00. The Contractor shall generate a single submittal log, submittal file in the Project trailer, and single construction schedule.

1. See section 1.02 for construction services to be provided by city outside of this package.

C. When successful bidders have been awarded the Contract, commencement and completion shall be as stated under the Instructions to Bidders.

D. The Project site is located at 402 South Point Road, in Madison, WI 53593, (see location map on the Drawings). Test borings have been made by others and boring data is included in the Appendix of this Project Manual. Bidders should visit the Project site and acquaint themselves with all existing conditions. Bidders shall thoroughly photograph any extenuating conditions as a matter of record.

E. Temporary services shall comply with, but not limited to, the Special Conditions and Section 01 50 00. The Contractor shall coordinate temporary service connections with local utilities and all regulatory agencies.

F. The Owner reserves the right to contract separately other work not specifically stated in the Project Manual. The construction coordination shall adapt to the Work.

G. After final cleaning and upon written notice from the Contractor to the Architect that the Work is completed, the Architect will make a punch list of deficiencies and request their completion prior to final payment. Final payment will be made to the Contractor in accordance with the Conditions of the Contract. Upon completion of the Work, the Contractor shall remove from the Project site all material, tools and equipment belonging to him, and leave the Project site with an appearance acceptable to the Owner.

1.02 CONSTRUCTION SERVICES TO BE PROVIDED BY CITY OUTSIDE OF CONTRACTOR CONTRACT

A. The Contractor shall maintain City installed silt sock during construction and remove when vegetation is established. The western culvert will be removed with the building project and will be the responsibility of the Contractor.

B. Removal of silt fencing along South Point Road once the berm vegetation has been established.

C. The silt fencing around the north relocated stockpile and on the east edge of Wetland No. 2 will remain during Warm Storage Building construction. It shall be maintained by and shall be removed by the Contractor.

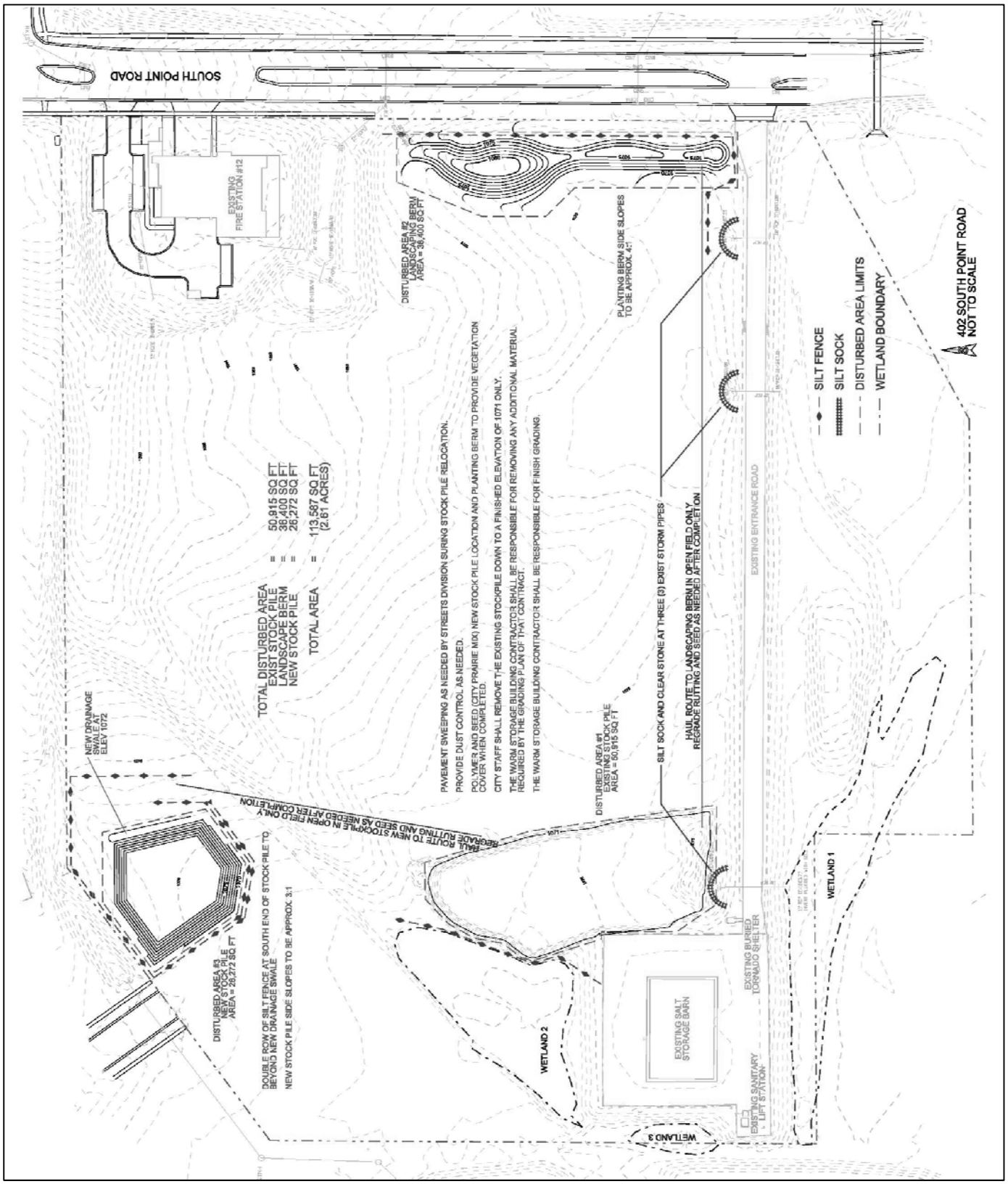
D. See attached anticipated erosion control plan by the city for the partial relocation of the existing stockpile.

E. Removal of tornado shelter. Contractor is responsible for any additional concrete base removal.

F. Installation of radio equipment for BAS system. Radio equipment and specifications to be determined by owner. Contractor to provide rough-ins as designated by the owner.

G. The City of Madison will provide final prairie seeding on existing berm. The Contractor shall provide plantings as designated on landscape plan and reseed/patch any disturbance caused by planting installation.

City of Madison Anticipated Erosion Control Plan



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SECTION 01 23 00
ALTERNATES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. To enable the Owner to compare total costs where alternative areas, materials, and methods might be used, Alternates have been established as described on the Drawings and in this Section of these Specifications.

B. Related Work Described Elsewhere:

1. Materials and methods to be used in the Base Bid and in the Alternates have been described on the Drawings and in pertinent Sections of these Specifications.
2. Method for stating the proposed Contract Sum is described in the Bid Form.

1.02 SUBMITTALS

A. All Alternates described in this Section are required to be reflected in the appropriate section on the Bid Form as submitted by bidders.

B. The contractor shall fill out the Bid Form per all instructions on the form. The Contractor shall also review the Owner's method of awarding low bids with alternates. The method is described in the notes on the bottom of the Bid Form. (Page E-5 of the Specifications)

1.03 PRODUCT HANDLING

A. If the Owner elects to proceed on the basis of one or more of the described Alternates, make all modifications to the Work required in furnishing and installing the selected Alternate or Alternates to the approval of the Architect/Engineer and at no additional cost to the Owner, other than as proposed on the Bid Form.

PART 2 - PRODUCTS

2.01 DEFINITIONS

A. The **Base Bid** for the Project shall, in general, include all of the work necessary to complete, as per Drawings and Specifications, the site and building Work. Alternate Bid prices shall also be based on complete areas and systems following all requirements of the Drawings and Specifications for all site and building Work.

B. **Alternate #1** for the Project shall include all structural steel, precast plank, concrete topping, steel pan stairs, painting, handrails, guard rails, under mezzanine lighting, and under mezzanine fire protection associated with construction of the parts storage mezzanine, space #201. Precast plank, concrete topping, and steel guard rails located above the utility/storage room and toilet room shall be included in base bid. Concrete footings for support of the mezzanine steel structure shall also be included in the base bid.

C. **Alternate #2** for the Project shall include the steel rails, bridge crane, bridge crane equipment, and electrical connections associated with the bridge crane installation. Structural loading for the bridge crane shall be included in the pre-engineered building design as part of the base bid.

END OF SECTION

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SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and catalog number, reference to recognized industry and government standards, or description of required attributes and performance.
2. To ensure that the specified products or equivalent products are furnished and installed in accordance with design intent, procedures have been established for advance substitution request submittals for review by the Architect/Engineer and Owner's Representative.

B. Related Work Described Elsewhere:

1. Individual requirements for products are described in other pertinent Sections of these Specifications and the Supplementary Conditions of the Contract.

1.02 QUALITY ASSURANCE

A. Product Quality Equivalence:

1. Provide all information necessary as determined by the Architect/Engineer for adequate comparison of specified product to requested substitution.
2. All substitutions shall be of equal or better quality than the specified product as determined by the Architect/Engineer.

1.03 SUBMITTALS

A. Submit samples, manufacturer's literature, colors, etc., of both original product specified and requested substitution.

B. For equipment submittals, provide physical data including dimensions, weights etc., and a drawing or diagram demonstrating that the proposed substitution fits in the space provided and that the designed supports are adequate. Differences between the specified product and the proposed substitution must be clearly identified for the Architect/Engineer's review.

C. Where equipment substitutions include change in utility requirements such as a change in motor horsepower, the difference between the specified product and the proposed substitution must be clearly identified for the Architect/Engineer's review.

D. Provide cost comparison between specified product and requested substitution in equivalent terms and quantities.

E. Substitution approval does not relieve the Contractor from submitting shop drawings for the product. Make all submittals of shop drawings, samples, and other items, in strict accordance with Section 01 33 00 - "Submittal Procedures".

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitution List:

1. All proposed substitutions shall be provided by the bidders on the Substitution List, in Section 00 26 00 of the Project Manual. The Owner will review the list of substitutions and determine whether or not the products are acceptable. Products and materials shall not be substituted with other products and materials during the construction phase by the Contractor. The decision of the Owner and Architect shall be final.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Substituted products shall be installed using the same quality workmanship and manner as the originally specified product, per the manufacturer's recommendations, and shall be acceptable to the Architect/Engineer.

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for project meetings, including, but not limited to, the following:

1. Pre-construction conference.
2. Pre-installation conferences.
3. Progress meetings.
4. Testing Dates.
5. Owner's commissioning progress inspections.

1.03 PRE-CONSTRUCTION CONFERENCE

A. The Owner's Representative shall schedule a pre-construction conference before starting construction, at a time convenient to the Owner and the Architect, but no later than 15 days after execution of the Agreement. Meeting will be held at the Project site or another convenient location. The Owner's Representative will conduct the conference. The Contractor will review and present Contractor's responsibilities and personnel assignments. Conference may be conducted prior to complete signing and routing of the contract.

B. Attendees: Authorized representatives of the Owner, Architect, and their consultants; the Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

C. Agenda: Discuss items of significance that could affect progress, including the following:

1. Introductions:
   a. Owner
   b. Architect
   c. Contractor
2. Status of Contracts
3. Permits and licenses
4. Insurance
5. Contractor information
   a. The Contractor shall provide copies of and discuss the following schedules. See Section 01 32 00 2.02 for construction schedule requirements.
      1) The complete project schedule overview. Indicate critical path items and key milestones throughout the contract.
      2) Six (6) week lookout schedule. Indicate key items of the critical path during this time frame.
   a. List of sub-contracts
   b. Insurance forms
6. Request for payment procedure
7. Change Order process
8. Correspondence
9. Orders and directions

10. Meetings
    a. Schedule bi-weekly construction progress meetings
    b. Discuss pre-installation meeting scheduling requirements
    c. Discuss Commissioning Inspections scheduling requirements
    d. Discuss Testing scheduling requirements
11. Submittals
12. Record Drawings
13. Existing facilities
14. Owner's day-to-day schedule
15. General cleaning
16. Parking
    a. Labor parking
    b. Trailer

1.04 PRE-INSTALLATION CONFERENCES

A. Conduct a pre-installation conference at the Project site before each construction activity that requires coordination with other construction. Sub-contractors shall be represented by the Foreman, Project Manager or scheduler of that trade and be authorized to make decisions associated with the conference.

B. Contractors shall coordinate with other trades the Owners Representative, Commissioning Agent, Maintenance Personnel, and design staff, as needed, prior to locating any piping, equipment, ductwork, or conduit. Equipment shall be located in such a manner as to provide easy and adequate access space to all components of the equipment requiring periodic service. In the event the Contractor installs equipment without a pre-installation conference the Owners Representative, Commissioning Agent, Maintenance Personnel, or design staff reserves the right to request positional changes at no cost to the owner.

C. Attendees: The Contractor, 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. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:

    a. Contract Documents.
    b. Options.
    c. Related Change Orders.
    d. Purchases.
    e. Deliveries.
    f. Shop drawings, product data, and quality-control samples.
    g. Review of mockups.
    h. Possible conflicts.
    i. Compatibility problems.
    j. Time schedules.
    k. Weather limitations.
    l. Manufacturer's recommendations.
    m. Warranty requirements.
    n. Compatibility of materials.
    o. Acceptability of substrates.
    p. Temporary facilities.
    q. Space and access limitations.
    r. Governing regulations.

s. Safety.

t. Inspecting and testing requirements.

u. Required performance results.

v. Recording requirements.

w. Protection.

2. Record significant discussions and agreements and disagreements of each conference, and the approved schedule.

3. Do not proceed with the installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

1.05 PROGRESS MEETINGS

A. The Contractor shall conduct the bi-weekly construction progress meetings at the job site. Coordinate dates of meetings with preparation of the payment request. Attendees: In addition to representatives of the Owner, Commissioning Agent, Maintenance Personnel, and design staff, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities who has performed work since the last progress meeting or is scheduled to perform work during the 6 week lookout schedule shall be represented at these meetings. All participants at the conference, including sub-contractors represented by the Foreman, Project Manager, or Scheduler of their associated trade shall be familiar with the Project and authorized to conclude matters relating to the Work.Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

D. Contractor's Construction Schedule: Review progress since last meeting and discuss next 6 weeks of construction schedule. Provide copies of updated six week lookout schedule to all attendees. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time.

1. Review the present and future needs of each entity present, including the following:Interface requirements.

b. Time.

c. Sequences.

d. Status of submittals.

e. Deliveries.

f. Off-site fabrication problems.

g. Access.

h. Site utilization.

i. Temporary facilities and services.

j. Hours of work.

k. Hazards and risks.

l. Housekeeping.

m. Quality and work standards.

n. Change Orders.

o. Documentation of information for payment requests.

E. Reporting: No later than 3 days after each meeting, distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

F. Schedule Updating: Revise the Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

1.06 TESTING DATES

1.07 OWNER'S COMMISSIONING PROGRESS INSPECTIONS

PART 2 -

2.01 Not Used

PART 3 - EXECUTION

3.01 Not Used

END OF SECTION

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 GENERAL

A. Submittals: Submit the following:

1. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category (action or informational).
    d. Name of subcontractor.
    e. Description of the work covered.
    f. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit two printed copies of initial schedule large enough to show entire schedule for entire construction period. Contractor shall provide entire project schedule at pre-construction meeting.

C. Daily Construction Reports: Submit two copies at monthly intervals.

D. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

E. Coordination: Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, submittals schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from parties involved.
2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

B. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.

C. Submit within seven days after Award of Contract.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Submit a comprehensive, fully developed, horizontal Gantt-chart-type Contractor's Construction Schedule within twenty-one days of date established for commencement of the Work.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.

C. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in ten percent increments within time bar.

D. Time Frame: Extend schedule from date established for commencement of the Work to date

of Substantial Completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early or late completion date, unless specifically authorized by Change Order.

E. Activities: Treat separate area 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 twenty days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for 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. Tabulation:
    a. Furnish a tabulation of each activity. Show the following information as a minimum for each activity:
        i. Preceding and following event numbers.
        ii. Activity description.
        iii. Estimated duration of activities.
        iv. Earliest start date (by calendar date).
        v. Earliest finish date (by calendar date).
        vi. Latest start date (by calendar date).
        vii. Latest finish date (by calendar date).
        viii. Slack or float (in calendar days).
4. Submittal Review Time: Include review and re-submittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
5. Startup and Testing Time: Include the number of days for startup and testing.
6. 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.
7. 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.
    a. Phasing: Arrange list of activities on schedule by phase.
    b. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
    c. Work Restrictions: Show the effect on the schedule of limitations of continued occupancies, uninterruptible services, use of premises restrictions, and provisions for future construction.
    d. Work Stages: Indicate important stages of construction for each major portion of the Work.
    e. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, interim milestones, all inspections, installation meetings, commissioning activities, Substantial Completion, and Final Completion.
8. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis to demonstrate the effect of the proposed change on the overall project schedule.

F. Daily Construction Reports: Prepare a daily construction report recording events at Project site, including list of subcontractors; high and low temperatures and general weather

conditions; accidents; stoppages, delays, shortages, and losses; meter readings; orders and requests of authorities having jurisdiction; and equipment or system tests and start ups.

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

PART 3 - EXECUTION

A. Contractor's Construction Schedule Updating: At monthly 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 actual completion percentage for each activity.
4. Distribution: Distribute copies of schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   a. Post copies in Project meeting rooms and temporary field offices.
   b. When revisions are made, distribute updated schedules to the same parties and post in the same locations.
5. Contractor shall provide copies of an updated 6 week lookout schedule at each construction progress meeting and discuss critical steps for the next 6 weeks. Lookout schedule shall identify all inspections, installation meetings, and commissioning activities being conducted during the lookout period.

END OF SECTION

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SECTION 01 32 13
SCHEDULING OF CONSTRUCTION

PART 1 - GENERAL

1.01 SUMMARY

A. To assure adequate planning and execution of the Work so that the Work is completed within the number of calendar days allowed in the Contract, and to assist the Architect in appraising the reasonableness of the proposed schedule and in evaluating progress of the work, prepare a manpower loading chart.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Requirements for Progress Schedule: Refer to General Conditions.
3. Construction Period: Refer to Form of Agreement.

C. Definitions:

1. "Day," as used throughout the Contract unless otherwise stated, means "calendar day."

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01 33 00.

B. Preliminary Man-loading Chart: Prior to construction start, General Contractor shall submit a manloading chart by crafts for duration of Contract.

C. Man-loading Chart: Within 10 calendar days after receipt of Notice to Proceed, submit one reproducible copy of the manloading chart prepared in accordance with Article 3.1 below.

D. Revised Analysis: Within ten calendar days after receipt of the Architect's review comments, submit one reproducible copy of the network analysis revised in accordance with those comments.

E. Periodic Reports: On the first working day of each month, the General Contractor shall submit a 3-month manpower loading chart by craft and major work item to the Owner and Architect.

1.03 QUALITY ASSURANCE

A. Perform data preparation, analysis, charting, and updating in accordance with pertinent recommendations contained in current edition of "CPM In Construction" manual of the Associated General Contractors.

PART 2 - PRODUCTS

2.01 MANLOADING CHART

A. Diagram:

1. Graphically show the order and interdependence of all activities necessary to complete the Work, and the sequence in which each such activity is planned to be accomplished, as planned by each contractor and their project field superintendents in coordination with all subcontractors and materials suppliers whose work is shown on the diagram.
2. Include, but do not necessarily limit to, indicated activities for:
    a. Project mobilization;
    b. Submittal and approval of shop drawings;
    c. Procurement of equipment and critical materials;

d. Fabrication of special equipment and material, and its installation and testing;

e. Final cleanup;

f. Final inspecting and testing; and

g. All activities of the Owner and the Architect which affects progress and/or affect required dates for completion of all or part of the Work.

3. Show information in such detail that duration times of activities will range normally from one to 15 calendar days.

4. Show on the diagram, as a minimum for each activity, preceding and following event numbers, description of each activity, cost, and activity duration in calendar days.

B. Tabulation:

1. Furnish a tabulation of each activity. Show the following information as a minimum for each activity:

a. Preceding and following event numbers.

b. Activity description.

c. Estimated duration of activities.

d. Earliest start date (by calendar date).

e. Earliest finish date (by calendar date).

f. Latest start date (by calendar date).

g. Latest finish date (by calendar date).

h. Slack or float (in calendar days).

PART 3 - EXECUTION

3.01 MANLOADING CHART

A. Submit in accordance with Article 1.02 above.

3.02 REVISIONS TO APPROVED SCHEDULE

A. Method:

1. Following approval of the schedule, if the Contractor desires to make changes in his method of operating and scheduling, they shall so notify the Architect in writing their reasons.

2. If the Architect considers these changes to be of a major nature, he may require the Contractor to revise and submit for approval, without additional cost to the Owner, all of the affected portions of the detailed diagrams and summary diagram to show the impact on the entire Work.

B. Major Change:

1. A change may be considered of a major nature if the time estimated to be required or actually used for an activity, or the logic of sequence of activities, is varied from the original plan to a degree that the Architect has reasonable doubt as to completion of the Work within the Contract Time.

2. Changes which affect activities with adequate slack time shall be considered a major change when their cumulative effect may affect the Contract completion date.

3.03 PERIODIC REPORTS

A. Contents:

1. Report actual progress by updating the manloading chart.

2. Note on the summary chart, or clearly show on a revised chart issued of affected portions of the detailed chart, all revisions causing changes in the detailed chart.

3. Revise the summary chart as necessary for clarity.

4. Activities or portions of activities completed during the reporting period, and their total value as basis for Contractor's periodic request for payment. Payment made pursuant to the Agreement may, when the Architect so directs, be based on the total value of such activities completed or partially completed after verification.
5. State the percentage of the Work actually completed and scheduled as of the report date, and the progress along the critical path in terms of days ahead of or behind the allowable dates.
6. If the work is behind schedule, also report progress along other paths with negative slack.
7. Include written narrative report which shows, but is not necessarily limited to:
    a. A description of problem areas, anticipated and current;
    b. Delaying factors and their impact;
    c. An explanation of corrective actions taken or proposed.
8. Show the date of latest revision.

B. Submit in accordance with Article 1.02 above.

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. Wherever possible throughout the Contract Documents, the minimum acceptable quality of workmanship and materials has been defined by manufacturer's name and product catalog number, reference to recognized industry and government standards, or description of required attributes and performance. To ensure that the specified products are furnished and installed in accordance with design intent, procedures have been established for advanced submittal of design data and its review by the Architect/Engineer and Owner's Representative. Make all submittals in strict accordance with the procedures defined in this Section.

B. Related Sections

1. Individual requirements for submittals are described in the pertinent Sections of these Technical Specifications.
2. Division 0 Section 00 73 00 - Supplementary Conditions.
3. Division 1 Section 01 78 36 - Warranties
4. Division 1 Section 01 78 23 - Operation and Maintenance Data

1.02 SUBMITTAL REQUIREMENTS

A. Make all submittals required by the Contract Documents, revise, and re-submit as necessary to establish compliance with the specified requirements.

B. Each submittal shall contain the number of copies which are required to be returned, plus three copies which will be retained by the Architect/Engineer unless indicated otherwise in other portions of this Section.

1. Alternatively, a single electronic copy in Adobe Acrobat format can be submitted if allowed by the Architect/Engineer. Required samples and final component submittals cannot be submitted electronically. Only electronic copies will be returned (no paper copies).

C. Each submittal shall indicate project name and location, Architect/Engineer contact information, and Contractor contact information. Contact information shall include name, project number, address, telephone and facsimile numbers.

D. Component Submittals

1. All items not specifically designed by the Architect/Engineer shall be considered components.
2. Local, state, and federal acceptance of component design is mandatory prior to fabrication and installation of components.
   a. If acceptance of the component design by the local, state, and federal jurisdictions is not obtained prior to installation of the component, the Contractor shall be responsible for all fines imposed.
3. Component submittals shall conform to the requirements of all submittals and shall have the additional requirements of this Section.
4. Preliminary and final component submittals shall be made for all components.
5. Preliminary Component Submittals
   a. Include required design criteria and design calculations.
   b. Include component designs and drawings.
6. Final Component Submittals
   a. Each final component submittal shall contain four copies (three copies that will be retained by the Architect/Engineer and one copy to be submitted to the

State). Electronic copies are not acceptable.

b. Include forms and review fees required by local, state, and federal rules and regulations applicable to work and Project location.

i. If the work and Project location is in the state of Wisconsin, the review fee is $100 for each component, and checks shall be made out to the "Wisconsin Department of Commerce".

ii. If the work and Project location is elsewhere, the Contractor shall coordinate the fee and check with the local, state, and federal requirements for component submittals of those jurisdictions.

c. Final component submittals shall include design criteria and calculations and shop drawings (including both erection and production drawings).

d. The design calculations shall bear the seal, registration number, and signature of a qualified Professional or Structural Engineer responsible for their preparation. The Engineer shall be registered in the state applicable to work and project location.

7. Individual Technical Specification Sections indicate specific requirements for each component. If the following components are included on a Project, component submittals shall be done for these items.

a. Wood trusses

b. Precast concrete planks and/or wall panels

c. Pre-engineered structural frames and/or buildings

d. Laminated wood beams

e. Steel joists and joist girders

f. Fire alarm systems

E. Additional Submittal Requests

1. The Architect/Engineer may request additional supporting data at any time to help determine compliance of submittals with the Contract Documents.

1.03 QUALITY ASSURANCE

A. Qualifications

1. Professional or Structural Engineer Qualifications:

a. Legally authorized to practice in the jurisdiction where the project is located and who is experienced in providing engineering services to the kind indicated that have resulted in installations similar to those required on this project and with a record of successful in-service performance.

B. Review and Coordination of Submittals

1. Prior to each submittal, carefully review and coordinate all aspects of each item being submitted including, but not necessarily limited to:

a. Determine and verify all interface conditions, catalog numbers, and similar data.

b. Coordinate with other trades as required.

c. Clearly indicate all deviations from requirements of the Contract Documents.

2. Verify the submittal contains all required information. Partial submittals will not be accepted.

3. Verify dimensions and completeness of each submittal. The Architect/Engineer review is limited as defined in the General Conditions of the Contract for Construction and does not include dimensions and items not included on the submittals.

4. All corrections to submittals shall be made directly on the submittal literature or drawings (not loose leaf documents) and shall be copied word for word to all copies.

5. Verify that each item and the submittal conforms in all respects with the requirements of the Contract Documents

6. Attach the Contractor's stamp of approval and signature to each submittal to certify that this coordination has been performed. Submittals transmitted to the Architect/Engineer without the Contractor's stamp will be returned without review, and shall be re-submitted when the Contractor's review has been completed and the stamp applied.

1.04 TIMING OF SUBMITTALS

A. General

1. Submittals shall be made far enough in advance of scheduled dates for installation to provide necessary time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.
2. The Contractor shall make the required submittals within the time required to meet the construction schedule or shall present, in writing, valid reasons for any delay. It shall be the contractor's responsibility to ensure that delivery of the submittals to the Architect/Engineer has been completed.
3. Obtain acceptance of all submittals prior to fabrication.

PART 2 - PRODUCTS

2.01 SUBMITTAL SCHEDULE

A. General

1. Compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the Work. Include a list of each item for which shop drawings, product data, samples, certificates of compliance, warranties, or other types of submittals are required. The Contractor shall adhere to the schedule except when specifically otherwise permitted in writing by the Architect/Engineer. The Contractor's failure to submit the aforementioned schedule will be grounds for withholding certification of payment.

B. Coordination

1. Coordinate the schedule with all necessary subcontractors and material suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described below.

2.02 SHOP DRAWINGS

A. Sufficient data in each set of shop drawings shall be included to permit a detailed study of the system submitted.

B. Scale and Measurements: Make all shop drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

C. Maximum sheet size for shop drawings shall be 24" by 36".

D. Shop drawings shall be specially drawn for this Project, including detailed erection and production drawings, setting drawings, diagrammatic drawings, material schedules, and samples. Copying the Architect/Engineer drawings is not permitted.

E. Shop drawings for all equipment in a given system shall be submitted at one time, with each complete set in a separate brochure.

F. Each sheet of shop drawings shall identify the Project name and location; the Architect/Engineer's name, Architect/Engineer's Project number, and contact information including address, telephone, and facsimile numbers; and the Contractor's name, Contractor's project number, and contact information including address, telephone, and facsimile numbers. In addition to the Contractor, the subcontractor/fabricator/manufacturer name, project number, and contact information shall be indicated.

G. All shop drawings shall be numbered in consecutive sequence, and each sheet shall indicate

the total number of sheets in the set. Each set shall be bound.

H. Each sheet shall indicate the date issued and any revisions. If the submittal is permitted to be phased or revisions are made, the provisions for phased submittals below shall be followed.

I. The shop drawings shall indicate types, shapes and sizes, and finishes of all materials. Where a shop coat of paint/primer is required, its brand name and manufacturer's identification number of type shall be indicated.

J. Erection Drawings - Detail product installation including:

1. Each member's designation (identification or piece mark), shape and size shall be clearly indicated and completely dimensioned.
2. Plans and elevations shall locate each member by designation, define all work provided, and indicate sequence of erection for stability, handling requirements, or for other special conditions.
3. Sections and details shall show member connections and relationship of members to adjacent materials, to the structure, and other construction.
4. Indicate all loading used in the design

K. Production Drawings - Detail product fabrication including:

1. Each member's designation (identification or piece mark), shape and size shall be clearly indicated and completely dimensioned.
2. Indicate methods for storage and transportation.

2.03 PRODUCT DATA

A. General

1. Submit manufacturer's literature, brochures, technical data, MSDS, etc., to permit a detailed study of the product submitted.
2. Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for review.

2.04 SAMPLES

A. Samples shall be of the precise article proposed to be furnished.

B. Submit two samples, unless otherwise requested.

C. Colors and Patterns: Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit two copies of accurate color and pattern charts to the Architect/Engineer for review and selection.

2.05 CERTIFICATES OF COMPLIANCE

A. Certify that all materials used in the Work comply with all specified provisions thereof. Certification shall not be construed as relieving the Contractor from furnishing satisfactory materials if, after tests are performed on selected samples, the material is found not to meet specified requirements.

B. Show on each certificate the name and location of the Project, name and address of Contractor, quantity and date or dates of shipment or delivery to which the certificate applies, and name of the manufacturing or fabricating company. Certification shall be in the form of a letter or company-standard forms containing all required data. Certificates shall be signed by an officer of the manufacturing or fabricating company.

C. In addition to the above information, all laboratory test reports submitted with Certificates of Compliance shall show the date or dates of testing, the specified requirements for which testing was performed, and results of the test or tests.

D. Upon completion of the Work, and as a condition of its acceptance, submit to the Architect/Engineer all Certificates of Compliance.

2.06 WARRANTIES

A. All warranties shall be compiled and submitted.

B. Submit three (3) copies.

2.07 OPERATION AND MAINTAINANCE DATA

A. All operational items of equipment require the manufacturer's operation and maintenance data information and parts lists. The information contained therein shall be in agreement with approved shop drawings, wiring diagrams, etc.

B. Electronic versions, preliminary and final, shall be sent to the Architect/Engineer before a Certificate of Substantial Completion is issued.

PART 3 - EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

A. General:

1. Consecutively number all submittals. Accompany each submittal with a Letter of Transmittal containing all pertinent information required for identification and checking of submittals.
2. Include on the Letter of Transmittal the Technical Specification Section number under which the submittal is made.

B. Internal Identification:

1. On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal number in which the item was included.

C. Re-submittals

1. When material is re-submitted for any reason, transmit under a new Letter of Transmittal and with a new submittal number.

D. Submittal Log:

1. Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Architect/ Engineer's review upon request.

3.02 COORDINATION OF SUBMITTALS

A. Grouping of Submittals:

1. Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

B. Phasing of Submittals:

1. Phasing of submittals shall not be permitted unless written permission has been given by the Architect/Engineer.
2. Phased submittals when permitted shall follow the sequence below:
   a. First submittal
   b. All subsequent submittals
      i. Newly detailed items shall be easily identified with clouds around the new items (when placed on sheets that were included in the first

submittal) or shall be submitted on new drawing sheets.

ii. When changed items are not identified on the submittal, the items will not be reviewed for conformance and the Architect/Engineer notations will not apply to the changes. Refer to the General Conditions of the Contract for Construction for changed items other than those requested by the Architect/Engineer.

C. Transmit required submittals to the Architect/Engineer for review. After review, the Architect/Engineer will return the number of submittals required to be returned marked with notations as follows:

1. The notations "Processed" or "Processed with Notations" authorize the Contractor to proceed with the purchase and/or fabrication of the items so noted, subject to the revisions, if any, required by the Architect/Engineer's and Owner's Representative review comments. Upon receipt, the Contractor shall have sufficient sets of prints made for distribution to appropriate subcontractors, fabricators, manufacturers, and suppliers who require them for coordination of their work.
2. The notation "Re-submit" requires the submittal to be corrected and re-submitted. The Contractor shall not proceed with purchase and/or fabrication of items marked "Re-submit".
3. Corrected and re-submitted items shall not be purchased and/or fabricated until the Architect/Engineer has marked the submittals "Processed" or "Processed with Notations".

D. Revisions After Approval:

1. When a submittal has been reviewed by the Architect/Engineer, re-submittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary. All decisions by the Owner and Architect are final.

END OF SECTION

SECTION 01 42 00
REFERENCE STANDARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Throughout the Contract Documents, reference is made to codes and standards which establish qualities and type of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.
2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship, which meet or exceed the specifically named code or standard.
3. It is also each Contractor's responsibility, when so required by the Contract Documents or by written request from the Owner, to deliver to the Owner all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Owner, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Owner.

B. Related Work Described Elsewhere:

1. Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Familiarity with Pertinent Codes and Standards:

1. In procuring all items used in this Work, it is each Contractor's responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this work meet or exceed the specified requirements.
2. Contractor shall ensure that he/she is using the latest edition of all codes, standards, specifications, and manufacturers data when reviewing all references and products in these specifications and drawings.

B. Rejection of Non-Complying Items:

1. The Owner reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements.
2. The Owner further reserves the right, and without prejudice to other recourse the Owner may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Owner.

C. Reference Precedent

1. In the case of conflict or overlap of code, standard, or guideline references, the most stringent provision shall apply.

D. Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies and organizations:

1. State, County, and Municipal Codes and Ordinances
2. City of Madison Standard Specifications for Public Works Construction
3. Other Codes, Standards, and Guidelines as may be applicable.
4. AAMA: American Architectural Manufacturers Association, Schaumburg, IL 60173-4268, (847) 303-5664; www.aamanet.org.
5. AASHTO: American Association of State Highway and Transportation Officials, Washington, DC 20001, (202) 624-5800; www.aashto.org.

6. ACI: American Concrete Institute International, Farmington Hills, MI 48333, (248) 848-3700; www.aci-int.org.
7. ADA(G): Americans with Disabilities Act, and Accessibility Guidelines.
8. AISC: American Institute of Steel Construction, Inc., Chicago, IL 60601-2001, (312) 670-2400; www.aisc.org.
9. ANSI: American National Standards Institute (successor to USASI and ASA0), New York, NY 10036, (212) 642-4900; www.ansi.org.
10. ASTM: American Society for Testing and Materials/ ASTM International, West Conshohocken, PA 19428-2959, (610) 832-9585; www.astm.org.
11. AWS: American Welding Society, Inc., Miami, FL 33126, (305) 443-9353; www.aws.org.
12. AWWA: American Water Works Association, Inc., Denver, CO 80235, (303) 794-7711; www.awwa.org.
13. BOCA: Buildings Officials & Code Administrators International, Inc., (now International Code Council.)
14. CRSI: Concrete Reinforcing Steel Institute, Schaumburg, IL 60173-4758, (847) 517-1200; www.crsi.org.
15. CS: Commercial Standard of National Bureau of Standards, U.S. Department of Commerce, Government Printing Office, Washington, DC 20402.
16. WisDOC: Department of Commerce, 201 W. Washington Ave., Madison, WI 53702, (608) 226-1018.
17. WisDNR: Department of Natural Resources, P.O. Box 7921, Madison, WI 53707-7921, (608) 266-2621.
18. FGMA: Flat Glass Marketing Association, (now Glass Association of North America,) Topeka, KS 66614-5321, (785) 271-0208; www.glasswebsite.com.
19. GA: Gypsum Association, Washington, DC 20002, (202) 289-5440; www.gypsum.org.
20. ICC: International Code Council, Falls Church, VA 22041, (703) 931-4533; www.iccsafe.org.
21. KCMA: Kitchen Cabinet Manufacturers Association, Reston, VA 20191-5435, (703) 264-1690; www.kcma.org.
22. NAAMM: The National Association of Architectural Metal Manufacturers, Chicago, IL 60603, (312) 332-0405; www.naamm.org.
23. NEC: National Electrical Code (see NFPA).
24. NEMA: National Electrical Manufacturers Association, Rosslyn, VA 22209, (703) 841-3200; www.nema.org.
25. NFPA: National Fire Protection Association, Quincy, MA 02169-7471, (617) 770-3000; www.nfpa.org.
26. SDI: Steel Deck Institute, Fox River Grove, IL 60021-0025, (847) 458-4647; www.sdi.org.
27. SJI: Steel Joist Institute, Myrtle Beach, SC 29577-6760, (843) 626-1995; www.steeljoist.org.
28. SSPC: Society for Protective Coatings, Pittsburgh, PA 15222-4656, (412) 281-2331; www.sspc.org..
29. TCA: Tile Council of America, Inc., Anderson, SC 29625, (864) 646-8453; www.tileusa.com.
30. UL: Underwriters Laboratories, Inc., Northbrook, IL 60062-2096, (847) 272-8800; www.ul.com.
31. UBC: Uniform Building Code, International Conference of Building Officials, (now International Code Council).

32. WCSBMPH: Wisconsin Construction Site Best Management Practice Handbook, Wisconsin Department of Natural Resources, P.O. Box 7921, Madison, WI 53707-7921

33. Federal Specifications and Federal Standards: Specifications Sales (3FRI), Building 197, Washington Navy Yard, General Services Administration, Washington, DC 20407.

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SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, facilities, and services necessary to complete the quality control work as shown on the drawings and herein specified.

B. Related Sections

1. Individual requirements for quality control are defined in other pertinent sections of these Specifications.

C. Payment Procedures

1. Contractor shall provide quality control services specified.
2. Contractor shall provide quality control services required by authorities having jurisdiction whether specified or not.
3. Contractor shall pay for tests and inspections performed by the testing agency unless the Owner has indicated otherwise.
4. Obtain costs for all specified testing and inspections performed by the testing agency and include costs in the base bid. Tests and Inspections not specified and estimated costs for re-testing and re-inspection shall not be included in the base bid.
5. Testing and inspecting requested by the Contractor and not required by the Contract Documents are the Contractor's responsibility.
6. Contractor shall bear all costs of removal and replacement of material for items that do not remain accessible and exposed for testing and inspections.
7. Contractor shall bear all costs made necessary by non-compliance with the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc., including those of repeated procedures and compensation for Design Professional's services and expenses.
8. Even if the Owner pays for original testing and inspections performed by the testing agency, the Contractor shall bear the costs for the following:
    a. Re-testing due to failure of initial test or due to non-compliance with Contract Documents.
    b. Re-inspection of Work due to failure of Work to pass initial inspection or due to non-compliance with Contract Documents.

1.02 DEFINITIONS

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

B. Quality Control: Tests, inspections, procedures, and related activities and actions performed during or after execution of the Work to evaluate that actual products incorporated into the Work and completed construction complies with requirements.

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

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

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

1.03 SYSTEM DESCRIPTION

A. Testing and inspecting services are required to verify compliance with specified requirements and governing rules and regulations, i.e., codes, laws, ordinances, etc. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

B. Portions of the Work which do not comply with requirements established by the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc., shall be made to comply.

C. Required Testing and Inspections:

1. Individual requirements for testing and inspection are defined in other pertinent sections of these Specifications.

2. Local, state, and federal jurisdiction inspections vary. Confirm the required inspections with the individual authorities.

3. The following testing and inspections shall be performed by a testing agency:

a. Site excavation inspection, rough grading inspection, and bearing capacity testing: Section 31 00 00 Earthwork.

b. Soil compaction testing and inspection and pavement base course testing and inspection: Section 31 00 00 Earthwork, 32 11 23 Aggregate Base Course, and Section 32 12 16 Bituminous Concrete Paving.

c. Concrete reinforcing inspection: Section 03 20 00 Concrete Reinforcement.

d. Concrete testing: Section 03 30 00 Cast-in-Place Concrete.

e. Masonry construction testing and inspection: Section 04 21 00 Clay Masonry Units and Section 04 22 00 Concrete Masonry Units.

f. Structural steel welding, bolts, and stud testing and inspection (except testing to qualify welders): Section 05 12 00.

g. Metal roof deck inspection: Section 05 31 00.

h. Underground piping inspection and Water supply testing: Section 33 00 00 Utility Services, Section 33 21 00 Water Supply, Section 33 21 00 Water Supply Wells, and Section 33 36 00 Septic Tank Systems.

i. Others, if required by the individual sections of these Specifications.

4. Re-testing/Re-inspecting is required for construction that replaced work that failed to comply with the Contract Documents or the provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc.

D. Specified testing and inspecting does not limit the Contractor's other quality assurance and quality control procedures that facilitate compliance with the Contract Documents.

E. Work shall be subject to testing and inspection by the Owner, Design Professional, testing agency, inspectors, and public authorities having jurisdiction.

F. Approval as a result of testing or inspection shall not be construed to be an approval of a violation of provisions of the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc.

G. Testing, inspections, or approvals presuming to give authority to violate or cancel the provisions of the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc., shall not be valid.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures.

B. Quality Assurance/Control Submittals

1. Certificate from qualified accreditation authority showing Testing and Inspection Agency's compliance with ASTM Standard E329 for each testing agency used.

2. Certificate issued by each Testing and Inspection Agency used that states the agency is independent and is not associated with the Contractor performing the work by any means and will remain independent and not associated with the Contractor for the duration of the project. It shall also state that all results and recommendations provided by the agency will be unbiased and impartial toward any party involved for the duration of the project.

C. Schedule of Testing and Inspecting

1. Prepare a Master Schedule of all items to be tested and inspected. By coordination with the construction schedule, establish tentative dates for each such activity.
2. Submit for the Design Professional's review. Make any agreed upon revisions and resubmit.

D. Prepare the schedule including items specified in Division 01 – Section 01 33 00 Submittal Procedures. Also include the following in tabular form:

a. Specification section number and title
b. Description of test and/or inspection required
c. Identification of applicable standard
d. Identification of test and/or inspection method required
e. Number of tests and/or inspections required
f. Time schedule and time span for tests and/or inspections
g. Entity responsible for performing tests and/or inspections
h. Requirements for obtaining samples
i. Unique characteristics/requirements for tests and/or inspections

2. Include in the schedule anticipated tests and/or inspections by manufacturer's representatives and any authorities having jurisdiction.
3. Resubmit schedule when revisions are proposed.

E. Reports

1. Prepare all reports including items specified in Division 01 – Section 01 33 00 Submittal Procedures. Submit certified reports that include the following:

a. Date of issue.
b. Project name and location.
c. Testing and Inspecting Agency contact information including name, project number, address, telephone and facsimile numbers.
d. Dates and locations of tests and/or inspections.
e. Names of individuals making tests and/or inspections.
f. Record of field conditions (temperature & weather) at time of test/inspection.
g. Product identification and applicable specification section.
h. Type and description of test/inspection method.
i. Complete test/inspection data.
j. Test and inspection results and interpretation of results.
k. Comments/professional opinions on compliance with the Contract Documents.
l. Recommendations on re-testing/re-inspection.
m. Signatures of individuals making tests and/or inspections.

2. Report test results as called for and in the form specified by the test method.

F. Jurisdictional Compliance Paperwork: 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.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Minimum qualification levels are established in individual specification sections in addition to the minimum qualifications specified herein.
2. Testing and Inspecting Agency Qualifications:
    a. Testing and Inspecting Agency qualified according to ASTM Standard E329 and with additional qualifications specified in other pertinent individual Specification sections.
    b. Testing and Inspecting Agency shall be accredited through an accreditation authority to meet ASTM Standard E329.
        i. Accreditation authority shall be acceptable to the Owner, Design Professional, and authorities having jurisdiction.
        ii. Pre-approved accreditation authorities acceptable to the Design Professional include:
            (a.) American Association for Laboratory Accreditation (A2LA)
            (b.) International Accreditation Service (IAS)
            (c.) National Voluntary Laboratory Accreditation Program (NVLAP)
            (d.) AASHTO Accreditation Program (AAP)
        iii. Pre-approval by the Design Professional does not automatically mean the Testing and Inspecting Agency is acceptable to the Owner or authorities having jurisdiction. The Contractor shall verify acceptability.
    c. Testing and Inspection Agency shall be independent and shall not be associated with the Contractor performing the work by any means. Agency shall also be able to provide unbiased and impartial results and recommendations to all parties involved in the project.
    d. Testing and Inspecting Agency shall be acceptable to the Owner, Design Professional, and authorities having jurisdiction.
        i. Pre-approved Testing and Inspecting Agencies acceptable to the Design Professional include:

a. CGC, Inc**. (Pre-approved by Owner)**
    2921 Perry Street
    Madison, WI 53713
    Phone: (608) 288-4100
    Fax: (608) 288-7887

b. Gestra Engineering Inc.
    Offices in Madison, Milwaukee, and Kenosha
    1626 W. Fond Du Lac Ave.
    Milwaukee, WI 53205
    Phone: (414) 933-7444 ext. 11
    Fax: (414) 933-7844

c. Soils & Engineering Services, Inc.
    1102 Stewart Street
    Madison, WI 53713-4648
    Phone: (608) 274-7600
    Fax: (608) 274-7511

        i. Pre-approval by the Design Professional does not automatically mean the Testing and Inspecting Agency is acceptable to the Owner or authorities having jurisdiction. The Contractor shall verify acceptability.

B. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
    a. ASTM Standard E329, 2009, "Standard Specification for Agencies Engaged in Construction Inspection and/or Testing"; ASTM International, West Conshohocken, PA, 2009, DOI: 10.1520/E0329-09, www.astm.org.
3. Where provisions of pertinent regulations, codes, and standards conflict with each other or this specification, the more stringent provisions shall govern. Refer uncertainties and requirements that are different, but apparently equal, to the Design Professional for a decision before proceeding.

PART 2 - PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Minimum levels of source quality control are established in individual specification sections.

PART 3 - EXECUTION

3.01 ADMINISTRATION

A. Testing and Inspecting Schedule
    1. Maintain the schedule for testing and inspecting to accurately reflect progress of the Work.
    2. Resubmit the testing and inspecting schedule to the Design Professional for review when revisions are proposed. Transmit in adequate time to permit proper rescheduling of activities in connection with inspection and tests.
    3. Do not decrease the testing and inspecting activity without written permission from the Design Professional.

B. Test and Inspection Log
    1. Prepare a record of tests and inspections that includes the following:
        a. Date test/inspection was conducted.
        b. Description of the Work tested or inspected.
        c. Date test or inspection results were transmitted to the Design Professional.
        d. Name of testing agency or special inspector conducting test or inspection.
        e. Test result – either compliant or noncompliant
        f. Date of re-test/re-inspection.
    2. Maintain log at the Project site and provide access to the log for Owner's and Design Professional's reference. Post changes and modifications as they occur.

C. Reports
    1. Promptly secure, process, and distribute copies of test and inspection reports and related instructions to ensure necessary retesting, replacement of materials, or both, as required, and with the least possible delay in progress of the Work.
    2. Transmit copies of reports created by the testing agency to any public authorities having jurisdiction when they so direct.
    3. Transmit copies of reports created by entities other than the testing agency to any public authorities having jurisdiction when they so direct and to the Design Professional.
    4. Promptly secure, process, and distribute copies of certificates of testing, inspection or approval to any public authorities having jurisdiction when they so direct and to the Design Professional.

3.02 PROTECTION AND REPAIR/RESTORATION

A. Protect construction exposed by or for quality control services.

B. Upon 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. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.
2. Comply with Division 01 – Section 01 73 29 Cutting and Patching as applicable.

C. Protection and Repair are the Contractor's responsibility, regardless of whether the Owner directly employs any testing and inspection services.

3.03 FIELD QUALITY CONTROL

A. Coordination

1. Coordinate sequence of activities to accommodate required quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting. Contractor shall cause the Work to remain accessible and exposed for testing and inspection purposes.
2. Contractor shall make arrangements for all quality control to be completed including the tests and inspections to be performed by testing agencies, inspectors, and public authorities having jurisdiction.
3. For testing and inspecting specified to be performed by a testing agency, contractor personnel are not allowed to perform these services without direct supervision from testing agency personnel.
4. Provide preliminary information about materials requiring testing and inspection to the testing agency or other entities requiring it.

B. Notification

1. Notify appropriate testing agency, inspector, or public authorities having jurisdiction sufficiently in advance of operations that require tests and/or inspections or when the Work is ready for testing and/or inspection. If sufficient notice is not given, reschedule the operations so the appropriate testing and inspections can be completed. Contract time will not be extended to accommodate inadequate notice.
2. To permit the Design Professional to witness tests and/or inspections when desired, notify the Design Professional not less than 24 hours in advance.

C. Associated Services: Cooperate with testing agency personnel, inspectors, and public authorities having jurisdiction. Provide reasonable auxiliary services as requested along with the following:

1. Access to and means for testing and inspections of Work and manufacturer's operations promptly upon request.
2. Incidental labor and facilities needed to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting.
4. Storage and field curing facilities.
5. Provide transportation of test materials if necessary.
6. Security and protection for samples and testing and inspecting equipment at Project site.

D. Perform indicated testing and inspections at the appropriate time using methods specified and documented in the schedule of testing and inspections. Provide labor to aid in the testing and inspecting services if necessary.

E. Provide testing laboratory facilities required to perform the off-site testing.

F. Report each test and inspection result as indicated.

G. Portions of the Work which do not comply with requirements established by the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc., shall be made to comply and such portions shall not be covered or concealed until authorized by testing agency, inspector, and public authorities having jurisdiction.

H. Re-test and re-inspect portions of the Work which did not comply with requirements established by the Contract Documents or provisions of governing rules and regulations, i.e., codes, laws, ordinances, etc. Report results as indicated.

I. 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 as indicated.

3.04 TESTING AGENCY RESPONSIBILITIES AND LIMITATIONS OF AUTHORITY

A. Cooperate with Design Professional and Contractor in performance of duties.

B. Provide qualified personnel to perform required tests and inspections in a reasonable time frame upon notice.

C. Promptly notify Design Professional and Contractor of irregularities, or deficiencies of Work which are observed during performance of services.

D. Determine the location from which test samples will be taken and in which in-situ tests are conducted.

E. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from specified requirements.

F. Submit a certified written report of each test, inspection, and similar quality control service to the Design Professional and Contractor. Reports shall be submitted in a prompt manner and shall be submitted within 7 days after the test, inspection, or similar quality control service was performed.

G. Testing agency is not authorized to:

1. Release, revoke, alter, or increase any requirements of the Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of Contractor.

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Temporary facilities and controls required for this Work include, but are not necessarily limited to:
    a. Temporary utilities such as water, electricity and heat
    b. Temporary haul roads
    c. Toilets
    d. Field offices and sheds
    e. Temporary stairs and scaffolding
    f. Temporary signs
    g. Fire protection
    h. Watchmen
    i. Storage of materials
    j. Glass replacement
    k. Cleaning up
    l. Enclosures
2. Related Work Described Elsewhere:
    a. Except that all equipment furnished by Contractors shall comply with all requirements of pertinent safety regulations, the ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the work are not part of this Section.
    b. Permanent installation and hook-up of the various utility lines are described in other pertinent Sections.

1.02 PRODUCT HANDLING

A. Use all means necessary to maintain temporary facilities and controls in proper and safe conditions throughout progress of the Work.

1.03 JOB CONDITIONS

A. Make all required temporary connections to existing utility systems with minimum disruption to services in the existing utility systems. When disruption of the existing service is required, do not proceed without the Architect/Engineer's approval and Owner’s consent and, when required, provide alternate temporary service.

PART 2 - PRODUCTS

2.01 UTILITIES

A. General:

1. All temporary facilities shall be subject to the Architect/Engineer's approval.

B. Temporary Water:

1. The Plumbing Trade shall furnish and install all necessary temporary water lines and water sources and, upon completion of the Work, remove all such temporary facilities as specified herein and in accordance with the Supplementary Conditions. The temporary sources shall be installed within 5’- 0" of the building at a minimum of two locations.
2. Each trade requiring water shall provide their own hoses from source to point of use.

3. The Owner shall pay for all water consumed throughout the duration of construction.

C. Temporary Lights and Power:

1. The Electrical Trade shall provide temporary service for power and lighting required in construction for all trades until construction has been completed, and approved service connections from the service board. The Electrical Trade shall provide the following facilities:
   a. Approved service connections from the service board. Confirm size of temporary service required and meter and install them accordingly. Provide temporary service from existing electrical service off-site. The new temporary service shall be located overhead on wooden power poles or direct buried into the ground and positioned to avoid conflict with construction equipment and personnel. Electrical Trade shall provide temporary service connection to a rain-tight service head 16'- 0" above grade.
   b. Provide 120 volt lighting and small power tool outlets throughout the Project site.
   c. Provide general lighting consisting of 150 watt (minimum) lamps and weatherproof sockets, and provide power outlets consisting of 120 volt pendant type cord connectors, and with ground fault circuit interrupters, for fractional horsepower electrical tools.
   d. 120 volt outlets shall be located such that no point in the Project site would make portable cord lengths excessive.
2. Each trade shall provide and maintain their own extension cords.
3. Use of in-place building switches or circuit breakers shall not be permitted. All construction power tools shall be fed from temporary power source with ground fault interrupter protection only.
4. Complete installation shall be in compliance with all applicable codes. The Electrical Contractor shall remove and salvage the temporary service when it is no longer required.
5. Trades requiring temporary three-phase power service shall make arrangements with the Electrical Trade through the General Contractor.
6. The Owner shall pay for all electricity consumed throughout the duration of construction.

D. Temporary Heat and Cold Weather Protection

1. Cold Weather Protection:
   a. All heating or covering, or both, required to protect the Project site from damage due to freezing during construction period prior to enclosure of building shall be provided by the General Contractor.
   b. Cold weather protection shall be provided by General Contractor.
2. Temporary Heating:
   a. When required, until time of substantial completion.
   b. In all areas and spaces that are roofed and have all exterior openings suitably enclosed.
3. General Contractor:
   a. Provide temporary window and door closures as required and closures for all other temporary openings. Supervise effectiveness of all closures and see that every reasonable precaution is used to prevent escape of heat.
   b. Permanent heating system may be used for temporary heating once the permanent heating system, heating controls, concrete installation, concrete curing, concrete saw-cutting, and masonry saw-cutting have been completed.
   c. If the permanent system is not operable and the building is enclosed and heating is required, then the General Contractor shall furnish and install a

temporary heating system.

d. All portable heating units shall be properly ventilated to prevent combustion gases from remaining in the heated area.

e. The General Contractor shall ascertain if temporary heating equipment will operate on the temporary electrical service available. If service is insufficient to operate equipment, the General Contractor shall make all other arrangements at no additional cost to the Owner.

f. The temporary heating system shall be removed by the General Contractor after the permanent heating system has been installed, is operating, and balanced. Temporary heating equipment shall be relocated by the General Contractor as required during construction to prevent interference with new construction.

g. Temperatures: Except as otherwise specified, a minimum temperature of 45 degrees F for the building shall be maintained until completion of the Project.

h. Operation: Supervise and be responsible for operation of temporary heating system as required by weather and building conditions through the duration of construction. Be responsible for maintenance of temporary heating systems during period of construction and do any emergency repair work required during temporary operation.

4. The Contractor shall pay for all fuel consumed and temporary heating equipment cost throughout the duration of construction until Substantial Completion at no additional cost to the Owner.

2.02 HAUL ROAD

A. The General Contractor shall build and remove a temporary haul road and lots for delivery of materials throughout the Project site at the Contractor's own expense and maintain it until completion of construction. All road materials shall be removed upon termination of access need, and the confines of the temporary roadway shall be repaired to match adjacent area. The Contractor shall maintain and repair temporary haul roads and lots as required to assure proper egress and ingress of construction equipment and vehicles. The temporary haul road shall be designed, by the Contractor, to prevent tracking of site materials on all public and private roads and lots. The use of specified aggregate base courses of paved roads and lots as temporary haul roads is not permitted.

2.03 TOILETS

A. The General Contractor shall provide and maintain temporary sanitary toilets, located where directed, in sufficient number required for the force employed. The toilets shall comply with the requirements of the Wisconsin Department of Commerce, General Orders on Sanitation. Toilets shall be self-contained chemical type.

B. The General Contractor shall maintain the temporary toilets in a sanitary condition at all times and shall supply toilet paper and hand sanitizer dispenser until completion of the Project.

2.04 FIELD OFFICES & SHEDS

A. The General Contractor shall provide and maintain a temporary watertight office where directed for use by the Contractor, Architect, and Owner. The office shall be equipped with a telephone, telephone answering machine, fax machine, plan racks, suitable tables for examination of plans, power, light, heat, and air conditioning.

B. If other offices are provided by other Contractors, they will be located as agreed to by the Contractor, the Architect/Engineer, and Owner.

C. Sheds for storage of materials that may be damaged by weather shall be provided and maintained by each Contractor. Sheds shall have raised wood floors.

D. All temporary facilities including furniture will remain the property of the Contractor and shall

be removed from the site after completion of the Work.

2.05 STAIRS & SCAFFOLDS

A. The Contractor shall:

1. Furnish and maintain equipment such as temporary stairs, fixed ladders, ramps, chutes, runways and the like as required for proper execution of work by all trades.

B. Underlay interior scaffolds with planking to prevent uprights from resting directly on the floor construction.

2.06 SIGNS

A. No individual advertising signs, plaques or credits, temporary or permanent, will be permitted on the building or premises, except the Contractor's name on his office or material shed.

B. General Contractor shall handle ordering and erection of a Project sign, traffic control signs for the temporary haul road in accordance with local regulations, construction parking signs, and temporary posts for the signs.

2.07 FIRE PROTECTION

A. The General Contractor shall provide and maintain in working order during the entire construction period with in the construction area, trailers & storage sheds. Fire extinguishers to be the size, number and type as required by local fire Marshalls.

B. The fire extinguishers and cabinets specified under Technical Specification Section 10 44 00 shall not be used for this purpose.

C. The contractor shall provide a roving fire watch at all times when activities involving open flame or spark hazards are being conducted. The roving fire watch may be any contractor employee assigned to the task but not actively involved in the operation being performed.

D. The contractor shall provide a roving fire watch to remain on the jobsite no less than 30 minutes after an operation involving open flame or spark hazards has been completed. The roving fire watch may be any contractor employee assigned to the task.

E. The contractor shall provide a roving fire watch whenever existing fire alarm or fire sprinkler systems are temporarily taken out of service. The roving fire watch may be any contractor employee assigned to the task and shall remain on fire watch until the system is restored to normal operation.

2.08 WATCHMEN

A. Watchmen will not be furnished by Owner. The Contractor shall provide such precautionary measures, to include the furnishing of watchmen if deemed necessary, to protect persons and property from damage or loss where the Contractor's work is involved.

2.09 STORAGE OF MATERIALS

A. The Contractor shall confine equipment, apparatus, storage of materials and operations to limits indicated by directions of the Architect/Engineer and shall not bring material onto the site until they are needed for the progress of the Work.

B. The storage of materials on the site and within the building shall be in strict accordance with the instructions of the Architect/Engineer. Storage of materials within the building shall at no time exceed the design carrying capacity of the structural system.

C. Provide and maintain watertight storage sheds on the premises where directed, for storage of materials that might be damaged by weather. Sheds shall have wood floors raised at least 6" above the ground.

D. All materials affected by moisture shall be stored on platforms and protected from the weather.

E. During the construction of this Project, materials, construction sheds and earth stockpiles shall be located so as not to interfere with the installation of the utilities nor cause damage to

existing lines.

F. The Contractor shall allot space to others for storage of their materials and erection of their sheds.

G. Should it be necessary at any time to move material sheds or storage platforms, the Contractor shall move the sheds at the Contractor's expense, when directed by the Owner or Architect/Engineer.

H. The Owner assumes no responsibility for materials stored in building or on the site. The Contractor assumes full responsibility for damage during the storing of materials.

2.10 GLASS REPLACEMENT

A. The Contractor shall assume all costs of replacement of glass broken, cracked, or damaged by him. Glass scratched through improper cleaning shall be considered damaged and shall be replaced by the party that caused the damage.

2.11 CLEANING UP

A. The Contractor shall be financially responsible for clean-up operations. Clean-up must be timely as well as thorough in order to meet safety regulations and permit trades to perform without hindrance from dirt and debris. The Owner will police housekeeping and take appropriate steps to maintain clean, safe working conditions. If the Contractor fails to meet acceptable housekeeping requirements, then the Contractor shall be charged for services arranged for by the Owner.

B. The Contractor shall provide dumpsters throughout the site, schedule periodic removal of all construction waste, and remove all construction waste.

C. "Housekeeping" and clean-up shall be listed on the Schedule of Values and on the Applications and Certificates for Payment as an item of work.

2.12 ENCLOSURES

A. Furnish, install, and maintain for the duration of construction all required tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, fences and other temporary construction necessary for proper completion of the Work in compliance with all city, safety and other regulations.

END OF SECTION

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SECTION 01 73 00
EXECUTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning – See section 01 74 00 - Cleaning
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

1.03 SUBMITTALS

A. Qualification Data: For land surveyor.

B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.

1.04 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 EXAMINATION

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

1. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities: 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 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; and underground electrical services.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions: 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.

3.02 PREPARATION

A. Existing Utility Information: Furnish information to local utility and Owner 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, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.03 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 and Construction Manager promptly.
B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
3. Inform installers of lines and levels to which they must comply.
4. Notify Architect and Owner's Representative when deviations from required lines and levels exceed allowable tolerances.
5. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
E. 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 and Owner's Representative.

3.04 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 or Owner's Representative. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect and Owner's Representative before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of **2** 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.

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.05 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 **8 feet** in spaces without a suspended ceiling.

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. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect or Owner's Representative.
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.

G. 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.

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

3.06 OWNER-INSTALLED PRODUCTS

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

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.

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 forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.07 PROGRESS CLEANING

See Specification Section:

01 74 00 - Cleaning

3.08 STARTING AND ADJUSTING

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

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

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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1, Quality Control.

3.09 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.

3.10 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

SECTION 01 74 00
CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Throughout the construction period, each Contractor shall maintain the Project site in a standard of cleanliness as described in this Section.
2. In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Inspection:

1. Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

B. Codes and Standards:

1. In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

PART 2 - PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

PART 3 - EXECUTION

3.01 FINAL CLEANING

A. "Clean," for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled commercial quality building maintenance equipment and materials.

B. Provide final cleaning of the work, at time indicated, consisting of cleaning each surface or unit of work to normal “clean” condition expected for a first class building cleaning and maintenance program. Comply with manufacturer’s instructs for cleaning operations.

C. Employ experience personnel or professional cleaners for final clearing.

D. Comply with manufacturers’ instructions for cleaning operations.

E. Remove labels which are not required as permanent labels.

F. Clean transparent materials (mirrors, window/door glass) to a polished condition; remove substance which are noticeable as vision obscuring.

G. Clean exposed exterior and interior hard-surfaced finishes, including metals, masonry, stone, concrete, painted surfaces, plastics, tile, wood, special coatings, and similar surfaces, to a dirt-free condition, free of dust, stains, films and similar noticeable distracting substances.

H. Removed debris and surface dust from limited-access spaces; roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.

I. Broom clean concrete floors in non-occupied spaces; vacuum clean carpeted and similar soft surfaces.

J. Clean light fixtures, lamps and diffuser lenses.

K. Prior to completion of the Work, remove from the Project site all tools, surplus materials, equipment scrap, debris, and waste.

1. Interior:
    a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
    b. Remove all traces of splashed materials from adjacent surfaces.
    c. Remove paint drippings, spots, stains, and dirt from finished surfaces.
2. Remove all packing materials and dispose of properly.
3. Polished surfaces: To surfaces requiring routine application of buffed polish, apply the polish recommended by manufacturer of the material being polished.

L. Schedule final commercial cleaning as approved by the Architect to enable the Owner to accept a completely clean building and site.

END OF SECTION

SECTION 01 74 20
CONSTRUCTION WASTE MANAGEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Owner has established that this project shall include proactive measures for waste management participation by all parties to the contract.

1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.
2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.
3. Waste disposal to landfills shall be minimized.

B. Definitions:

1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
3. 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.
4. Recycle: Recovery o demolition or construction waste for subsequent processing in preparation for reuse.
5. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
6. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation in to the work.
7. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
8. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
9. Landfill: Any public or private business involved in the practice of trash disposal.
10. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

1.02 PERFORMANCE REQUIREMENTS

A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of a minimum of 50% by weight of total waste generated by the Work.

B. Salvage/Recycle Requirements: Owner's goal is to salvage and recycle as much non-hazardous construction waste as possible including the following materials:

1. Site clearing waste
2. Masonry and CMU
3. Lumber
4. Wood sheet material
5. Wood trim
6. Metals
7. Roofing

8. Insulation
9. Carpet and pad
10. Gypsum Board
11. Piping
12. Electrical conduit
13. Packaging: Regardless of salvage/re3cycle goal indicated above, salvage and recycle 100% of the following uncontaminated packaging materials:
    a. Paper
    b. Cardboard
    c. Boxes
    d. Plastic sheet and film
    e. Polystyrene packaging
    f. Wood crates
    g. Plastic pails

1.03 SUBMITTALS:

A. Project information: Construction Waste Management Plan.

B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include the following information:
    1. Material category
    2. Generation point of waste
    3. Total quantity of waste in tons
    4. Quantity of waste recycled, both estimated and actual in tons.
    5. Total quantity of waste recovered in tons.
    6. Total quantity of waste recovered as a percentage of total waste.

C. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated and of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

D. Record of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

E. Record of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

F. Recycling and processing Facility Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifest, weight tickets, receipts, and invoices.

G. Qualification data: For refrigerant recovery technician.

1.04 QULAITY ASSURANCE

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

B. Waste Management Conference: Environmental Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:
    1. Review and discuss Waste Management Plan.
    2. Review requirements for documenting quantities of each type of waste and its disposition.
    3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.

4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.05 CONSTRUCTION WASTE MANAGEMENT PLAN

A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be recycled, or disposed in landfill of incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling of transportation procedures.
   1. Recycled Materials: Assign recycling to recycling subcontractor. Or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
   2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility. List hazardous material waste and disposal separately.
   3. 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.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Include the following:
   1. Total quantity of waste.
   2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
   3. Total cost of disposal (with no waste management).
   4. Revenue from salvaged materials.
   5. Revenue from recycled materials.
   6. Savings in hauling and tipping fees by donating materials.
   7. Savings in hauling and tipping fees that are avoided.
   8. Handling and transportation costs. Include cost of collection containers for each type of waste.
   9. Net additional cost or net savings from waste management plan.

E. Waste Management plan shall include locations of sorting and waste storage facilities on Site Plan of Project.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION:

A. Implement waste management plan as approved by Construction Manager. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Comply with the following procedures:
   1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.

2. Separate construction waste by type at Project site to maximum extent practical.
3. Recycle and waste bin areas are to maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials found.
4. Do not mix recyclable materials.
5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpile to drain surface water. Cover to prevent windblown dust.
6. Store materials away from construction area. Do not store within drip line or remaining trees.
7. Store components off the ground and protect from weather.
8. Remove construction waste off Owner's property and transport to appropriate receiver or processor.

B. Hazardous Wastes: Store in secure areas and comply with following:
1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
b. Disposal of fluorescent tubes to open containers is not permitted.

C. Unused fertilizers shall not be co-mingled with construction waste.

D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at the Project site.
1. Distribute waste management plan to everyone concerned within seven days of submittal return.
2. Distribute waste management plan to entities when they first begin work on the site. Review plan procedures and locations established for salvage, recycle, and disposal.

E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with environmental controls specified in Division 1 Section 01 50 00 "Temporary Facilities, Construction Controls and Facilities."

F. Submit "Waste Reduction Progress Reports" each month as part of Application for Payment.
1. Materials identified in Report shall be reported by weight.
2. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
3. Procure receipts or other validation of waste management procedures and include them as part of the submittal.

3.02 RECYCLING CONSTRUCTION WASTE – GENERAL

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

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall be shared equally by owner and Contractor.

3.03 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 for incinerator acceptable to authorities having jurisdiction.

1. Except 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 on site.

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

END OF SECTION

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 GENERAL

A. Substantial Completion: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in 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. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, Certificate of Occupancy from local jurisdiction, and similar documents.
2. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities.
3. Prepare and submit Project Record Documents, Operation and Maintenance Manuals, and similar final record information.
4. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
6. Complete start-up testing of systems.
7. Submit test/adjust/balance reports.
8. Terminate and remove temporary facilities from Project site, along with mock-ups, construction tools, and similar elements.
9. Advise Owner of changeover in heat and other utilities.
10. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
11. Complete final cleaning requirements, including touch-up painting.
12. Touch-up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

B. Substantial Completion 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. Re-inspection: Request a single re-inspection when the Work identified in the previous inspection as incomplete is completed or corrected.
2. Additional Re-inspections: If additional re-inspections due to incomplete work are necessary, the Architect will be compensated on a time and material basis. The value of the work, performed by the Architect and its staff, shall be deleted from the Contractor’s Contract in the form of a Change Order. The Owner will then compensate the Architect directly.
3. Results of completed inspection will form the basis of requirements for Final Completion.

C. Final Completion: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit a final Application for Payment according to Division 1 Section 01 29 00 - Payment Procedures.
2. Submit copy of Architect's substantial completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The copy of the list shall state that each item has been completed or otherwise resolved for

acceptance.

3. Submit three copies of completed “Contractor’s Affidavit of Payment of Debts and Claims”, AIA Document G706, with supporting documents attached thereto including:
    a. Three copies of completed “Contractor’s Affidavit of Release of Liens”, AIA Document G706A.
    b. Three copies of completed “Consent of Surety to Final Payment”, AIA Document G707.
    c. Three copies of completed “Consent of Surety to Reduction in or Partial Release of Retainage”, AIA Document G707A.
    d. Contractor’s release or waiver of liens, conditional upon receipt of final payment.
    e. Separate releases or waivers of liens from subcontractors and material and equipment suppliers.
4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
5. Submit pest-control final inspection report and warranty.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

D. Final Completion 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 of Final Acceptance after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
    1. Re-inspection: Request a single re-inspection when the Work identified in the previous inspection as incomplete is completed or corrected.
    2. Additional Re-inspections: If additional re-inspections due to incomplete work are necessary, the Architect will be compensated on a time and material basis. The value of the work, performed by the Architect and its staff, shall be deleted from the Contractor’s contract in the form of a Change Order. The Owner will then compensate the Architect directly.

E. List of Incomplete Items (punch list): Submit three copies 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 and proceeding from lowest floor to highest floor.
    2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

F. Project Record Documents: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

G. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings. Label marked-up Contract Drawing set as “Record Prints.”

H. 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 prepare the marked-up Record Prints.
    1. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
        a. Mark Record Prints with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

b. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.

I. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy 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.

J. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:

1. Operation Data: Include emergency instructions and procedures, system and equipment descriptions, operating procedures, and sequence of operations.
2. Maintenance Data: Include manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance, and copies of warranties and bonds.
3. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

K. Warranties: Submit written warranties to the Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

1. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
2. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.

PART 2 - GENERAL

2.01 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.

PART 3 - EXECUTION

3.01 CLOSEOUT PROCEDURES

A. Demonstration and Training: Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. Provide instructors experienced in operation and maintenance procedures.
2. Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at the start of each season.
3. Schedule training with Owner, through Architect, with at least seven days advance notice.
4. Coordinate instructors, including providing notification of dates, times, length of

instruction, and course content.

5. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections. For each training module, develop a learning objective and teaching outline. Include instruction for system design and operational philosophy, review of documentation, operations, adjustments, troubleshooting, maintenance, and repair.

B. Final Cleaning: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and federal and local environmental and antipollution regulations.

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.

D. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:

1. 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.
2. Sweep paved areas broom clean. Remove spills, stains, and other foreign deposits.
3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
4. Remove construction equipment and surplus material from Project site.
5. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains.
6. Remove debris and surface dust from limited access spaces.
7. Sweep concrete floors broom clean in unoccupied spaces.
8. Vacuum carpet and similar soft surfaces; shampoo if visible soil or stains remain.
9. Clean transparent materials, including mirrors and glass. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken transparent materials. Polish mirrors and glass.
10. Remove labels that are not permanent.
11. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored.
    a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    b. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication and foreign substances.
    c. Clean plumbing fixtures to a sanitary condition, free of stains.
    d. Replace disposable air filters and clean permanent air filters.
    e. Clean light fixtures, lamps, globes, and reflectors. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
12. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
13. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. To aid in the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated in the Work, furnish and deliver the data described in this Section and in pertinent other Sections of these Specifications.

B. Related Work Described Elsewhere:

1. Make all submittals in strict accordance with the provisions of Section 01 33 00 and the Special Conditions of the Contract.
2. Required contents of submittals may also be amplified in other pertinent Sections.

1.02 QUALITY ASSURANCE

A. In preparation of data required by this Section, use only personnel who are thoroughly trained and experienced in operation and maintenance of the described items, completely familiar with the requirements of this Section, and skilled in technical writing to the degree needed for communicating the essential data.

1.03 SUBMITTALS

A. Preliminary:

1. Submit two copies of a preliminary draft of the proposed manual or manuals to the Architect/Engineer for review and comments. Architect will submit one manual to the Owner for its review.
2. Submit one digital O & M manual in original electronic form (PDF). PDFs shall be of high quality with searchable text. Scanned copies are not acceptable.

B. Final:

1. Unless otherwise directed in other pertinent Sections, or in writing by the Architect/Engineer, submit three copies of the final manual to the Architect/Engineer prior to indoctrination of operation and maintenance personnel.

PART 2 - PRODUCTS

2.01 INSTRUCTION MANUALS

A. General:

1. Where instructions are required to be submitted under other Sections of these Specifications, prepare in accordance with the following:

B. Format:

1. Size: 8-1/2" x 11".
2. Paper: White bond, at least 20 lb. weight.
3. Text: Neatly typewritten.
4. Drawings: 11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable, but fold to fit within the manual and provide a drawing pocket inside rear cover or bind in with text.
5. Flysheets:
   a. Separate each portion of the manual with neatly prepared flysheets briefly describing contents of the ensuing portion; flysheets may be in color.
6. Binding:

a. Bind Operator and Maintenance information in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-by-11-inch paper. Slant D-style rings are preferred. Binders shall have view windows on front and side panels, contractor shall provide project information and title of binder sheets for both panels. Multiple volumes shall indicate volume number and total number (IE Volume 1 of 3).

7. Measurements:

a. Show the U.S. measurements plus the SI equivalents.

C. Covers:

1. Provide front and back covers for each manual, using durable material approved by the Architect/Engineer and clearly identified on or through the front cover with at least the following information:

a. PROJECT NAME

b. PROJECT OWNER

c. LOCATION

i. (general subject of this manual)

ii. (space for approval signature of the Architect/Engineer and approval date)

D. Contents: Include at least the following:

1. Contractor shall provide all manufacturer's documentation provided with new equipment to the owner. Documentation shall include but not be limited to installation instructions, parts diagrams/lists, warranty cards, registration cards, operation instructions, and maintenance instructions. A minimum of one complete set shall be provided in each O&M manual.

2. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency data regarding the installation.

a. Complete instructions regarding operation and maintenance of all equipment involved, including lubrication, disassembly, and reassembly.

b. Complete nomenclature of all parts of all equipment.

c. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other pertinent data regarding procurement procedure.

d. Electrostatic copy of all guarantees and warranties issued.

e. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturer's data with which this installation is not concerned.

f. Manufacturers installation instructions.

g. Manufacturers parts list and assembly diagrams.

h. Manufacturers wiring diagrams

i. Manufacturers recommended use, care and cleaning methods, special precautions.

j. Summary list of equipment vendors, service companies, parts suppliers with company name, address and phone number.

k. Summary list of recommended spare parts to have on hand at all times.

l. Summary list of recommended lubes, oils, packing materials, and other related maintenance supplies.

m. Copies of test reports, balancing reports, etc.

n. Such other data as required in other pertinent Sections of these Specifications.

PART 3 - EXECUTION

3.01 INSTRUCTION MANUALS

A. Preliminary:

1. Prepare a preliminary draft of each proposed manual. Show general arrangement, nature of contents in each portion, probable number of drawings and their size, and proposed method of binding and covering. Secure the Architect/Engineer's approval prior to proceeding with final.

B. Final:

1. Complete the manuals in strict accordance with the approved preliminary drafts and the Architect/Engineer's review comments.
2. Submit all O & M manuals in original electronic form (PDF). Scanned copies are not acceptable. PDF files need to be of a high quality resolution with searchable text."
3. Submit one draft copy of O & M manual at least 15 days prior to scheduled O & M training for review by maintenance personnel.

C. Revisions:

1. Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of manuals with the Architect/Engineer. If the Contractor is required by the Architect to revise previously approved manuals, compensation will be made as provided under "Changes to the Contract" in the General Conditions.

END OF SECTION

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SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.01 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.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for warranties required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Contractor's period for correction of the Work.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 1 Section 01 33 00 "Submittal Procedures" specifies procedures for submitting warranties.
2. Divisions 2 through 48 Sections for specific requirements for warranties on products and installations specified to be warranted.
3. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.

C. Disclaimers and Limitations: Manufacturers' disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturers' disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

D. Separate Prime Contracts: Each Prime Contractor is responsible for warranties related to its own Contract.

1.03 DEFINITIONS

A. Standard product warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.

B. Special warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.04 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.

D. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

E. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

1.05 SUBMITTALS

A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.

1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within 15 days of completion of that designated portion of the Work.

B. When the Contract Documents require the Contractor, or the Contractor and a subcontractor, supplier or manufacturer to execute a special warranty, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

C. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Architect, for approval prior to final execution.

1. Refer to Divisions 2 through 48 Sections for specific content requirements and particular requirements for submitting special warranties.

D. Form of Submittal: At Final Completion compile 3 copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the Table of Contents of the Project Manual.

E. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper. D-style rings are preferred.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the 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 the installer.

2. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

3. When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS

2.01 Not Used

PART 3 - EXECUTION

3.01 LIST OF WARRANTIES

A. Schedule: Provide warranties on products and installations as specified in the following Sections:

1. Section 08 11 16……Aluminum Windows
2. Section 08 36 13……Sectional Overhead Doors
3. Section 08 70 00……Door Hardware
4. Section 08 80 00……Glazing
5. Section 13 34 19……Metal Building Systems – Wall and Roof Panel Finish
6. Section 22 10 00..... Plumbing
7. Section 23 00 00..... Heating, Ventilating and Air Conditioning
8. Section 23 09 00..... Controls & Instrumentation
9. Section 26 29 13..... Starters
10. Section 26 24 16..... Panelboards
11. Section 26 20 00..... Distribution Panelboard
12. Section 26 50 00..... Lighting

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Throughout progress of the work, each Contractor shall maintain an accurate record of all changes in the Contract Documents, as described in Article 3.01 below.
2. Upon completion of the work of this contract, transfer the recorded changes to a set of Record Documents, as described in Article 3.02 below.

B. Related Work Described Elsewhere:

1. Section 01 33 00: Submittal Procedures

1.02 QUALITY ASSURANCE

A. General:

1. The Contractor shall delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved in advance by the Architect/Engineer.

B. Accuracy of Records:

1. Thoroughly coordinate all changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other documents where such entry is required to properly show the change. Accuracy of records shall be such that future searches for items shown in the Contract Documents may reasonably rely on information obtained from the approved Record Documents.

C. Timing of Entries:

1. Make all entries within 24 hours after receipt of information.

1.03 SUBMITTALS

A. Final Submittal:

1. Prior to submitting Request for Final Payment, submit the final Record Documents to the Architect/Engineer and secure his approval.

1.04 PRODUCT HANDLING

A. Use all means necessary to maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of the recorded data to the final Record Documents. In the event of loss of recorded data, use all means necessary to secure the data to the Architect/Engineer's approval; such means shall include, if necessary in the opinion of the Architect/Engineer, removal and replacement of concealing materials and, in such case, all replacements shall be to the standard originally specified in the Contract Documents.

PART 2 - PRODUCTS

2.01 RECORD DOCUMENTS

A. Job Set:

1. Promptly following Award of Contract, secure from the Architect/ Engineer at no charge to the Contractor, one complete set of all documents comprising the Contract.

B. Final Record Documents:

1. At a time near the completion of the work, secure from the Architect/Engineer at no

charge to the Contractor, one complete set of all Drawings and Specifications included in the Contract.

PART 3 - EXECUTION

3.01 MAINTENANCE OF JOB SET

A. Identification:

1. Immediately upon receipt of the job set described in Paragraph 2.01 above, identify each of the Documents with the title "Record Documents - Job Set".

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect/Engineer.
    a. Do not use the job set for any purpose except entry of new data and for review by the Architect/Engineer, until start or transfer of data to final Record Documents.
    b. Maintain the job set at the site of Work as that site is designated by the Architect/Engineer.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by note and by graphic line, as required. Date all entries. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

D. Making Entries on Other Documents:

1. Where changes are caused by directives issued by the Architect/Engineer, clearly indicate the change by note in ink, colored pencil, or rubber stamp.
2. Where changes are caused by Contractor - originated proposal approved by the Architect/Engineer, including inadvertent errors by the Contractor which have been accepted by the Architect/Engineer, clearly indicate the change by note in erasable colored pencil.
3. Make entries in the pertinent Documents as approved by the Architect/Engineer.

E. Conversion of Schematic Layouts:

1. In most cases on the Drawings, arrangement of conduits and circuits, piping, ducts, and other similar items, is shown schematically and is not intended to portray precise physical layout. Final physical arrangement is as deter-mined by the Contractor, subject to the Architect/Engineer's approval. However, design of future modifications of the facility may require accurate information as to the final physical arrangement of items which are shown only schematically on the Drawings.
2. Show on the job-set of Record Drawings, by dimension accurate to within 1", the center line of each run of items such as are described in Paragraph 3.01.E.1. above. Clearly identify the item by an accurate note such as "cast iron drain", "galv. water", etc. Show by symbol or note the vertical location of the item ("under slab", "in ceiling plenum", "exposed", etc.). Make all identification sufficiently descriptive that it may be related reliably to the Specifications.
3. The Architect/Engineer may waive the requirements for conversion of schematic data where, in the Architect/Engineer's judgment, such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect/Engineer.
4. Timing of Entries: Be alert to changes in the work from how it is shown in the Contract Documents. Promptly, and in no case later than 24 hours after the change

has occurred and been made known to the Contractor, make the entry or entries required.

5. Accuracy of Entries: Use all means necessary, including the proper tools for measurement, to determine actual locations of the installed items.

3.02 FINAL RECORD DOCUMENTS

A. General:

1. The purpose of the final Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed with lengthy and expensive site measurement, investigations, and examination.

B. Approval of Recorded Data Prior to Transfer:

1. Following receipt of the documents described in Paragraph 2.01-B above, and prior to start of transfer of recorded data thereto; secure a review by the Architect of all recorded data. Make all required revisions.

C. Transfer of Data to Drawings:

1. Carefully transfer all change data shown on the job-set of Record Drawings to the corresponding sepia, coordinating the changes as required, and clearly indicating at each affected detail and other drawing the full description of all changes made during construction and the actual location of items described in Paragraph 3.01-E above. Call attention to each entry by drawing a "cloud" around the area or areas affected. Make all change entries on the Drawings neatly, consistently, and in ink or crisp black pencil.

D. Transfer of Data to Other Documents:

1. If the Documents other than Drawings have been kept clean successfully during progress of the Work, and if entries have been sufficiently orderly thereon to the approval of the Architect/Engineer, the job-set of those Documents (other than Drawings) will be accepted by the Architect/Engineer as final Record Documents for those Documents. If any such Document is not so approved by the Architect/Engineer, secure a new copy of that Document from the Architect/Engineer at the Architect/Engineer's usual charge for reproduction; carefully transfer the change data to the new copy and to the approval of the Architect/ Engineer.

E. Review and Approval:

1. Submit the completed total set of Record Documents to the Architect as described in Paragraph 1.03 above. Participate in review meeting or meetings as required by the Architect/Engineer, make all required changes in the Record Documents, and promptly deliver the final Record Documents to the Architect/ Engineer. Architect will deliver a copy of the Contractor's final Record Documents to the 48150.

3.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor shall have no responsibility for recording changes in the Work subsequent to acceptance of the Work by the Owner, except for changes resulting from replacements, repairs, and alterations made by Contractor as part of his guarantee.

END OF SECTION

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SECTION 02 30 00
SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Test borings have been made and boring data is available for review in the appendix of this specification (Appendix A); however, these records do not form a part of the Contract Documents, but are provided for information only.

B. Neither the Owner, nor the Architect/Engineer guarantee continuity of conditions indicated at the boring locations.

C. Contractor will have to interpret the soil boring data and be satisfied as to the materials to be excavated and materials upon which fill or other materials may be placed.

D. Bidders should visit the site and acquaint themselves with all existing conditions. Prior to bidding, bidders may make their own subsurface investigations to satisfy themselves as to site and subsurface conditions, but all such investigations shall be performed only under time schedules and arrangements approved in advance by the Architect/Engineer.

1.02 QUALITY ASSURANCE

A. Adjustment of Work:

1. Readjust all work performed that does not meet technical or design requirements, but make no deviations from the Contract Documents without specific and written approval from the Architect/Engineer.
2. Soils Engineer will be retained by the Contractor to observe performance of work in connection with excavating, filling, backing and grading.

END OF SECTION

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SECTION 03 10 00
CONCRETE FORMS AND ACCESSORIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Work under this Section includes all labor, materials, equipment, and services necessary to complete the concrete forms and accessories work as shown on the Drawings and herein specified.

B. Products Installed But Not Supplied Under This Section:

1. Built-in anchors, inserts, and bolts for connection of other materials.
2. Built-in sleeves, thimbles, anchor slots, and water stops.
3. Masonry accessories attached to formwork.
4. Metal fabrications attached to formwork.
5. Flashing, reglets, and sheet metal attached to formwork.

C. Related Sections:

1. Section 01 33 00: Submittal Procedures
2. Section 03 20 00: Concrete Reinforcement
3. Section 03 30 00: Cast-In-Place Concrete

1.02 DEFINITIONS

A. Non-Architectural Concrete Surfaces: Formed surfaces where appearance is not a design consideration.

1.03 SUBMITTALS

A. General: Submit four (4) copies of the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Submit no later than ten days after notice to proceed or five days prior to pour, whichever is earlier.

C. Product data for proprietary materials and items, including forming accessories, joint systems, and others if requested by Architect.

D. Shop drawings, if requested by the Architect/Engineer:

1. Conform to ACI 301.
2. Indicate fabrication and erection of forms for finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually.
3. Architect/Engineer's review is for general architectural applications and features only. The design, engineering, safety, and construction of formwork, re-shoring, and back-shoring (including for structural stability and efficiency) shall remain the sole responsibility of the Contractor.
4. Calculations for formwork, re-shoring, and back-shoring as applicable, sealed by a Professional Engineer licensed in the state applicable to work and Project location.
5. Obtain acceptance of shop drawings prior to fabrication.

E. Samples of materials, if requested by Architect/Engineer, including names, sources, and descriptions, as follows:

1. Form ties.
2. Form liners.
3. Reglets.

4. Waterstops.
5. Expansion joint materials.
6. Others, if requested by the Architect/Engineer.

1.04 QUALITY ASSURANCE

A. General: Conform to ACI 347: "Recommended Practice for Concrete Formwork".

B. Design Criteria:
1. All formwork is subject to the Architect/Engineer's approval.
2. The design, engineering, safety, and construction shall remain the responsibility of the Contractor.
3. Conform to ACI 347, "Recommended Practice for Concrete Formwork"
4. Formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.
5. Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Architect/Engineer. When omission of forms is accepted, provide additional concrete two (2) inches beyond the minimum design profiles and dimensions of the footings as detailed.

C. Regulatory Requirements:
1. Conform to requirements of local, state, and federal rules and regulations applicable to work and Project location.
2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
a. American Concrete Institute, ACI 117 - 90 "Standard Specifications for Tolerances for Concrete Construction and Materials."
b. American Concrete Institute, ACI 301 - 99 "Specifications for Structural Concrete."
c. American Concrete Institute, ACI 302.1R "Guide for Concrete Floor and Slab Construction".
d. American Concrete Institute, ACI 318 - 02 "Building Code Requirements for Structural Concrete."
e. American Concrete Institute, ACI 304.2R - 96 "Placing Concrete by Pumping Methods."
f. American Welding Society, AWS D1.4-81 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction."

D. Where provisions of the above codes and standards are in conflict with each other or the building code in force for this Project, the most stringent shall govern.

E. Allowable Tolerances:
1. Non-Architectural Concrete: Conform to ACI 347, Article 3.3.

F. Where a conflict occurs between the standard specified, the more stringent shall govern.

1.05 DELIVERY, STORAGE, AND HANDLING

A. On delivery to job site, place materials in area protected from weather.

B. Store materials above ground on framework or blocking and cover with protective waterproof covering providing for adequate air circulation or ventilation.

C. Handle materials to prevent damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Conform to ACI 347-78 "Recommended Practice for Concrete Formwork", Chapter 4 - Materials for Formwork.

B. Forms for Exposed Finish Concrete Surfaces:

1. Construct formwork with plywood, metal, metal-framed plywood-faced or other panel type materials acceptable to Architect/Engineer, to provide continuous, straight, smooth exposed surfaces.
2. Formwork shall be mortar-tight and constructed of a material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
3. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings.
4. Temporary openings may be provided on all walls and forms to limit the free fall of the concrete to less than four feet and should be so located as to facilitate the placing and consolidation of the concrete. The ports shall be spaced no more than 6 feet apart to limit the horizontal flow of concrete.

C. Forms for Unexposed Finish Concrete Surfaces:

1. Construct formwork with plywood, board, metal, or other acceptable material.
2. Provide lumber dressed on at least two edges and one side for tight fit.

D. Forms for Textured Finish Concrete Surfaces:

1. Units of face design, size, arrangement, and configuration to match Architect/Engineer's control sample. Provide solid backing and form supports to ensure stability of textured form liners.

E. Forms for Cylindrical Columns and Supports:

1. Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that will produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.

F. Pan-Type Forms:

1. Glass-fiber-reinforced plastic or formed steel, stiffened to support weight of placed concrete without deformation.

G. Carton Forms:

1. Biodegradable paper surface, treated for moisture-resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

H. Form Ties and Accessories:

1. Provide factory-fabricated, adjustable-length, removable or snap-off form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal.
2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2" inside the outer concrete surface. Cutting ties back from face of wall or use of wire ties will not be permitted.
3. Provide ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in the concrete surface.
4. Ties shall be fitted with tapered rubber plugs and plug holes shall be filled with non-shrink grout after forms are removed where concrete is exposed to view. Where the walls have earth on both sides, tapered rubber plugs on the ties will not be required. In these areas snap ties will be sufficient.

I. Form Coatings:

1. Provide commercial formulation compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to

be cured with water of curing compounds.

PART 3 - EXECUTION

3.01 GENERAL

A. Conform to ACI 347 "Recommended Practice for Concrete Formwork", Chapter 3, Construction.

B. Allowable Tolerances: Construct formwork to provide completed cast-in-place concrete surfaces complying with the tolerances specified in ACI 347 "Recommended Practice for Concrete Formwork", and as follows:

1. Variation from plumb in lines and surfaces: 1/4" per 10 feet, but not more than 1".
2. Variation from level or from grades indicated on the Drawings: for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines, 1/4" in any bay or 20 feet max. and 1/2" in 40 feet or more.
3. Variation in cross-sectional dimensions of thickness of slabs and walls: - 1/4" and + 1/2".
4. Variations in footings plan dimensions: - 1/2" and + 2"; misplacement or eccentricity: 2% of the footing width in direction of misplacement but not more than 2"; thickness reduction: 5%.

C. Provide for openings, offsets, key-ways, screeds, bulkhead, and other features required.

D. Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

E. Limit the free fall of the concrete to less than four feet. Temporary openings may be provided on walls and forms to accomplish this, and should be so located as to facilitate the placing and consolidation of the concrete. The ports shall be spaced no more than 6 feet apart to limit the horizontal flow of concrete.

F. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.

G. Embedded Items:

1. Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete.
2. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.
3. Provide metal inserts for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work.

H. Coat form contact surfaces with form-coating compound before reinforcement is placed.

3.02 FORMWORK

A. Forms for exposed concrete:

1. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
2. Use extra studs, walers and bracing as required to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form materials which will produce bow.
3. Form molding shapes, recesses and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

B. Corner treatment for all concrete:

1. Form chamfers with 3/4" x 3/4" strips, accurately formed and surfaced to produce uniformly straight lines and tight edge joints.
2. Extend terminal edges to limit and miter chamfer strips at changes in direction.

3.03 REMOVAL OF FORMWORK

A. Formwork not supporting concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 degrees F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided that curing and protection operations are maintained.

B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs and other structural elements may not be removed in less than 14 days, and not until concrete has attained design minimum 28 day compressive strength.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Work under this Section includes all labor, materials, equipment, and services necessary to complete the concrete reinforcement work as shown on the Drawings and herein specified.

B. Products Supplied But Not Installed Under This Section:

1. Concrete reinforcement.

C. Related Sections:

1. Section 01 33 00: Submittal Procedures
2. Section 03 10 00: Concrete Forms and Accessories
3. Section 03 30 00: Cast-In-Place Concrete

1.02 SUBMITTALS

A. General: Submit four (4) copies of the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Submit no later than ten days after notice to proceed or five days prior to pour, whichever is earlier.

C. Product data for proprietary materials and items, including reinforcement, reinforcing bar couplers, reinforcing bar chairs, dowels and dowel baskets, and others if requested by Architect.

D. Shop drawings as follows:

1. Conform to ACI 301.
2. Placing Drawings:
   a. Detail fabricating, bending, and placing of reinforcement.
   b. Show sizes and dimensions for fabrication of reinforcing steel and bar supports.
   c. Show sizes and dimensions for placing of reinforcing steel and bar supports.
   d. Show sizes and dimensions for fabrication of reinforcing wire fabric and supports.
   e. Show sizes and dimensions for placing of reinforcing wire fabric and supports.
   f. Indicate reinforcement sizes, spacing dimensions, locations, and quantities. Show bar schedules and diagrams of bent bars, stirrup spacing dimensions, splicing, and supporting and spacing devices. Include any special reinforcing required.
   g. Conform to American Concrete Institute, ACI SP-66 - 94 "ACI Detailing Manual" providing full wall elevations.
   h. Use 24" x 36" paper size and format per "Fig. 20-Recommended Layout for Placing Drawings" in the American Concrete Institute "Details and Detailing of Concrete Reinforcement (ACI 315-80)*(Revised 1986)."
3. Certificates:
   a. Provide mill test certificates identifying chemical and physical analysis of each load of reinforcing steel delivered to the supplier.
4. Initial submittal of reinforcement shop drawings shall be complete. No partial submittals will be accepted.
5. Obtain acceptance of shop drawings prior to fabrication.

E. Samples of materials if requested by Architect, including names, sources, and descriptions, as follows:
   1. Fiber reinforcement.
   2. Welded wire reinforcement.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
   2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
      a. American Concrete Institute, ACI 117 - 90 “Standard Specifications for Tolerances for Concrete Construction and Materials.”
      b. American Concrete Institute, ACI 301 - 99 "Specifications for Structural Concrete."
      c. American Concrete Institute, ACI 302.1R "Guide for Concrete Floor and Slab Construction".
      d. American Concrete Institute, ACI 315 - 99 “Details and Detailing of Concrete Reinforcement.”
      e. American Concrete Institute, ACI 318 - 02 “Building Code Requirements for Structural Concrete.”
      f. American Concrete Institute, ACI SP-66 - 94 "ACI Detailing Manual”
      g. American Welding Society, AWS D1.4-81 “Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction.”
      h. American Welding Society, AWS D4 Structural Welding Code – Reinforcing Steel.
      i. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."

B. Where provisions of the above codes and standards are in conflict with each other or the building code in force for this Project, the most stringent shall govern.

C. CONTACT A/E AND OWNER FOR INSPECTION OF ALL INSTALLED CONCRETE REINFORCEMENT PRIOR TO CONCRETE PLACEMENT.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent damage and accumulation of dirt or excessive rust.

C. Deliver and store welding electrodes in accord with AWS D 1.4.

1.05 REFERENCE STANDARDS

A. ACI 301 - Specification for Structural Concrete for Buildings.

B. AWS D.4 - Structural Welding Code - Reinforcing Steel.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Reinforcing Bars:

1. “Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement”, ASTM A 615 (ASTM A 615M), Grade 60 (Grade 420), deformed.
2. “Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement”, ASTM A 996 (ASTM A 996M), Grade 60 (Grade 420), Type A.

B. Coated Reinforcing Bars:
1. “Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement”, ASTM A 767 (ASTM A 767M), Class 2, 2.0 oz/psf zinc, galvanized after fabrication and bending.
2. “Standard Specification for Epoxy-Coated Steel Reinforcing Bars”, ASTM A 775 (ASTM A 775M), patching material supplied, surface prepared to meet SSPC-Vis 1.

C. Bar Mats:
1. “Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement”, ASTM A 184 (ASTM A 184M), clipped.

D. Wire:
1. “Standard Specification for Steel Wire, Plain, for Concrete Reinforcement”, ASTM A 82, plain, cold-drawn steel.
2. “Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement”, ASTM A 496.

E. Welded Wire Fabric:
1. “Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete”, ASTM A 185, flat sheets.
2. “Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete”, ASTM A 497, flat sheets.
3. Provide sheet welded wire fabric for concrete reinforcement. Rolled welded wire fabric is not permitted.

F. Coated Wire and Welded Wire Fabric:
1. “Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement”, ASTM A 884 (ASTM A 884M), Class A, patching material supplied, surface prepared to meet SSPC-Vis 1.

G. Reinforcement Supports:
1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement in place. Do not float bars into place or use bricks.
2. Use wire bar-type supports complying with CRSI specifications. Do not use wood, brick, and other unacceptable materials.
3. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
4. For footings, use chairs for reinforcing. Do not float bars into place or use bricks.
5. For exposed-to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).
6. Uncoated or Coated to match reinforcement.

H. Tie Wire: Annealed steel, black, 16 gauge minimum. Uncoated or Coated to match reinforcement.

2.02 ACCESSORIES

A. Welding Electrodes:
1. AWS A5.1, low hydrogen, E70 series.

2.03 FABRICATION

A. Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.

B. Reinforcement with any of the following defects will not be permitted in the Work.
   1. Bar lengths, depths and bends exceeding specified fabrication tolerance.
   2. Bend or kinks not indicated on Drawings or final shop drawings.
   3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Placement:
   1. Comply with the requirements in Chapters 5-6 of ACI 301.

B. Steel Adjustment:
   1. Move within allowable tolerances to avoid interference with other reinforcing steel, conduits, or embedded items.
   2. Do not move bars beyond allowable tolerances without concurrence of Architect/Engineer.
   3. Do not heat, bend, or cut bars without concurrence of Architect/Engineer.

C. Splices:
   1. Lap splices: Tie securely with wire to prevent displacement of splices during placement of concrete.
   2. Welding: Perform in accordance with AWS D 1.4.
   3. Do not splice bars except at locations shown on drawings without concurrence of Architect/Engineer.

D. Wire Fabric:
   1. Install in longest practicable length.
   2. Lap adjoining pieces one full mesh minimum and lay splices with 16 gauge wire.
   3. Do not make end laps midway between supporting beams, or directly over beams of continuous structures.
   4. Offset end laps in adjacent widths to prevent continuous laps.
   5. Provide chairs and bolsters to properly locate fabric.

E. Bar and Fabric Supports:
   1. Provide sufficient numbers of supports and of strength to carry bar and fabric reinforcement.
   2. Do not place reinforcing bars more than 2" beyond the last leg of any continuous bar support.
   3. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Protect reinforcing with minimum thickness of concrete cover for cast-in-place concrete as follows; unless otherwise noted on the Drawings.
   1. Cast against and permanently exposed to earth 3"
   2. Exposed to earth or weather:
      a. #6 through #18 bars 2"
      b. #5 bars, 5/8" wire and smaller 1-1/2"
   3. Not exposed to weather or in contact with the ground.
      a. Slabs, walls:

i. #14 and #18 bars 1-1/2"

ii. #11 and smaller 3/4"

b. Beams, girders, columns:

c. Principle reinforcement, ties, stirrups, spirals 1-1/2"

G. Cleaning: Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete.

H. Installation:

1. Position, support, and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as required.

2. Arrange, space and securely tie bars and bar supports together with 16 gauge wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that ends are directed away from exposed concrete surfaces.

I. CONTACT A/E AND OWNER FOR INSPECTION OF ALL INSTALLED CONCRETE REINFORCEMENT PRIOR TO CONCRETE PLACEMENT.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this Section includes all labor, materials, equipment, and services necessary to complete the cast-in-place concrete work as shown on the Drawings and herein specified.

B. Products Installed But Not Supplied Under This Section

1. Concrete Accessories
2. Concrete Reinforcement
3. Joint Sealers

C. Related Sections:

1. Division 32 Section 32 16 00 – "Sidewalks, Curbs, and Gutters" for concrete sidewalks, exterior slabs on grade and curb and gutter.

D. Related Sections

1. Division 1 Section 01 33 00– Submittal Procedures
2. Division 1 Section 01 45 00 – Quality Control
3. Division 3 Section 03 10 00– Concrete Forms and Accessories
4. Division 3 Section 03 20 00– Concrete Reinforcement
5. Division 32 Section 32 76 40 – Pavement Joint Sealants

1.02 SUBMITTALS

A. General: Submit four (4) copies of the following according to Conditions of the Contract and Division 1 Specification Sections.

B. Submit no later than ten days after notice to proceed or five days prior to pour, whichever is earlier.

C. Product data for proprietary materials and items, including admixtures, patching compounds, curing compounds, hardeners, dry-shake finish materials, and others if requested by Architect.

D. Samples of materials, if requested by the Architect, including names, sources, and descriptions, as follows:

1. Color finishes.
2. Aggregate.
3. Others, if requested by the Architect.

E. Concrete mix designs indicating material content per cubic yard for each class of concrete to be furnished. Concrete mix properties shall be indicated. Each mix design shall include the following as a minimum.

a. Dry weights of cementitious materials.
b. Saturated surface-dried weights of fine and coarse aggregate with ASTM grading size number.
c. Quantities, type and name of admixtures with manufacturer's recommendations for proportioning.
d. Weight of water.
e. Specified Average Compressive Strength (f'_c) and Required Average Compressive Strength (f'_{cr}).
f. Water/Cementitious Materials (W/C) Ratio.

g. Slump.

F. Mix design tests.

G. Laboratory test reports for each material in concrete mix. In lieu of submitting laboratory test reports for each material in concrete mix, submit material certificates signed by the manufacturer and the Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

H. Certificates:

1. Manufacturer and Contractor certifications that materials meet specification requirements.
2. Ready-mix delivery tickets, ASTM C 94.

I. Minutes of pre-installation conference.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
   a. American Concrete Institute, ACI 117 - 90 “Standard Specifications for Tolerances for Concrete Construction and Materials.”
   b. American Concrete Institute, ACI 301 - 99 "Specifications for Structural Concrete."
   c. American Concrete Institute, ACI 302.1R - 96 "Guide for Concrete Floor and Slab Construction".
   d. American Concrete Institute, ACI 318 - 02 “Building Code Requirements for Structural Concrete.”
   e. American Concrete Institute, ACI 304R-00 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
   f. American Concrete Institute, ACI 304.2R - 96 "Placing Concrete by Pumping Methods."
   g. American Concrete Institute, ACI 305R - 99 "Hot Weather Concreting."
   h. American Concrete Institute, ACI 306R - 97 "Cold Weather Concreting."
   i. American Concrete Institute, ACI 308R - 01 "Guide to Curing Concrete."
   j. ASTM International, ASTM C309 – 11 “Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.”
   k. American Welding Society, AWS D1.4-81 “Recommended Practices for Welding Reinforcing Steel, Metal Inserts, and Connections in Reinforced Concrete Construction.”
   l. American Welding Society, AWS D4 Structural Welding Code – Reinforcing Steel.
   m. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
3. Where provisions of the above codes and standards are in conflict with each other or the building code in force for this project, the most stringent shall govern.

B. Allowable Tolerances:

1. Flatwork true to plane 1/8" in 10'- 0" in areas to receive vinyl composition tile or rubber flooring, and flatwork true to plane 1/4” in 10’- 0” elsewhere. 1/4” accumulated maximum.

C. Maintain copy of ACI 301 on site.

D. Testing:

1. Engage a testing agency acceptable to Architect to perform testing responsibilities of the Contractor as specified in ACI 301.
2. Contractor shall pay all costs of tests and transportation of test material.
3. Submit 7 day and 28 day compressive strength test results to the Architect for his review.
4. Test in accordance with Section 01 45 00 and "Methods of Sampling and Testing", ASTM C 94/C 94M.
5. Sample every 100 yards or fraction thereof for concrete poured in one day and submit 7-day and 28-day compressive strength test results to the Architect for his review.

E. Materials and installed work may require testing and retesting at any time during progress of Work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section 01 31 19 "Project Meetings" and the following:

1. At least 3 to 5 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
    a. Contractor's superintendent.
    b. Agency responsible for concrete design mixes.
    c. Agency responsible for field quality control.
    d. Ready-mix concrete producer.
    e. Concrete subcontractor.
    f. Primary admixture manufacturers.

G. Structural Design Data

1. Concrete:
    a. Floor slab, walks, aprons, utility encasements and yard slabs: f'c=4000 PSI
    b. Footings: f'c=3000 PSI
    c. Piers, foundation walls: f'c=4000 PSI
    d. Precast topping: f’c=4000 PSI
    e. Parking lots: f’c=4500 PSI
    f. All miscellaneous: f'c=4000 PSI

H. Concrete Mixes:

Min. Comp. Strength (PSI/28 days)	Max. Aggr. Size (in.)	Min. Cement (lbs/cu.yd.)
3000	1-1/2	493.5
4000	3/4	587.5
4000	3/4	540.5

Max. Wtr./ Cement Ratio	Max. Slump[1] (in.)	Air Content (percentage)
0.50	3	2-4
0.45	3	6[2]
0.45	3	2-4

[1]Indicates slump prior to addition of super plasticizers..
[2]Exterior concrete exposed to frost. Minimum air content 6% plus or minus 1 percent.

1. Minimum 28 day concrete cylinder strength shall be:
   a. Footings 3000 PSI
   b. Foundation Walls 4000 PSI
   c. Slab Systems 4000 PSI
2. Use ACI recommendations for slag cement substitute.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Cement: Store in weather-tight enclosures and protect against dampness, contamination, and warehouse set.

B. Aggregates:
   1. Stockpile to prevent excessive segregation, or contamination with other materials or other sizes of aggregates.
   2. Use only one supply source for each aggregate stockpile.

C. Admixtures:
   1. Store to prevent contamination, evaporation or damage.
   2. Protect liquid admixtures from freezing or harmful temperature ranges.
   3. Agitate emulsions prior to use.

1.05 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Allowable Concrete Temperatures:
      a. Cold weather: Maximum and minimum, ASTM C 94/C 94M.
      b. Hot weather: Maximum 90 degrees F. Do not place concrete during rain, sleet or snow unless protection is provided.
   2. Concrete work shall conform to American Concrete Institute, ACI 306R when the following conditions exist for more than three consecutive days:
      a. The average daily temperature is less than 40 degrees F (5 degrees C). The average daily temperature is the average of the highest and the lowest temperatures occurring during the period from midnight to midnight.
      b. The air temperature is not greater than 50 degrees F (10 degrees C) for more than one-half of any 24 hour period.
   3. Concrete work shall conform to American Concrete Institute, ACI 305R when any combination of the following conditions that tends to impair the quality of freshly mixed or hardened concrete by accelerating the rate of moisture loss and rate of cement hydration or otherwise cause detrimental results exists:
      a. High ambient temperature (generally greater than 75 degrees F).

b. High concrete temperature
c. Low relative humidity
d. Wind speed
e. Solar radiation

4. Do not place concrete during rain, sleet or snow unless protection is provided.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms and Accessories:
1. See Section 03 10 00.

B. Reinforcement:
1. See Section 03 20 00.

C. Concrete:
1. Cement:
a. “Standard Specification for Portland Cement”, ASTM C 150.
2. Admixtures:
a. Air entraining:
i. “Standard Specification for Air-Entraining Admixtures for Concrete”, ASTM C 260.
b. Chemical Admixtures:
i. “Standard Specification for Chemical Admixtures for Concrete”, ASTM C 494/C 494M, Type A.
ii. Concrete may contain a Type A water-reducing admixture.
iii. Admixtures are to be used in accordance with manufacturer's recommendations.
iv. Chemical admixtures containing chlorides, sulfides, or nitrides are not permitted.
v. Admixtures shall be supplied by a single manufacturer.
vi. Admixture manufacturers are to be approved in writing by Architect/Engineer prior to use.
c. Do not use calcium chloride in concrete.
3. Aggregates:
a. “Standard Specification for Concrete Aggregates”, ASTM C 33.
4. Water: Clean and not detrimental to concrete.
5. Slump: Plus tolerance 0, minus tolerance 1-1/2".
6. Mix proportioning: To produce 7-day and 28-day compressive strength of moist cured laboratory samples, as specified under Structural Design Data.
7. Ready-Mixed Concrete:
a. “Standard Specification for Ready-Mixed Concrete”, ASTM C 94/C 94M.
8. Fly Ash:
a. “Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete”, ASTM C 618, Class C with a low sulfur content [Class F].
b. Quality shall be consistent and from the same source. Fly ash shall be Type C.
c. Fly ash shall be supplied by a single manufacturer.
d. Proportioning by weight of cement shall not exceed 15%.
i. For every 100 lbs. of cement, the mix shall be adjusted as follows:

(a.) 10 lbs. fly ash

(b.) 90 lbs. cement

e. Use of fly ash in exterior or entrained concrete on or after October 1 is not permitted.

D. Fiber Mesh:

1. Nylon fiber made of 100% virgin nylon 6 fiber for secondary reinforcement of concrete, ASTM C 39, ASTM C 78, and ASTM C 496. Acceptable products: Nycon nylon fiber as manufactured by Nycon, Inc., Nurlon Fiber Reinforcement as manufactured by Smith Chemical Corporation, and Forta Nylon as manufactured by FORTA Corporation.
2. Fiber Reinforcement: Polypropylene fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III, not less than 3/4 inch long.
3. Steel fibers per ASTM A 820.

E. Evaporation Reducer

1. CONFILM as manufactured by ChemRex, Division of Degussa Construction Chemicals. Install per manufacturer's recommendations.

F. Concrete Curing and Sealing Compound

1. “Standard Specification for Specification for Liquid Membrane-Forming Compounds for Curing Concrete”, ASTM C 309-11.
2. Curing and sealing materials shall be as follows:
   a. All cast-in-place concrete to shall be moisture cured in accordance with ACI 301-99.
   b. All interior cast-in-place concrete flatwork to remain exposed to view shall receive KURE AND HARDEN as manufactured by BASF, The Chemical Company. KURE AND HARDEN shall be applied at the manufacturers recommended rate. Acceptable substitutions include E-CURE concrete curing compound manufactured by SpecChem.
   c. All exterior cast-in-place concrete shall receive “type 2” white pigment curing compound in accordance with ASTM C309-11.
3. No compound used shall inhibit or otherwise affect the application of the finish.

G. Concrete Joint Sealant

1. Joints to be sealed include control joints, construction joints, expansion joints, building isolation joints, bollard isolation joints, and isolation joints around floor cleanouts.
   a. Joint compounds shall be as follows:
      i. THC-901 as manufactured by Tremco, Inc., or Sonolastic SL 2 as manufactured by Sonneborn / ChemRex.
         (a.) All joints in concrete flatwork shall receive, unless otherwise stated, Tremco THC-901 or Sonolastic SL 2 .
         (b.) Exterior concrete expansion joints in concrete walks and at bollards shall receive, unless otherwise stated, Tremflex S/L as manufactured by Tremco, Inc.
   b. All joints in concrete flatwork to receive floor finish in accordance with Division 9 will receive joint filler under Division 9.

H. Backer Systems

1. Horizontal joint backers
   a. Concrete Expansion and Isolation Joints where sealant is and is not specified:
      i. 1/4 inch thick: 1.7 PCF Polyethylene crosslinked closed cell foam with 1/2" deep tear-off strip used with either hot or cold sealants, Dyna

Strip/Foamtastic Expansion Joint Material as manufactured by Symons Corporation.

I. Waterstops

1. Adhesive: Volclay WB-Adhesive
   a. Application Rate: 400 – 600 linear feet per gallon.
2. Waterstop: Expanding Bentonite/Butyl Waterstop-RX 101 as manufactured by Colloid Environment Company (CETCO).
3. Rapid Hydration: Waterstop-RXRH.
4. Polyvinyl Chloride Waterstops:
   a. Polyvinyl Chloride Waterstops shall be 6 inches wide, 3/8 inches thick minimum, ribbed center bulb type and shall comply with U.S. Corps of Engineers Specification CRD-C572. Waterstops shall be continuous. Concrete shall be thoroughly vibrated around the waterstop to avoid honeycombs and to insure complete embedment of the ribbed flanges.

J. Concrete Retaining Wall Weepholes

1. Dimensions: 2” x 2” x length shown on the Drawings
2. Material: Rigid PVC tubing.
3. Manufacturer: VisiPak Extrusion or equivalent.
4. Spacing: 4’- 0” on center. Coordinate locations with masonry coursing and nominal dimensions.
5. Color: Light gray.

K. Dovetail Anchor Inserts

1. Galvanized steel inserts with flexible dovetail furnished under Technical Specification Section 04 05 23.

PART 3 - EXECUTION

3.01 INSPECTION

A. Assure that excavations and formwork are completed, and that ice and excess water are removed.

B. Check that reinforcement is secured in place.

C. Verify that expansion and isolation joint material, anchors and other embedded items are secured in position.

D. Contact design professional and owner for pre-pour inspection of all conditions that the concrete will hide.

3.02 INSTALLATION

A. Preparation:

1. Notify other crafts involved in ample time to permit the installation of their work; cooperate with other trades in setting such work, as required.
2. Thoroughly wet form immediately before placing concrete, where form coatings are not used.
3. Coordinate the installation of joint materials, inserts, weepholes, embeds and bond breakers with placement of forms and reinforcing steel.
4. Provide mechanical equipment for conveying concrete, and runways for wheeled concrete conveying equipment as required.

B. Placing Concrete:

1. Place concrete in compliance with the practices and recommendations of ACI 304.

2. Convey concrete from mixer to final position by method which will prevent separation or loss of material.
3. Maximum amount of concrete free fall shall be four feet so that placement of concrete remains plastic and flows into position.
4. Deposit concrete in continuous operation until panel or section is completed.
5. Place concrete in horizontal layers of 18" maximum thickness.
6. Use air-entrained admixture 6% plus or minus 1% in exterior concrete exposed to weather.
7. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is complete. Checkerboard placement is not permitted. Concrete shall be placed in strips.

C. Joints
1. General: Construct joints true to line with faces perpendicular to surface plane.
2. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by the Architect/Engineer.
3. Contraction Joints in Slabs-on-Grade: Form weakened plane contraction joints, sectioning concrete into locations or areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   a. Sawcut 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 no longer tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
   b. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams and other locations, as indicated.

D. Waterstops
1. General: Components and installation shall be in accordance with manufacturer's printed specifications and recommendations. CETCO: (847) 392-5800.
2. Concrete Walls:
   a. Locate at junction of:
      i. Footings and foundation walls
      ii. Horizontal and vertical construction joints;
      iii. Vertical control joints;
3. Slabs-on-grade:
   a. Locate at the junction of:
      i. Floor slabs and walls;
      ii. Construction joints

E. Finishing
1. Formed Surfaces:
   a. General:
      i. Repairs and patches shall be done with compatible concrete grout.
      ii. Repairs and patches are subject to approval of the Architect/Engineer. Repairs and patches deemed unacceptable by the Architect/Engineer shall be remedied at no cost to the Owner.
   b. Rough-Formed Finish: As-cast concrete texture imparted by form facing material. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
      i. Apply to concrete surfaces not exposed to view.
   c. 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 defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.

i. Apply to concrete surfaces exposed to view.

d. Architectural Rubbed Finish: Apply the following finish to smooth-formed finish concrete scheduled to remain exposed to view:

i. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Unformed Surfaces:

a. 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. Floor Slabs:

a. General:

i. Comply with ACI 302.1R recommendations for spreading, vibrating, screeding, floating, re-straightening, troweling, and other finishing operations for concrete surfaces.

ii. Do not wet concrete surfaces during finishing operations.

b. Floating:

i. First Floating:

(a.) Apply first floating immediately after screeding and before any excess moisture or bleed water is present on the surface.

ii. Second Floating:

(a.) Do not work surface until surface is ready for the second floating. (typically after evaporation of most of the bleed water and the water sheen has disappeared.)

(b.) Compact and consolidate concrete surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Re-straighten, cut down high spots, and fill low spots. Repeat float passes and re-straighten until surface is left with a uniform, smooth, granular texture. Multiple passes shall be made perpendicular to previous passes.

iii. Apply float finish to surfaces to receive trowel finish.

c. Scratch Finish: After the first floating, and while still plastic, texture concrete surface. Use stiff brushes, brooms, or rakes to produce a profile amplitude of ¼ inch in one direction.

i. Apply scratch finish to surfaces to receive concrete floor topping and to receive mortar setting beds for bonded cementitious floor finishes.

d. Trowel Finish: After both first and second floatings, apply first troweling and consolidate concrete surface with power-driven trowel or by hand troweling if area is small or inaccessible to power driven trowels. Power-driven trowels shall not be used on elevated slabs unless specifically allowed in writing by the Architect/Engineer. Continue troweling passes and re-straighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any defects that would telegraph through applied coatings or floor coverings.

i. Apply trowel finish to surfaces to be covered with resilient flooring, carpet, ceramic tile or quarry tile set over a cleavage membrane, paint of another thin-film-finish coating system, and elsewhere as indicated.

ii. Apply trowel finish to all surfaces that have not been indicated

elsewhere.

iii. Flatness and levelness tolerances shall be as follows:

(a.) Finish and measure surface so gap at any point between concrete surface and an unleveled, free-standing, 10-foot long straight edge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

iv. Do not work surface until surface is ready for troweling.

e. Fine Broom Finish: After floating and first troweling, and while still plastic, texture concrete surface. Slightly scarify surface with a fine soft-bristled broom in one direction.

i. Apply fine broom finish to surfaces where ceramic or quarry tile is to be installed by either thick-set or thin-set method and elsewhere as indicated.

ii. Comply with flatness and levelness tolerances for trowel finished floor surfaces.

f. Broom Finish: After floating and first troweling, and while still plastic, texture concrete surface. Scarify surface with a stiff-bristled broom in one direction.

i. Apply broom finish to exterior concrete platforms, stoops, steps, ramps, yard slabs, equipment pads, site concrete, garage floors, and elsewhere as indicated.

F. Hardening:

1. Harden concrete in accordance with manufacturer's recommendations.

G. Curing and Sealing:

a. Keep concrete moist by using curing compounds in accordance with manufacturer's recommendations and moisture cure in accordance with ACI 301.

b. Place concrete joint fillers, backer systems, and waterstops as specified herein and in accordance with manufacturer's recommendations.

H. Testing:

1. All concrete shall be tested in standard 6 x 12 inch cylinders.

2. Frequency of Testing:

a. Make at least one strength test for each 100 cubic yards, or fraction thereof, of each mixture design of concrete placed in any one day. When the total quantity of concrete with a given mixture design is less than 50 cubic yards, the strength tests may be waived by the Architect/Engineer if, in his judgment, adequate evidence of satisfactory strength is provided, such as strength test results for the same kind of concrete supplied on the same day and under comparable conditions to other work.

3.03 PROTECTION OF COMPLETED WORK

A. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading, shock and vibration.

3.04 CLEANING

A. All cleaning shall comply with Technical Specification Section 01 74 00 of this Project Manual.

END OF SECTION

SECTION 03 41 13
PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Floor planks.

B. Connection plates brackets.

C. Grouting plank joint keys.

1.02 RELATED SECTIONS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping and reinforcement.

B. Section 04 22 00 - Masonry load bearing support walls.

C. Section 05 12 00 - Structural Steel: Supporting steel lintels and headers.

1.03 REFERENCES

A. ACI 301 - Specifications for Structural Concrete for Buildings.

B. ACI 318 - Building Code Requirements for Reinforced Concrete.

C. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel.

D. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

E. ASTM A 416/A 416M - Standard Specification for Steel Strand, Uncoated Seven-Wire for Pre-stressed Concrete.

F. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

G. ASTM C 150 - Standard Specification for Portland Cement.

H. AWS B2.1 - Standard for Welding Procedure and Performance Qualification.

I. AWS D1.1 - Structural Welding Code - Steel.

J. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

K. PCI JR-307 - Tolerances for Precast and Pre-stressed Concrete.

L. PCI MNL-116 - Manual for Quality Control for Plants and Production of Precast and Pre-stressed Concrete Products.

M. PCI MNL-120 - Design Handbook - Precast and Pre-stressed Concrete.

N. PCI MNL-123 - Manual on Design of Connections for Precast Pre-stressed Concrete.

O. PCI MNL-124 - PCI Design for Fire Resistance of Precast Pre-stressed Concrete.

P. PCI MNL-126 - Manual For The Design of Hollow Core Slabs.

Q. UL - (Underwriters Laboratories Inc.) Fire Resistance Directory.

1.04 DESIGN REQUIREMENTS

A. Design components to withstand dead loads and live loads in a unrestrained condition:

1. Floor Assembly: see Drawings for live load.

2. Concentrated loads as indicated on Drawings.

B. Maximum Allowable Deflection of Floor Planks: 1/240 cambered to achieve flat surface under dead load.

C. Design components to accommodate construction tolerances, deflection of other building

structural members and clearances of intended openings.

D. Grouted Keys: Capable of transmitting horizontal shear force of 2,000 lb/ft.

1.05 SUBMITTALS FOR REVIEW

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Shop Drawings: Indicate plank layout, unit identification marks, connection details, edge conditions, bearing requirements, support conditions, dimensions, openings, openings intended to be field cut, and relationship to adjacent materials.

C. Product Data: Indicate standard component configuration, design loads, deflections, and cambers.

D. Submit final component design calculations and drawings as required by local, state, and federal rules and regulations applicable to work and project location. Minimum of five (5) copies shall be submitted.

E. Submit fees for local and state review. Local and state acceptance of component design is mandatory prior to fabricating components. Submittal shall include required forms, fees, calculations, registered stamps, and signatures.

1.06 SUBMITTALS FOR INFORMATION

A. Section 01 33 00 - Submittals: Procedures for submittals.

B. Design Data: Indicate calculations for loadings and stresses of planks, pre-stressing; signed and sealed by design engineer.

C. Fabricator's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.07 QUALITY ASSURANCE

A. Design planks in accordance with the requirements of:

1. PCI MNL-120 - Design Handbook.
2. PCI MNL-126 - Manual for the Design of Hollow Core Slabs.
3. PCI MNL-124 - Design for Fire Resistance of Precast Pre-stressed Concrete.
4. ACI 318.
5. ACI 301.

B. Design connections in accordance with PCI MNL-123 - Manual on Design of Connections for Precast Pre-stressed Concrete.

C. Design planks under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State of Wisconsin.

D. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

E. Maintain 3 copies of each referenced document applicable to design or fabrication on site.

F. Fabricator Qualifications: Company specializing in manufacturing the work of this section with 3 years experience.

G. Erector Qualifications: Company specializing in erecting the work of this Section 3 years experience approved by fabricator.

H. Welder Qualifications: Qualified within previous 12 months in accordance with AWS B2.1.

1.08 PRE-INSTALLATION MEETING

A. Convene 1 week before starting work of this Section.

B. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Material and Equipment: Transport, handle, store, and protect products.

B. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

C. Mark each member with date of production and final position in structure.

1.10 PROJECT CONDITIONS

A. Section 01 31 19 – Project Meetings.

B. Coordinate with framing components directly associated with the Work of this Section.

C. Coordinate field cut openings with affected section.

D. Coordinate location of hanger tabs and devices for mechanical and electrical work.

PART 2 - PRODUCTS

2.01 FABRICATORS

A. Mid-States Concrete

B. Spancrete

C. J.W. Peters, Inc.

D. Substitutions: Material and Equipment not permitted.

2.02 MATERIALS

A. Concrete Materials: ACI 301.

B. Tensioning Steel Tendons: ASTM A 416/A 418M, Grade 270, of diameter appropriate to member design.

C. Reinforcing Steel: ASTM A 615/A 615M, deformed steel bars.

D. Non-Shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi at 28 days.

E. Cement Grout: Minimum compressive strength of 3,000 psi at 28 days.

2.03 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts: ASTM A 36/A 36M, carbon steel; prime painted.

B. Bearing Pads: High density plastic, 1/8 inch thick, smooth on one side.

C. Sill Seal: Compressible glass fiber strips.

2.04 FABRICATION

A. Planks: Plant cast, pre-stressed, hollow core.

B. Dimensions as indicated on Drawings.

C. Weld reinforcing in accordance with AWS D1.4.

D. Embed anchors, inserts, plates, angles, and other items at locations indicated.

E. Provide openings required by other Sections, at locations indicated.

F. Cut exposed ends flush.

G. Plant Finish: Finish members to PCI MNL-116 Commercial Standard Grade.

H. Connecting and Supporting Steel Devices: Do not paint surfaces in contact with concrete or

surfaces requiring field welding.

2.05 FABRICATION TOLERANCES

A. Conform to PCI MNL-116 and PCI JR-307 - Tolerances for Precast and Pre-stressed Concrete.

2.06 SOURCE QUALITY CONTROL AND TESTS

A. See Section 01 45 00 for general requirements for testing and inspection.

B. See Section 03 30 00 for testing of concrete and grout materials and mix designs.

C. Inspect and test stressing tendons before delivery for compliance with specified standards.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as indicated on Drawings.

B. Verify supporting structure is ready to receive work.

3.02 PREPARATION

A. Prepare support devices for the erection procedure and temporary bracing.

3.03 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Align and maintain uniform horizontal and end joints, as erection progresses.

C. Maintain temporary bracing in place until final connections are made. Protect members from staining.

D. Install bearing pads and sill seal at bearing ends of planks as indicated.

E. Adjust differential camber between precast members to tolerance before final attachment and grouting.

F. Adjust differential elevation between precast members to tolerance before final attachment.

G. Secure units in place. Perform welding in accordance with AWS D1.1.

H. Tape seal underside of Install sealant backer rod in plank joints to prevent grout leakage.

I. Grout longitudinal keys as indicated.

J. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

3.04 ERECTION TOLERANCES

A. Erect members level and plumb within allowable tolerances. Conform to PCI MNL-116.

3.05 PROTECTION OF FINISHED WORK

A. Section 01 77 00 - Contract Closeout: Protecting installed work.

B. Protect members from damage caused by field welding or erection operations.

C. Provide non-combustible shields during welding operations.

3.06 CLEANING

A. Clean weld marks, dirt, and blemishes from surface of exposed members.

END OF SECTION

SECTION 03 60 00
GROUT

PART 1 - GENERAL

1.01 RELATED WORK ELSEWHERE

A. Division 3 Section 03 30 00 – Cast-In-Place Concrete

B. Division 5 Section 05 12 00 – Structural Steel

C. Division 5 Section 05 50 00 – Metal Fabrications

1.02 DELIVERY AND STORAGE

A. Prevent damage to or contamination of non-shrink grouting materials during delivery, handling and storage.

B. Store all non-shrink grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-Shrink Grout: “Construction Grout” as manufactured by BASF, “Set Grout” as manufactured by BASF, or “CG-86 Construction-Grade Grout” as manufactured by W. R. Meadows, Inc., and conforming to the following requirements:

1. Manufactured under rigid quality control specifically for grout used in transferring heavy loads.
2. Containing non-metallic aggregates especially graded to minimize bleeding.
3. Having an initial setting time of approximately one hour at 70° F.
4. Producing no settlement or drying shrinkage at 3 days or thereafter.
5. Having higher strength at all ages than plain cement grout of the same flowability.
6. Resisting attack by oil and water and having lower absorption than plain cement grout of the same flowability.

B. Portland cement: ASTM C 150, Type I.

C. Sand: ASTM C 33; Fine Aggregate.

D. Water: Potable.

E. Pea Gravel: ASTM C 33. Coarse aggregate, graded so that at least 90% passes 3/8" sieve and 90% is retained by a No. 4 sieve.

2.02 MIXES

A. For less than 2" clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of grout material and water.

B. For greater than 2" clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.

C. Use the minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.

D. Portland cement mortar for raked-out edges of non-shrink grout: 1 part portland cement, 2 parts sand and 0.50 parts water by weight.

PART 3 - EXECUTION

3.01 MIXING

A. Mix non-shrink grouting materials and water in a mechanical mixer for no less than 3 minutes.

B. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.

C. After the grout has been mixed, do not add more water for any reason.

3.02 PERFORMANCE

A. Installation methods and procedures shall be approved by the Architect/Engineer before work is begun.

B. Build leak-proof forms that are strong and securely anchored and shored to withstand grout pressures.

C. Provide enough clearance between the formwork and the area to be grouted to permit proper placement of grout.

D. Remove all defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.

E. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout.

F. Cover concrete areas with waterproof membrane until ready to grout.

G. Remove foreign materials from all steel surfaces in contact with grout.

H. Align, level and maintain final positioning of all components to be grouted.

I. Take special precautions during extreme weather conditions according to the manufacturer's written instructions.

J. Immediately before grouting, remove waterproof membranes and clean any contaminated surfaces.

K. Saturate all concrete surfaces with clean water; remove excess water and leave none standing.

L. Place non-shrink grouting material quickly and continuously by the most practical means permissible: pouring, pumping or under gravity pressure.

M. Do not use either pneumatic-pressure or dry packing methods without written permission of the Architect/Engineer.

N. Apply grout from one side only to avoid entrapping air.

O. Final installation shall be thoroughly compacted and free from air pockets.

P. Do not vibrate the placed grout mixture, or allow it to be placed if the area is being vibrated by nearby equipment.

Q. Do not remove leveling shims for at least 48 hours after grout has been placed.

R. After shims have been removed, fill voids with plain cement-sand grout.

S. After the non-shrink grout has reached initial set, rake out all exposed edges approximately 1" into the grouted area and point with portland cement mortar.

T. Cure grout for 3 days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION

SECTION 04 05 13
MASONRY MORTAR

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all items necessary and perform all work required to install the masonry mortar work indicated by the Contract Documents.

1.02 RELATED SECTIONS

A. Application of mortar used in the installation of masonry units is specified in each respective Section of masonry materials and is not included in the work required for this Section.

1.03 REFERENCE

A. American Society for Testing and Materials (ASTM).
   1. ASTM C 144: Standard Specification for Aggregate for Masonry Mortar
   2. ASTM C 150: Standard Specification for Portland Cement
   3. ASTM C 207: Standard Specification for Hydrated Lime for Masonry Purposes.
   4. ASTM C 270: Standard Specification for Mortar for Unit Masonry
   5. ASTM C 404: Standard Specification for Aggregates for Masonry Grout.
   6. ASTM C 476: Standard Specification for Grout for Masonry.

1.04 QUALITY ASSURANCE

A. Mortar supplied shall be from a portland cement/lime pre-mixed bag. The content of lime shall be clearly stated on every bag. Bags that do not contain the words: "Portland - Lime", shall be rejected.

B. Interior Mortar: Non-colored

C. Exterior Mortar: Colored

1.05 SUBMITTALS

A. Submit product data on all mortars, colors, and admixtures.

B. Submit certification that mortar and grout material meet ASTM standards.

C. Submit certification that mortar and grout material contain specified water repellent admixture.

D. Submit water repellent admixture manufacturer's literature.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site dry and in unbroken containers. Store materials above ground in waterproof shelters.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Pre-mixed (non-colored and colored) Blend: As manufactured by Dri-Mix Concrete Co., Glen-Gery Corp., Medusa Cement Co., Tamms Industries Co., Twin City Concrete Products Co., or The Western Lime and Cement Co. Equivalent products of other manufacturers may be acceptable if approved as equal by Architect/Engineer.

2.02 MATERIALS

A. Pre-Mixed Blend: Portland cement/lime pre-mixed mortar complying with this Specification. Masonry cement pre-mixed mortar is not acceptable.

1. Portland Cement: ASTM C 150, Type 1, Portland Cement
2. Lime: ASTM C 207, Type S, Hydrated Lime

B. Pre-Mixed Colored Blend: Portland cement/lime pre-mixed colored mortar complying with this Specification. Masonry cement pre-mixed colored mortar is not acceptable.
1. Portland Cement: ASTM C 150, type 1, Portland Cement
2. Lime: ASTM C 207, Type S, Hydrated Lime
3. Mortar Color: Finely ground mineral pigment of high purity, non-fading, lime-proof, not detrimental to mortar, color as selected from standard colors by the Architect/Engineer.

C. Fine Aggregate: ASTM C 144

D. Coarse Aggregate: ASTM C 404, Size No. 8

E. Water: Clean and potable

F. Mortar Admixture: High strength, high bond, weather resistant, abrasion resistant additive to mortar, when directed or indicated on the Drawings, "Laticrete 8510" as manufactured by Laticrete International, Inc.; “Dry-Block Mortar Admixture” as manufactured by Grace Construction Products, Masonry Division; “Mortar Tite” as manufactured by Addiment, Inc.; or other products approved by Architect/Engineer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer's published instructions and requirements. Install materials with uniform appearance and in proper relation with adjacent construction.

B. See specific Section of masonry materials for Installation instructions.

3.02 PROPORTIONS AND MIXING

A. Meet requirements of ASTM C 270 and proportion mortar types as specified.

B. Meet requirements of ASTM C 476 for masonry grout and proportion grout types as specified.

C. Proportion material accurately and mix thoroughly by machine to a uniform consistency and color. Mix mortars with the maximum amount of water consistent with workability.

D. For facing work, add mortar color, as selected when indicated on the Drawings and white cement to product mortar as established by sample.

E. When additional bonding is required between mortar and masonry so as to produce a high strength, high bond, weather resistant or abrasion resistant joint, add an admixture to mortar. Use admixture in conditions of sill rowlocks, top of wall, or exposed scope area surfaces; anywhere water might collect and set atop masonry work. Admixture powder shall be thoroughly mixed with dry mortar and aggregate before adding the gauging water.

F. Do not use mortar that has begun to set. Re-temper mortar by adding water if mortar begins to stiffen from evaporation or absorption of a part of the mixing water. Use and place mortar in final position within 2-1/2 hours after mixing.

G. Mortar appearance shall be consistent color and texture upon curing.

3.03 MORTAR SCHEDULE

A. Exterior Masonry Walls
1. Mortar: Type S, ASTM C 270, 1,800 PSI minimum, cement-lime
2. Proportions: Portland Cement - one part; Lime - 1/4 to 1/2 parts; and Aggregate - 2-1/4 to 3 parts

3. Water-repellent Admixture: One pound per cubic foot of cementitious materials, when requested.
4. Mortar Color: As required to produce mortar established by the samples.

B. Interior Masonry Partitions
1. Mortar, Type N, ASTM C 270, 750 PSI minimum, cement-lime
2. Proportions: Portland Cement - one part; Lime - 1/2 to 1-1/4 parts; and Aggregate - 2-1/4 to 3 parts

C. Exterior Reinforced Load Bearing Masonry Walls
1. Mortar: Type M, ASTM C 270, 2500 PSI minimum, cement-lime
2. Proportions: Portland Cement - one part; Lime - 1/4 part; and Aggregate - 2-1/4 to 3 parts
3. Water-repellent Admixture: One pound per cubic foot of cementitious materials, when requested.
4. Mortar Color: As required to produce mortar as established by samples.

D. Interior Reinforced Load Bearing Masonry Partitions.
1. Mortar: Type M, ASTM C 270, 2500 PSI minimum, cement-lime.
2. Proportions: Portland Cement - one part; Lime - 1/4 part; and Aggregate - 2-1/4 to 3 parts

END OF SECTION

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SECTION 04 05 16
MASONRY GROUT

PART 1 - GENERAL

1.01 RELATED WORK DESCRIBED ELSEWHERE

A. Division 4 Section 04 05 23 – Masonry Accessories

B. Division 4 Section 04 22 00 – Concrete Masonry Units

C. Division 8 Section 08 11 19 – Steel Doors and Frames

D. Division 9 Section 09 29 00 – Gypsum Board

1.02 MATERIAL FURNISHED UNDER THIS SECTION AND INSTALLED UNDER OTHER SECTIONS

A. Provide to the Contractor under Section 04 22 00 all the masonry grout necessary to fill hollow metal door and window frames in masonry wall construction.

B. Provide to the Contractor under Section 09 29 00 all the masonry grout necessary to fill hollow metal door and window frames to be installed in metal stud wall construction.

1.03 QUALITY ASSURANCE

A. Codes and Standards:

1. All work shall conform to the requirements of the State of Wisconsin Building Code.
2. All work shall conform to the requirements of the following codes and standards.

B. American Society for Testing and Materials (ASTM):

1. ASTM C 476: Standard Specification for Grout for Masonry.
2. Other ASTM Specifications as referenced in this Section.
3. Where provisions of pertinent regulations, codes, and standards conflict with this Specification, the more stringent provisions shall govern.
4. ACI 530.1- Specifications for Masonry Structures.

1.04 PRODUCT HANDLING

A. Store all cementitious ingredients in weather-tight enclosures and protect against contamination and warehouse set.

B. Stockpile and handle aggregates to prevent contamination from foreign materials.

C. Keep water free of harmful materials.

PART 2 - PRODUCTS

2.01 PORTLAND CEMENT

A. ASTM C 150, Type I or II

2.02 HYDRATED LIME

A. ASTM C 207, Type S

2.03 AGGREGATES

A. ASTM C404.

2.04 WATER

A. Water shall be clean and free of deleterious amounts of acids, alkalies, or organic materials.

2.05 ADMIXTURES **Admixtures shall not be added to the grout.**

2.06 ANTI-FREEZE

A. Anti-freeze compounds shall not be added to the grout.

PART 3 - EXECUTION

3.01 GROUT PROPORTIONS (By volume)

A. Minimum strength of grout shall be 3000 PSI.

B. Table

Type	Portland Cement	Hydrated Lime	Aggregates	
			Fine	Coarse
Fine	1	1/10	2-1/4 to 3 times the volumes of the cementitious materials	
Coarse	1	1/10	2-1/4 to 3 times the volumes of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials.

3.02 MEASUREMENT

A. Measure materials by volume or equivalent weight.

B. Do not measure by shovel.

3.03 MIXING

A. General:
   1. Mix materials in a mechanical batcher.

B. Water:
   1. Use the minimum amount of water to produce a workable consistency.

C. Cold Weather Requirements:
   1. Heat water and aggregates to assure grout temperatures between 40 degrees F and 120 degrees F until placed.
   2. Do not heat water or aggregates above 120 degrees F.

D. Timing:
   1. Do not grout until masonry mortar has cured at least 24 hours.

E. Placing:
   1. Convey the masonry grout from the mixer to the place of final deposit by methods that will prevent segregation of materials.
   2. Place the masonry grout in such a manner that it remains plastic and readily flows between and around obstructions.
   3. Consolidate masonry grout with a mechanical vibrator.

F. Cleaning:
   1. Immediately upon completion of a masonry grouting operation, clean up all spills and droppings of masonry grout from any exposed surface.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Described Elsewhere:
   1. Division 4 Section 04 05 13 – Mortar
   2. Division 4 Section 04 21 00 – Brick Masonry
   3. Division 4 Section 04 22 00 – Concrete Masonry Units

1.02 QUALITY ASSURANCE

A. Acceptable Manufacturers:
   1. Dur-0-Wal Products
   2. Heckmann Building Products, Inc,
   3. Hohmann & Barnard, Inc.
   4. WIRE-BOND, Masonry Reinforcing Corporation of America

B. Codes and Standards:
   1. All work shall conform to the requirements of the State of Wisconsin Building Code.
      a. All work shall conform to the requirements of the following codes and standards:
      b. American Society for Testing and Materials (ASTM) Specifications as referenced in this Section.
      c. Where provisions of pertinent regulations, codes and standards conflict with this Specification, the more stringent provisions shall govern.

1.03 PRODUCT HANDLING

A. Deliver and store in manufacturer's original containers.

B. Store above ground on skids, and protect from the elements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Wire: ASTM A 82.

B. Steel Sheet: ASTM A 1008/A 1008M or ASTM A 1011/A 1011M.

C. Galvanized Finish: ASTM A 153/A 153M, Grade B-1 or B-2.

D. Neoprene: ASTM D 2000, 2AA-805, 80 durometer hardness.

E. PVC: ASTM D 2287, Type PVC 6534-4, 80 durometer hardness.

F. Steel Reinforcing Bar: ASTM A 615/A 615M.

2.02 MASONRY WALL REINFORCING

A. W1.7 (9 Gauge) Side & Cross Rods

B. Truss Configuration

C. Welded Construction

D. Galvanized Finish

2.03 ANCHORING DEVICES

A. Wire: 3/16" diameter minimum – hot-dip galvanized

B. Sheet: 16 gage minimum

C. Galvanized Finish

D. General:

1. Cavity Walls with Masonry Backup:

a. Truss Type Steel Joint Reinforcement with Ties:

b. 9 gauge longitudinal wires welded not more than 16 inches center to center to 9 gauge cross wires. Eye lengths shall be designed to span cavity widths. Hot-dipped galvanized Series 500, Model Cavity, Adjustable Tab, by WIRE-BOND, or equal.

2. Cavity Walls with Stud Backup:

a. 16 gauge x 6" Hohmann and Barnard DW-10X. Screw to studs with cadmium-plated coated screws.

3. Cavity Walls with Cast-in-Place Backup:

a. 22 gauge x 1" x 1" galvanized steel inserts with flexible dovetail brick tie, Hohmann & Barnard model no. 315 or equal.

2.04 MASONRY FLASHING SYSTEMS

A. Design based on the use of products of Hohmann & Barnard, Inc.

1. EPRA-MAX EPDM Self-Sealing 40 mil. cross-laminated polyethylene/rubberized asphalt flashing.

2. Stainless Steel Drip Plate.

3. # T-1 Stainless Steel Termination Bar.

2.05 BRICK MASONRY VENTS

A. Flexible polyvinyl chloride

B. 'T' shape

C. One vent for every 32 inches of flashing and 32 inches center to center at top of walls and at the head of windows.

D. Vent shall fill full head joint of brick masonry.

2.06 CONCRETE MASONRY UNIT VENTS

A. Clear medium density polyethylene tube, 3/8" o.d. x 4" long.

B. Acceptable Manufacturer: Hohmann & Barnard, Inc.

C. One vent for every 32 inches of flashing and 32 inches center to center at top of walls and at the sills of windows.

2.07 MASONRY MORTAR NET

A. Mortar-Net as manufactured by Hohmann and Barnard, Inc.

1. Sizes per drawings to be placed at all base and window head conditions where masonry weeps are present.

2.08 STEEL REINFORCING BAR

A. Sizes as per Drawings.

2.09 CONTROL JOINTS

A. Pre-molded neoprene or PVC type

2.10 BOND BREAKER STRIP

A. 15 lb. asphalt felt

2.11 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and subject to approval of the Architect.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Masonry Wall Reinforcing:
   1. Required for all unit masonry construction.
   2. Place to assure a 5/8" mortar coverage on exterior face.
   3. Side rods shall lap 6" at splices.
   4. Reinforcement shall be continuous except shall not pass through control joints.
   5. Place in every second block course unless otherwise noted on Drawings.

B. Control and Expansion Joints:
   1. Provide vertical expansion, control and isolation joints in masonry where shown on Drawings.
   2. Rake out mortar in preparation for application of caulking and sealants.

C. Anchoring Devices:
   1. Build in required anchoring and related items as the masonry work progresses.

D. Bond Breaker Strip:
   1. Install bond breaker strip as shown on Drawings.

E. Masonry Vents
   1. Keep masonry vents free of mortar droppings.
   2. Install in masonry head joints.
   3. Install perpendicular and parallel to the plane of the masonry unit and wall.

END OF SECTION

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SECTION 04 22 00
CONCRETE MASONRY UNITS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Described Elsewhere:
   1. Division 4 Section 04 05 13 – Mortar
   2. Division 4 Section 04 05 23 – Masonry Accessories

1.02 MATERIAL INSTALLED BUT FURNISHED UNDER OTHER SECTIONS

A. Hollow metal door and window frames to be installed in concrete masonry and precast concrete walls.

B. Non-shrink grout to be installed in hollow metal door and window frames and to be installed in masonry walls.

C. Flashing.

D. Masonry insulation.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. All work shall conform to the requirements of the State of Wisconsin Building Code.
   2. All work shall conform to the requirements of the following codes and standards:
      a. American Society for Testing and Materials (ASTM) specifications as referenced in this Section.
   3. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent shall govern.
   4. ACI 530.1: Specifications for Masonry Structures.
   5. Minimum Compressive Strength of Concrete Masonry: f'm = 1500 PSI.

1.04 PRODUCT HANDLING

A. Protection:
   1. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacement:
   1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

C. Storage:
   1. Store masonry units above ground on level platforms which allow air circulation under stacked units.
   2. Cover and protect against wetting prior to use.
   3. Reinforcing and anchors shall be protected from contact with soil.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire Resistance Ratings:
   1. Masonry units used in fire rated assemblies, as shown on the Drawings, must be manufactured to endure the fire test made in conformance with ASTM E 119: "Standard Test Methods for Fire Tests of Building Construction and Materials"

2.02 HOLLOW AND SOLID LOAD-BEARING UNITS

A. ASTM C 90, Class 3 normal weight units. Lightweight units are to be used in fire rated wall locations.

B. Aggregates: ASTM C 331, Aggregate type: Section 3.1.2 - Aggregates prepared by processing natural materials, such as pumice, scoria, or tuff.

C. Nominal face dimensions: 8" x 16".

2.03 ARCHITECTURAL BLOCKS

A. Colored Split-Face Architectural Concrete Units:

1. Architectural masonry with texture, finishes and colors equivalent to Colored Split-Face Masonry Units, Standard, as manufactured by Lakes Brick and Block, County Materials or equal. Final color selection by the Architect. Samples of the masonry and colors available shall be submitted to the Architect for his review. ASTM C 67, with respect to freezing and thawing. Units shall as comply with the following:
   a. ASTM C 55, Type II.
   b. Grade N: Exterior use above or below grade.
   c. Nominal Face Dimension: 8" x 16"
   d. Provide stretchers, corners, caps, cap ends, bullnoses, and bond beams as required for a complete and proper installation.
   e. Colored split-face units shall be single sourced.
   f. Color: Design based on County Materials Corporation color #252 – Tanned Leather.

2.04 WATER REPELLANT ADMIXTURE

A. Water repellant admixture shall be fabricated within the masonry.

B. Acceptable Products and Manufacturers:

1. DRY-BLOCK Integral Water-Repellant Admixture for Block as manufactured by W.R. Grace Company, Grace Construction Products, Masonry Division, or approved equal.

C. Technical Data:

1. Achieves Class E, ASTM E 154 wind-driven rain resistance test (5" per hour rain and 62.5 MPH wind). Increase in flexural bond strength (ASTM E 72). Exceed standard units according to ASTM C 140 for both normal and lightweight units. Water vapor transmission reduced when tested in conformity with ASTM E 96. ASTM E 514 for wind-driven rain resistance, ASTM E 72 for bond strength to mortar and ASTM E 96 for reducing water vapor transmission.

PART 3 - EXECUTION

3.01 GENERAL

A. Materials:

1. Concrete masonry units shall be dry when laid.
2. Reinforcement to be placed shall be free of loose rust, ice, soil, or other detrimental coatings.
3. All masonry units exposed to view, top blocks, end blocks, corner blocks, sills, jambs and headers shall be constructed of units 100% solid. No masonry units exposed to view shall display interior or end cores.

B. Cutting:

1. All masonry cutting shall be done with motor driven masonry saws.

C. Protection:

1. When rain or snow is imminent and work is discontinued, the tops of exposed masonry walls shall be covered with a well secured, non-staining, waterproof cover.
2. Adequate precautions shall be taken to prevent damage to the walls during erection by high winds or other causes.
3. Where necessary, foundation walls shall be temporarily braced to prevent damage from backfilling operations.

D. Pattern:
1. Lay all masonry in running bond unless otherwise noted.

E. Joining Masonry:
1. Stop off horizontal runs of masonry by racking back 1/2 length of unit in each course.
2. Toothing is not permitted except upon written acceptance of the Architect.
3. Joining fresh masonry to set masonry:
    a. Remove loose masonry and mortar
    b. Clean bonding surfaces before placing new work

F. Placing Masonry:
1. Adjust each unit to final position while mortar is still soft and plastic.
2. Mortar coverage:
    a. Hollow units:
        i. Hollow units shall be laid with full mortar coverage on horizontal and vertical face shells, except that webs shall also be bedded in all courses of piers, columns, and pilasters, and in the starting course on solid foundation walls, thicken floors, and where adjacent to cells or cavities to be reinforced and/or filled with grout or concrete.
    b. Solid units:
        i. Solid units shall be laid with full head and bed joints.
3. Any unit disturbed after mortar has stiffened shall be removed and re-laid with fresh mortar.
4. Vertical cells to be filled with grout shall be aligned to provide a continuous unobstructed opening.
5. Mortar joint thickness shall be a nominal 3/8" to provide overall modular unit dimensions.
6. Fill all cores of concrete masonry units in fire rated and exterior wall construction solid with perlite insulation.

G. Tooling and Tuck Pointing:
1. Tooling:
    a. Tool exposed joints when "thumb-print" hard with a round jointer, slightly larger than width of joint.
    b. Trowel-point or concave-tool exterior joints below grade.
    c. Flush cut all joints not tooled.
    d. Mortar joints in surfaces to be parged or covered with other masonry or hard tile should be cut flush.
    e. Mortar joints in walls made with scored masonry units shall be tooled to duplicate the scored effect.
2. Tuck Pointing:
    a. Rake mortar joints to a depth of not less than 1/2 in. no more than 3/4 in.
    b. Fill solidly with Type "S" pointing mortar.
    c. Tool joints.

H. Built-In Items:

1. Bolts, anchors, steel reinforcing, steel joint reinforcing, metal fabricated door frames, lintels, and other accessories shall be installed as the masonry work progresses.
2. Chases shall be built-in and not cut-in.

I. Tolerances:
1. Variation from the Plumb:
a. In the lines and surfaces of columns, walls and arises: in 10 feet - ¼ inch; in any story or 20 feet maximum -3/8 inch; in 40 feet or more - ½ inch.
b. For external corners, control joints and other conspicuous lines: in any story or 20 feet maximum - ¼ inch; in 40 feet or more - ½ inch.
2. Variation from the Level or the Grades Indicated on the Drawings: in 20 feet - ½ inch; in 40 feet - ¾ inch.
3. Variation of the Linear Building Lines from Established Position in Plan and Related Portion of Columns, Walls and Partitions: in 20 feet – ½ inch; in 40 feet – ¾ inch.
4. Variation in Cross-Sectional Dimensions of Columns and in the Thickness of Walls: Minus ¼ inch; plus ½ inch.

3.02 REINFORCEMENT

A. Reinforcement shall be factory-fabricated sections as defined in Specification Section 04 05 23 "Masonry Accessories."

B. Reinforcement shall be continuous except at control joints or expansion joints.

C. Reinforcement splices shall be lapped 6 inches or more.

3.03 BONDING AND ANCHORING

A. Corners:
1. Bond corners by lapping alternate courses of the corner walls.

B. Intersecting Walls:
1. Bond intersecting walls by laying 1/2 of the units in masonry bond or by providing horizontal rigid steel anchors 16" on center vertically.

C. Masonry Walls Adjoining Structural Steel:
1. Anchor masonry walls to structural steel by keying masonry to steel or by providing flexible metal anchors 16" on center vertically or 32 " horizontally as required.

3.04 CLEANING

A. All masonry shall be cleaned with soap powder or other mild solutions, stiff brushes, and clear water. For new construction, this should not be attempted until 48 hours after the first masonry unit has been laid.
1. If stiff brushes, soap and water are not sufficient, the surface should be wetted with clear water, then scrubbed with a solution of muriatic acid no stronger than 1 part acid to 9 parts water, followed immediately by a thorough rinsing with clear water working from the top down. This shall not be attempted until seven days after the first masonry unit has been laid.

B. Cut out any defective joints and holes in exposed masonry and re-point.

C. Protect all metal lintels and fabrications, and other corrodible parts when masonry is cleaned with acid solution.

D. Leave work area and surrounding surfaces clean and free of mortar spots, droppings, and broken masonry.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere:
   1. Division 3 Section 03 41 13 – Precast Concrete Hollow Core Planks
   2. Division 6 Section 06 10 00 – Rough Carpentry

1.02 WORK FURNISHED BUT NOT INSTALLED

A. Anchor bolts, angles and plates.

B. Columns, beams, loose lintels, shelf angles, and plate steel.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
   2. All work shall conform to the requirements of the following codes and standards:
      a. American Institute of Steel Construction (AISC)
         i. "Load and Resistance Factor Design Specification for Structural Steel Buildings", December 27, 1999 with September 4, 2001 Errata.
         ii. "Code of Standard Practice For Steel Buildings and Bridges", March 7, 2000.
         iii. "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts", June 23, 2000.
      b. American Society for Testing and Materials (ASTM), Specifications as referenced in this Section.
      c. American Welding Society (AWS) D1.1 "Structural Welding Code".
   3. Where provisions of pertinent codes and standards conflict with this Specification, the more stringent provisions shall govern.

B. Design Requirements:
   1. Connections shall be designed in accordance with these Specifications by the fabricator to support all applied loads, with the design approved or certified by a Structural Engineer.
   2. Connections not shown on the Drawings shall be selected or completed by the fabricator to withstand design loadings indicated. The fabricator shall utilize a qualified Structural Engineer to prepare calculations, shop drawings, and other structural data for steel connections.

C. Professional Engineer Qualifications: A Professional Engineer who is legally authorized to practice in the jurisdiction where the Project is located and who is experienced in providing engineering services to the kind indicated that have resulted in installing steel connections similar to those indicated for this Project and with a record of successful in-service performance.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Within 15 days after Award of Contract, and before any of the materials of this Section are delivered to the Project site, submit complete shop drawings to the Architect/Engineer in accordance with the provisions of Section 01 33 00 of these

Specifications; show erection plans, connection details including location, type and size of all bolts and welds. Weld symbols shall conform to AWS A2.4-86 "Symbols for Welding and Nondestructive Testing."

B. Product data or manufacturer's specifications and installation instructions for following products. Include laboratory test reports and other data to show compliance with these Specifications (including specified standards).

1. Structural steel (each type) including certified copies of mill reports covering chemical and physical properties.
2. High strength bolts (each type), including nuts and washers.
    a. Indicate Direct Tension Indicators if used.
3. Structural steel primer paint.

C. Welder's Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Submit final connection design calculations and drawings as required by local, state, and federal rules and regulations applicable to Work and Project location. Minimum of five (5) copies shall be submitted.

1.05 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacement:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

C. Delivery:

1. Anchor bolts and other anchorage devices which are embedded in cast-in-place concrete, or masonry construction shall be delivered to the Project site in time to be installed before the start of cast-in-place concrete operations or masonry work.

D. Storage:

1. Structural steel shall be stored off the ground and kept free of dirt and other foreign matter.
2. Other materials shall be stored in a weather-tight and dry place until ready for use in the Work.

E. Submittals

1. Submit in accordance with Section 01 33 00.
    a. Steel shop drawings.
    b. Grout data and instruction sheet.
    c. Product data.
    d. Welder's Certificates.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel:

1. ASTM A 36/A 36M: Standard Specification for Carbon Structural Steel; minimum Fy = 36 or Fy = 50 as specified on Drawings.
    a. ASTM A 992/A 992M: Standard Specification for Structural Steel Shapes; Grade 50 Structural Steel

2. ASTM A 53/A 53M: Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; Grade B.
3. ASTM A 500: Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
4. ASTM A 501: Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
5. ASTM A 506: Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled; Grade D or E,
6. Shear Stud Connectors: ASTM A 354, or Threaded Rods: ASTM A 307.

B. Fasteners:
1. Bolts:
a. ASTM A 325: Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 KSI Minimum Tensile Strength
b. ASTM A 307: Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

C. Grout:
1. Grout shall comply with Technical Specification Section 03 60 00.

2.02 FINISHES

A. General:
1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
2. Finish metal fabrications after shop assembly.

B. Shop Finish
1. Surface Preparation:
a. SSPC-SP1: The Society for Protective Coatings “Surface Preparation Specification No. 1 – Solvent Cleaning”, September 1, 2000 Edition and SSPC-SP2: “Surface Preparation Specification No. 6 – Commercial Blast Cleaning”, September 1, 2000 Edition.
2. Primer:
a. Fast curing, universal modified alkyd, rust-inhibiting shop coat with good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Primer shall comply with all federal standards for VOC, lead, and chromate levels. Color shall be gray.
b. Shop prime immediately after surface preparation, applying according to manufacturer’s instructions to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surface.
3. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
a. ASTM A 153/A 153M for galvanizing hardware.
b. ASTM A 123/A 123M for galvanizing both fabricated and un-fabricated products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

C. Touch-Up Painting
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and

repair-painting galvanized steel, with dry film containing not less than 90 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

D. Finish Painting

1. Finish painting shall be performed under Division 9 Section – Paints and Coatings.

2.03 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and subject to approval of the Architect.

PART 3 - EXECUTION

3.01 TOLERANCES

A. Rolling, fabricating and erection tolerances shall conform to the requirements of AISC "Code of Standard Practice for Steel Buildings and Bridges", except for architecturally exposed steel which shall conform to the AISC "Specification for Architecturally Exposed Structural Steel."

3.02 FABRICATION

A. General:

1. Fabricate all structural steel in accordance with the State of Wisconsin Building Code and the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings and Code of Standard Practice for Steel Buildings and Bridges.

B. Shop Painting:

1. Shop paint all steelwork, except contact surfaces which are to be welded, high strength bolted with friction type connections or in contact with concrete.

3.03 ERECTION

A. General:

1. Erect all structural steel in accordance with the State of Wisconsin Building Code and the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings and Code of Standard Practice.

B. Surface Conditions:

1. Inspection:
   a. Prior to work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
   b. Verify that all structural steel may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.
2. Discrepancies:
   a. In the event of discrepancy, immediately notify the Architect/Engineer.
   b. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

C. Column Bases, And Bearing Plates:

1. Column bases and bearing plates for beams and similar structural members shall be aligned with anchor bolts and grouted with non-shrink grout in accordance with Technical Specification Section 03 60 00.

D. Gas Cutting:

1. Field correcting of fabrication by gas cutting shall not be permitted on any major member in the structural framing without prior approval of the Architect/Engineer.

E. Field Touch-Up Painting:

1. After the erection of structural steel, touch-up paint field bolt heads, nuts, field welds and abrasions in the shop paint coating with the same paint used for the shop painting.

F. Install and maintain temporary support and shoring.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following metal fabrications:

1. Rough hardware.
2. Loose bearing and leveling plates.
3. Loose steel lintels.
4. Shelf and relieving angles.
5. Steel Bollards
6. Miscellaneous framing and supports for the following:
    a. Overhead doors.
    b. Applications where framing and supports are not specified in other Sections.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 5 Section 05 12 00 – "Structural Steel" for structural steel framing system components.
2. Division 5 Section 05 51 00– "Metal Stairs" for metal framed stairs with metal pan treads.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Shop drawings detailing fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide templates for anchors and bolts specified for installation under other Sections.

C. Samples representative of materials and finished products as may be requested by Architect/Engineer.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.

B. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel," AWS D1.2 "Structural Welding Code--Aluminum," and AWS D1.3 "Structural Welding Code--Sheet Steel."

1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.05 PROJECT CONDITIONS

A. Field Measurements: Check actual locations of walls and other construction to which metal fabrications must fit by accurate field measurements before fabrication. Show recorded

measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.01 FERROUS METALS

A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials selected for their surface flatness, smoothness, and freedom from surface blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Steel Plates, Shapes, and Bars: ASTM A 36/ A 36M.

C. Rolled Steel Floor Plates: ASTM A 786/A 786M.

D. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500.

2. Hot-Formed Steel Tubing: ASTM A 501.

E. Cast-in-Place Anchors in Concrete: Anchors of type indicated below, fabricated from corrosion-resistant materials capable of sustaining, without failure, the load imposed within a safety factor of 4, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; 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 required, hot-dip galvanized per ASTM A 153/A 153M.

F. Welding Rods and Bare Electrodes: Select according to AWS specifications for the metal alloy to be welded.

2.02 FASTENERS

A. General: Provide plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), with hex nuts, ASTM A 563/ A 563M, and, where indicated, flat washers.

C. Machine Screws: ANSI B18.6.3 (ANSI B18.6.7M).

D. Lag Bolts: ANSI B18.2.1 (ANSI B18.2.3.8M).

E. Wood Screws: Flat head, carbon steel, ANSI B18.6.1.

F. Plain Washers: Round, carbon steel, ANSI B18.22.1 (ANSI B18.22M).

G. Lock Washers: Helical, spring type, carbon steel, ANSI B18.21.1.

H. Anchor Bolts: ASTM F1554-99, Grade 36

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material: Carbon steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.

K. Adhesive Anchors: Hilti HVA adhesive anchor with anchor meeting ASTM A193-01b, Grade B7.

1. Threads on anchors shall conform to Unified Standard Series of ASME B18.2.6 with Class 2A tolerances.

2.03 GROUT

A. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Non-shrink, Nonmetallic Grouts:

a. B-6 Construction Grout; Bonsal American, Inc.

b. Diamond-Crete Grout; Concrete Service Materials Co.

c. Sure-Grip High Performance Grout; Dayton Superior Specialty Chemical Corp.

d. Euco N-S Grout; Euclid Chemical Co.

e. Five Star Grout; Five Star Products, Inc.

f. Vibropruf #11; Lambert Corp.

g. Crystex; L & M Construction Chemicals, Inc.

h. Masterflow 928 and 713; ChemRex-Degussa Building Systems.

i. Sealtight 588 Grout; W. R. Meadows, Inc.

j. Sonogrout 14; Sonneborn Building Products, ChemRex-Degussa Building Systems

k. Kemset; ChemMasters.

2.04 CONCRETE FILL

A. Concrete Materials and Properties: Comply with requirements of Division 3 Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 PSI (20 MPa), unless higher strengths are indicated.

2.05 FABRICATION, GENERAL

A. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than that needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.

C. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Remove sharp or rough areas on exposed traffic surfaces.

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 that no roughness shows after finishing, and contour of welded surface matches those adjacent.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

G. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

H. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. 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.

I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

J. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.

2.06 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 Sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts that bear on wood structural connections, and furnish steel washers elsewhere.

2.07 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of the required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required. Galvanize after fabrication.

2.08 LOOSE STEEL LINTELS

A. Fabricate loose structural steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Weld adjoining members together to form a single unit where indicated.

2.09 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not a part of structural steel framework as required to complete the Work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive other adjacent construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete or building into masonry. Furnish inserts if units must be installed after concrete is placed.

a. Except as otherwise indicated, space anchors 24 inches (600 mm) on-center and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

C. Fabricate support for suspended toilet partitions as follows:

1. Beams: Continuous steel shapes of size required to limit deflection to L/360 between hangers.

2. Hangers: Steel rods spaced not more than 36 inches (900 mm) on-center. Thread rods to receive anchor and stop nuts. Fit hangers with wedge-shaped washers for full bearing on sloping flanges of support beam.

3. Braces and Angles: Steel angles of size required for rigid support of beam and for secure anchorage.

2.10 TRENCH DRAIN FRAMES AND COVERS

A. Provide heavy-duty type trench drain cover and frame constructed of gray iron, class 35, Model No. R-4990-DX with type 'A' grate opening as manufactured by Neenah Foundry Co. Coordinate with concrete and reinforcing steel installer of the cover and supports.

2.11 STEEL BOLLARDS

A. Fabricate pipe bollards from Schedule 40 steel pipe.

B. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve.

2.12 FINISHES

A. General:

1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.

2. Finish metal fabrications after shop assembly.

B. Shop Finish

1. Surface Preparation:

a. SSPC-SP1: The Society for Protective Coatings "Surface Preparation Specification No. 1 – Solvent Cleaning", September 1, 2000 Edition and SSPC-SP2: "Surface Preparation Specification No. 6 – Commercial Blast Cleaning", September 1, 2000 Edition.

2. Primer:

a. Fast curing, universal modified alkyd, rust inhibiting shop coat with good resistance to normal atmospheric corrosion compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Primer shall comply with all federal standards for VOC, lead, and chromate levels. Color shall be gray.

b. Shop prime immediately after surface preparation, applying according to manufacturer's instructions to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surface.

3. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

a. ASTM A 153/A 153M for galvanizing hardware.

b. ASTM A 123/A 123M for galvanizing both fabricated and un-fabricated products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

C. Touch-Up Painting

1. Immediately after erection, clean field welds, bolted connections, and abraded areas

of the shop paint and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and repair-painting galvanized steel, with dry film containing not less than 90 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

D. Finish Painting

1. Finish Painting shall be performed under Division 9 Section – Paints and Coatings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

B. Center nosings on tread widths with noses flush with riser faces and tread surfaces.

C. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

3.02 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. 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 the surfaces of exterior units that have been hot-dip galvanized after fabrication and are intended for bolted or screwed field connections.

E. Field Welding: Comply with the following requirements:

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 that no roughness shows after finishing, and contour of welded surface matches those adjacent.

3.03 SETTING LOOSE PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.

B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.

1. Use non-shrink, metallic grout in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.

3.04 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a 2.0-mil (0.05-mm) minimum dry film thickness.

END OF SECTION

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SECTION 05 51 00
METAL STAIRS AND RAILS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Provide all metal pan stairs, pipe guardrails, and handrails complete in place as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Division 3 Section 03 30 00 – Cast-In-Place Concrete

B. Division 4 Section 04 22 00 – Concrete Masonry Units

C. Division 5 Section 05 12 00 – Structural Steel

D. Division 5 Section 05 50 00 – Metal Fabrications

1.03 QUALITY ASSURANCE

A. Reference Standards

1.	ASTM A 307, A 563/A 563M	Bolts & Nuts
2.	FS FF-W 92	Washers
3.	FS FF-S 325	Masonry Anchorages
4.	ASTM A 242/A 242M	Steel Pans
5.	AWS D 1.1-75	Structural Welding
6.	ASTM A 1011/A 1011M	Hot Rolled Carbon Steel
7.	ASTM A 36/A 36M	Steel Plates, Shapes, Bars
8.	ASTM A 500	Cold-Formed Steel Tubing (Grade B)
9.	ASTM A 53/A 53M	Steel Pipe (Type E or S, Grade B)
10.	ASTM A 1008/A 1008M	Cold-Rolled Steel Sheets
11.	ASTM A 123/A 123M	Galvanizing for Assembled Products
12.	ASTM A 153/A 153M	Galvanizing for Iron and Steel Hardware.

1.04 SUBMITTALS

A. General

1. Comply with Section 01 33 00 of this Specification.

B. Manufacturer's Data: For information only, submit 2 copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions for products to be used in the fabrication of steel stair work, including paint products. Indicate by transmittal that copy of instructions has been distributed to the installer.

C. Shop Drawings: Submit shop drawings for the fabrication and erection of steel stair assemblies which are not completely shown by the manufacturer's data sheets. Include plans and elevations at not less than 1" to 1' - 0" scale, and include details of sections and connections at not less than 3" to 1' - 0" scale. Show anchorage and accessory items.

D. Submit final component design calculations and drawings as required by local, state, and federal rules and regulations applicable to Project location. Minimum of five (5) copies shall be submitted.

E. Submit fees for local and state review. Local and state acceptance of component design is mandatory prior to fabricating components. Submittal shall include required forms, fees, calculations, registration stamps, and signatures.

1.05 PRODUCT HANDLING, STORAGE AND DELIVERY

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect work and materials of other trades.

B. Replacements: In the event of damage, immediately make all repairs or replacement, with the approval of the Architect/Engineer, at no additional cost to Owner.

PART 2 - PRODUCTS

2.01 MATERIALS/FABRICATION

A. General

1. Workmanship

a. Use materials of the size and thickness shown, or if not shown, of the required size and thickness to produce adequate strength and durability in the finished product for the intended use. Work to the dimensions shown or accepted on shop drawings, using proven details of fabrication and support. Use the type of materials shown or specified for the various components of the work.

b. Form exposed work true to line and level with accurate angles and surfaces and straight, sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation of otherwise impairing the work.

c. Weld corners and scams continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

d. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown use Phillips flat-head (countersunk) screws or bolts.

e. Provide for anchorage of the type shown, coordinated with the supporting structure. Fabricate and space anchoring devices as shown and as required to provide adequate support for the intended use of the work.

f. Use welding for joining pieces together, unless otherwise shown or specified. Fabricate units so that bolts and other fastenings do not appear on finish surfaces. Make joints true and tight, and make connections between parts light-proof tight. Provide continuous welds, ground smooth where exposed.

g. Construct stair units to conform to sizes and arrangements as shown. Construct entire assembly to support a minimum live load of 100 lbs. per sq. ft., unless otherwise shown. Provide all metal framing, hangers, columns, struts, clips, brackets, bearing plates and other components as required for the support of stairs and platforms. Erect stairwork to line, plumb, square, and true with runs registering level with floor and platform levels.

h. Provide brackets and bearing surfaces as detailed and as required to anchor and contain the stairs on the supporting structure.

i. Finishing

i. Shop paint all steel stair work, except those members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded and galvanized surfaces, unless otherwise specified.

ii. Remove scale, rust and other deleterious materials before the shop coat of paint is applied. Clean off heavy rust and loose mill scale.

iii. Apply shop coat(s) of paint to fabricated metal items in accordance with requirements of SSPC-PA 1 “Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel” for shop painting.

iv. Immediately after surface preparation, brush or spray on steel primer paint, applied in accordance with the manufacturer's instructions.

B. Components

1. Fabricate strings of structural steel channels, or plates, or a combination thereof, as shown. Provide closures for exposed ends of strings.
2. Metal pan riser and sub-treads: Form metal pans of 0.1046" thick structural steel sheets (12 gauge), complying with ASTM A 568/A 568M, Grade B. Shape pans to conform to the configuration shown.
3. Construct riser and sub-tread metal pans with steel angle supporting brackets, of size shown, welded to strings. Secure metal pans to brackets with rivets or welds.
4. Secure sub-platform metal pans to platform frames with welds.
5. Railings:
    a. Wall Brackets: #1386 Malleable Iron for 1-1/2" pipe railing or equal primed steel to be finish painted under Technical Specification Section 09 90 00.
    b. End Caps: Weld-on steel 938 for 1-1/2" pipe primed steel to be finish painted under Technical Specification Section 09 90 00.
    c. Rails and Posts: 1-1/2" diameter primed steel to be finish painted under Technical Specification Section 09 90 00.
6. Provide cast metal, abrasive non-skid type, as shown on the Drawings: 4" wide by full length of step between strings, unless otherwise shown. Fabricate in thickness, profile, and surface pattern as shown. Equip each nosing with integral anchors for embedding in pan fill material, spaced not more than 4" from each end and not more than 15" on-center.
    a. Manufacturers offering products to comply with requirements include the following:
        i. Amstep Products
        ii. American Safety Tread Co., Inc.
        iii. Safe-T-Metal Co., Inc.
        iv. Wooster Products, Inc.

2.02 FINISHES

A. General:

1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
2. Finish metal fabrications after shop assembly.

B. Shop Finish

1. Surface Preparation:
    a. SSPC-SP1: The Society for Protective Coatings “Surface Preparation Specification No. 1 – Solvent Cleaning”, September 1, 2000 Edition and SSPC-SP2: “Surface Preparation Specification No. 6 – Commercial Blast Cleaning”, September 1, 2000 Edition.
2. Primer:
    a. Fast curing, universal modified alkyd, rust-inhibiting shop coat with good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Primer shall comply with all federal standards for VOC, lead, and chromate levels. Color shall be gray.
    b. Shop prime immediately after surface preparation, applying according to manufacturer’s instructions to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surface.
3. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:

a. ASTM A 153/A 153M for galvanizing hardware.

b. ASTM A 123/A 123M for galvanizing both fabricated and un-fabricated products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch (0.76 mm) thick or thicker.

C. Touch-Up Painting

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

2. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and repair-painting galvanized steel, with dry film containing not less than 90 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

D. Finish Painting

1. Finish painting shall be performed under Division 9 Section – Paints and Coatings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchorages

1. Provide setting drawings, diagrams, templates, instructions and directions for the installation of anchorages, including concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate the delivery of such items with work at the Project site.

B. Fastening to In-Place Construction

1. Provide anchorage devices and fasteners where necessary for securing steel stair items to in-place construction: including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, leg bolts and other connectors as required.

C. Perform all cutting, drilling and fitting required for the installation of the miscellaneous metal items. Set the work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

1. Fit exposed connections accurately together to form tight hairline joints. Weld connections which are not to be left as exposed joints, but cannot be shop-welded because of shipping size limitations. Grind joints smooth and touch-up shop paint coat. Do not weld, cut or abrade the surfaces of units which have been hot-dip galvanized after fabrications, and are intended for field connections.

D. Field Welding

1. Comply with AWS Code for the procedures of manual shielded metal-arc welding, the appearance and quality of welds made, and the methods used in correcting welding work.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Finish Hardware Installation.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Division 8 Section 08 70 00 – Finish Hardware.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed finish carpentry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

PART 2 - PRODUCTS

1. Finish Hardware.
   a. See Division 08 70 00.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.03 INSTALLATION, GENERAL

A. Install according to specified requirements.

3.04 CLEANING

A. Clean finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.05 PROTECTION

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

END OF SECTION

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SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:
   1. All thermal and moisture protection required for this Work including, but not necessarily limited to:
      a. General building insulation
      b. Perimeter insulation
      c. Wall polyethylene vapor retarder
   2. Materials furnished and installed under another section
      a. Pre-engineered metal building blanket wall and simple saver roof insulation.

1.02 SUBMITTALS

A. Submit technical data indicating thermal conductance factors of furnished insulation.

B. Submit samples: two 6" x 6" pieces of each type and thickness of rigid insulation.

C. Submit manufacturer’s recommended installation instructions.

D. Submit manufacturer's certification that materials meet Specification requirements.

1.03 PRODUCT HANDLING

A. Protection:
   1. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the Work and materials of all other trades.

B. Delivery and Storage:
   1. Deliver materials to the Project Site, and store in a safe dry place with all labels intact and legible at time of installation.

C. Replacements:
   1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 INSULATION MATERIALS

A. General:
   1. All reference to R-Values shall mean aged R-Values.

B. Hollow metal door frame stop insulation
   1. At all hollow metal door frames to receive weatherstripping and to be grouted solid furnish to door frame installers:
      a. Equivalent of Polytect Expanded Polystyrene as manufactured by Plymouth Insulation.
      b. R-value: 4 per 1 inch of thickness
      c. Compressive Strength: 10 PSI

C. Other Materials
   1. Where so indicated on the Drawings, furnish and install.
      a. Rigid Perimeter Insulation:
         i. Perimeter Foundation Wall/Floor Slab Insulation:

(a.) 2" thick extruded polystyrene
(b.) R-Value: R5 per inch
(c.) Compressive Strength: 25 PSI

D. Cavity Wall Insulation
1. Extruded polystyrene as of the sizes shown on the Drawings.
2. R-Value: R5 per inch
3. Compressive Strength: 15 PSI
4. Edges: Tongue & Groove

2.02 ADHESIVE

A. As recommended by insulation manufacturer.

2.03 MECHANICAL FASTENERS

A. As recommended by insulation manufacturer.

B. Minimum length 1/2" longer than insulation thickness.

2.04 VAPOR BARRIER

A. Provide as shown on the Drawings. 6 mil polyethylene vapor barrier.

B. Sheet membrane material for under slab vapor barrier shall be:
a. Viper® VaporCheck™ II - 6-mil Class C White (vapor barrier); by Insulation Solutions, East Peoria, Illinois 866.698.6562 www.insulationsoulution.com

2.05 PREPARATION

A. Remove or protect against projections in construction framing that may damage or prevent proper installation.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify masonry joints where insulation is installed are struck flush.

C. Verify that openings in masonry walls are sealed. Cut insulation around vents, louvers, pipes, conduit, and other wall penetrations.

D. Verify that resilient rods or seals are in place around fixtures, pipes, receptacle outlets, and other items in or through the wall to seal openings.

E. Examine areas to receive rigid insulation to insure work of preceding trades is completed.

F. Check surfaces to receive rigid insulation to assure they are in uniform plane; and free of concrete fins, debris, grease, oil or other items detrimental to installation.

G. Proceed with application of insulation only when conditions are satisfactory.

3.02 INSTALLATION

A. Except as otherwise specifically directed by the Architect/ Engineer, install all insulation in accordance with the current edition of "The Manufacturer's Application Instructions."

B. General:

1. Fit insulation snugly between framing.
2. Maintain integrity of insulation over entire area to be insulated.
3. Insulate small areas between closely spaced framing members.
4. Carefully cut and fit insulation around pipes, conduits, and other obstructions.
5. Where pipe or conduit are located in stud spaces, place insulation between exterior wall and pipe, compressing insulation where necessary.
6. Do not install insulation requiring compression in excess of 10%.
7. Install insulation to attain minimum R-value as indicated for finished assembly.

C. Mechanical Fasteners:
1. Install adhesively applied mechanical fasteners minimum of 48 hours prior to applying insulation.

D. Cavity Wall Insulation:
1. Install insulation against masonry wall within cavity.
2. Place insulation with long dimension horizontal and mechanically fasten.

END OF SECTION

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SECTION 07 92 00
JOINT SEALERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This Section describes sealing of all joints where shown on the Drawings and elsewhere as required to provide a positive barrier against passage of air and passage of moisture.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section.

B. Qualifications of Manufacturers:

1. Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.

C. Qualifications of Installers:

1. Proper caulking and proper installation of sealants require that installers be thoroughly trained and experienced in the necessary skills and thoroughly familiar with the specified requirements.

D. For caulking and installation of sealants throughout the Work, use only personnel who have been specifically trained in such procedures and who are completely familiar with the joint details shown on the Drawings and the installation requirements called for in this Section.

1.03 SUBMITTALS:

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data: Within 15 calendar days after Award of the Contract, submit:

1. A complete materials list showing all items proposed to be furnished and installed under this Section.
2. Sufficient data to demonstrate that all such materials meet or exceed the specified requirements.
3. Specifications, installation instructions, and general recommendations from the materials manufacturers showing procedures under which it is proposed that the materials will be installed.
    a. Upon approval by the Architect, the proposed installation procedures will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

C. Prior to acceptance of Work, furnish written guarantee for five (5) years covering repairs required to maintain caulking in a weather-tight condition. Make repairs at no expense to Owner.

1.04 PRODUCT HANDLING

A. Delivery and Storage:

1. Deliver all materials of this Section to the Project site in the original unopened containers with all labels intact and legible at time of use. Store only under conditions recommended by the manufacturers. Do not retain on the Project site any material which as exceeded the shelf life recommended by its manufacturer.

B. Protection:

1. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 SEALANTS

A. Sealant material shall be a one part polyurethane sealant exceeding the requirements of Federal Specification TT-S-00230.

B. Sealant Manufacturers and Products:

1. Sonneborn Building Products “Sonolastic NP1”
2. Sika Corp.”Sikaflex 180”
3. Tremco, Inc. “Dymeric 511”

C. Sealant shall be applied on the exterior of the building between exterior door, sidelight, window and louver frames and masonry and concrete; at exterior expansion and control joints in masonry; under thresholds; and other areas where nature of work required it for appearance or to insure tight construction.

D. Prime surfaces in accordance with manufacturer's recommendations prior to applying sealant.

E. Follow manufacturer's recommendation on maximum width and depth of beads, generally maximum width of bead not-to-exceed two times the depth, minimum depth 1/4".

F. Fill joints deeper than 1/2" with polyurethane foam spacers.

G. Sealant shall be applied on the interior of the building between all doors, sidelight, window and louver frames and masonry, drywall, and concrete; at interior expansion and control joints in masonry; under thresholds, between cabinetry and walls; and other areas where nature of work requires it for appearance or to insure tight construction.

H. Sealant shall be at least 1/2" deep; fill joints deeper than 1" with non-impregnated filler before caulking. Prime block and other porous surfaces prior to caulking as per manufacturer’s specifications.

I. Sealant behind removable flanges, beads or drops when possible, removing items or doing work in advance for this purpose.

2.02 COLORS

A. Colors for each sealant will be selected by the Architect/Engineer from standard colors normally available from the specified manufacturers. Should such standard color not be available from the approved manufacturer except at additional charge, provide all such colors at no additional cost to the Owner.

B. In concealed installations and in partially or fully exposed installations where so approved by the Architect/Engineer, standard gray or black sealant may be used.

2.03 PRIMERS

A. Use only those primers which are non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealant used.

2.04 BACKUP MATERIALS

A. General: Use only those backup materials which are specifically recommended for this installation by the manufacturer of the sealant used, and which are non-absorbent and non-

staining.

2.05 BOND-PREVENTIVE MATERIALS

A. Use only bond-preventive materials best suited for the application and as recommended by the manufacturer of the sealant used.

2.06 MASKING TAPE

A. For masking around joints, provide masking tape conforming to Federal Specification -UU-T-106c.

2.07 OTHER MATERIALS

A. All other materials, not specifically described but required for complete and proper caulking and installation of sealants, shall be first quality of their respective kinds, new, and as selected the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Follow the manufacturer’s recommended method of preparation for each type of material to which sealant to be applied.

3.03 INSTALLATION OF BACKUP MATERIAL

A. Use only the backup material recommended by the manufacturer of the sealant and approved by the Architect/Engineer for the particular installation, compressing the backup material 25% to 50% to secure a positive and secure fit. When using backup of tube or rod stock, avoid lengthwise stretching of the material. Do not twist or braid hose or rod backup stock. Open cell backer rod is not permitted.

3.04 PRIMING

A. Use only the primer recommended by the manufacturer of the sealant and approved by the Architect/Engineer for the particular installation. Apply the primer in strict accordance with the manufacturer's recommendations as approved by the Architect/Engineer.

3.05 BOND-BREAKER INSTALLATION

A. Install an approved bond-breaker where recommended by the manufacturer of the sealant and where directed by the Architect/Engineer, adhering strictly to the installation recommendations as approved by the Architect/Engineer.

3.06 INSTALLATION OF SEALANTS

A. General:

1. Prior to start of installation in each joint, verify the joint type according to the details in the Drawings, and verify that the required proportion of width of joint to depth of joint has been secured.

B. Equipment:

1. Apply sealant under pressure with hand or power-actuated gun or other appropriate means. Guns shall have nozzle of proper size and shall provide sufficient pressure to completely fill joints as designed.

C. Masking:

1. Thoroughly and completely mask all joints where the appearance of sealant on adjacent surfaces would be objectionable.

D. Installation of Sealant:

1. Install the sealant in strict accordance with the manufacturer's recommendations as approved by the Architect/Engineer, thoroughly filling all joints to the recommended depth.

E. Tooling:

1. Tool all joints.

F. Cleaning Up:

1. Remove masking tape immediately after joints have been tooled.
2. Clean adjacent surfaces free from sealant as the installation progresses. Use solvent or cleaning agent as recommended by the sealant manufacturer.

END OF SECTION

SECTION 08 11 00
STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This Section describes all standard and non-standard steel doors and steel door frames delivered to the Project.

B. Related Work Described Elsewhere:

1. Division 4 Section 04 22 00 – Concrete Masonry Units
2. Division 8 Section 08 70 00 – Finish Hardware
3. Division 8 Section 08 80 00 – Glazing

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with applicable standards specified:
   a. Underwriters Laboratories, Inc. (UL)
   b. Factory Mutual Research Approvals (FM)
   c. American National Standards Institute (ANSI)
   d. American Society for Testing and Materials (ASTM)
   e. Federal Specifications (FS)

B. Qualifications of Manufacturer:

1. Products used in this work of this Section shall be produced by manufacturer regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect.

C. Qualifications of Installers:

1. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

D. Single Source:

1. All work of this Section shall be produced by a single manufacturer unless otherwise approved by the Architect.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 calendar days after Award of Contract, submit:
   a. Complete materials list of all items proposed to be furnished and installed under this Section.
   b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
   c. Shop drawings showing details of each frame type, elevations of each door design type, details of all openings, and all details of construction, installation, and anchorage.

C. The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting or rejecting actual installation procedures used on the

Work.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ceco Door Products, Milan, TN. – Trio Door Series

B. Curries Company, Mason City, IA – 777 Door Series

C. Or Approved Equal

2.02 STEEL FABRICATION

A. Carbon Steel: Cold rolled, ASTM A 1008/A 1008M.

2.03 COATING MATERIALS:

A. Primer: Manufacturer's standard rust inhibitive primer. Similar to Zeibart Car Coating.

2.04 CORE FILLER MATERIAL:

A. Manufacturer's standard fibrous honeycomb for interior doors and polyurethane insulation cores for exterior doors, for maximum energy efficiency. Minimum R-Value of 10.

2.05 ANCHORS, FASTENERS HARDWARE AND ACCESSORIES

A. Manufacturer's standard.

2.06 OTHER MATERIALS

A. All other materials not specifically described but required for the complete and proper installation of the work of this Section shall be new, first quality for their respective kinds and subject to approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 EXISTING CONDITIONS

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point when this installation will properly commence.
2. Verify that all hollow metal work may be installed in accordance with all product codes and regulations, the original design and their referenced standards.

3.02 FABRICATION

A. General:

1. Fabricate hollow metal work to be rigid, neat in appearance, and free from defects, warp or buckle.
2. Completed fabrications to meet ANSI A151.1.
3. Accurately form metal to required sizes and profiles, including astragals if utilized.

4. Clearly identify work that cannot be permanently factory assembled before shipment to assure proper assembly at Project site.
5. Grind and dress exposed welds to form smooth, flush surfaces.
6. Do not use metallic filler to conceal manufacturing defects.

B. Doors:

1. Form interior face sheets and exterior face sheets of 18 gauge metal.
2. Stiffener:
   a. Stiffen face sheet with continuous vertical formed steel sections over full thickness of interior space between door faces.
   b. Stiffeners of 22 gauge minimum, spaced not more that 6" apart, spot welded to both face sheets not more that 4" on-center.
   c. Fill spaces between stiffeners with core material.
3. Join door faces at vertical edges by mechanical interlock.
4. Exterior doors shall have sealed flush top caps.
5. Exterior doors shall be insulated with polyurethane insulation. Minimum R-value of 10.

3.03 FRAMES

1. Interior Frames:
   a. 16 gauge
   b. Diecut mitered corners with interlocking tabs and slots for alignment.
   c. Frames shall be grouted solid with light-weight plaster before installation by installer.
   d. Fabricated with mitered joints for installation after wall is erected.
   e. Coating Materials:
      i. Primer: Manufacturer's galvanized rust inhibitive primer.
2. Exterior Frames:
   a. Exterior frames to be 14 gauge galvanized steel.
   b. Diecut mitered corners with interlocking tabs and slots for alignment.
   c. Frames shall be filled with spray foam insulation before installation by installer.
   d. Fabricated with mitered joints for installation after wall is erected.
   e. Coating Materials:
      i. Primer: Manufacturer's galvanized rust inhibitive primer.

3.04 EDGE CLEARANCES

A. Between doors and frame at head and jamb: 1/8"

B. At sills without thresholds: 3/4" maximum

C. At sills with thresholds: 1/4" maximum between threshold and door.

D. Between meeting edges of pairs of doors: 1/8".

3.05 PREPARATION FOR HARDWARE

A. ANSI A 115.

3.06 FINISH

A. Dress tool marks and surface imperfections to smooth surfaces, and remove irregularities.

B. Chemically treat and clean doors and frames.

C. Apply manufacturer's standard primer.

3.07 INSPECTION

A. Assure that frame openings correspond to dimensions of frame furnished.

B. Check that surfaces to contact frame are free of debris.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.08 INSTALLATION

A. Anchorage:

1. Attach anchor to opening.
2. Minimum number of anchors:
    a. Masonry Walls, Concrete Walls & Structural Steel:
        i. Frames up to 7'- 6": 3 anchors per jamb.
        ii. Frames 7'- 6" to 8'- 0": 4 anchors per jamb.
        iii. Frames more than 8' -0": 1 anchor for each 2'- 0" of jamb or fraction thereof.
    b. Stud Partitions:
        i. Frames up to 7'- 6": 3 anchors per jamb
        ii. Frames 7'- 6" to 8'- 0" 4 anchors per jamb
        iii. Frame more than 8'- 0": 4 anchors plus one additional anchor for each 2'- 0" or fraction thereof over 8'- 0".
3. Frames: SDI 105
4. Hardware: SDI 107
5. Doors: SDI 100.

B. Exterior Door Frames:

1. These frames shall be back-coated with rust-inhibitive asphalt coating, shop filled with rigid insulation, and frame filled solid with grout by installer before installation.

3.09 ADJUSTMENT AND CLEANING

A. Remove dirt and excess sealants or glazing compound from exposed surfaces.

B. Touch-up marred or abraded surfaces to match original finish.

C. Adjust moving parts for smooth operation.

D. Remove debris from Project site.

3.10 GUARANTEES

A. Guarantee doors and frames against failure of materials or workmanship to include excessive leakage of air infiltration, excessive deflections, faulty operation of sash, deterioration of finish or metal in excess of normal weathering, and defects in hardware and weather-stripping.

B. Guarantee to extend for two years.

END OF SECTION

SECTION 08 11 16
ALUMINUM WINDOW FRAMES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install clearstory aluminum window frames as shown on the Drawings and specified herein for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. For purposes of designating type and quality for work in this Section, Drawings and Specifications are based on Kawneer. Whenever substitute products are to be considered, supporting technical literature, samples and drawings must be submitted five (5) days prior to bid date in order to make a valid comparison of the products involved.

1.03 SUBMITTALS

A. Shop Drawings:

1. Within 15 days after Award of Contract, and before any of the materials of this Section are delivered to the Project site, submit complete shop drawings to the Architect/Engineer in accordance with the provisions of Section 01 33 00 of these Specifications; show construction of all parts, metal thickness, installation and erection details including connections, anchorage, fastening and sealing methods. Also show sections of typical members, dimensions and elevation, frame sizes, spacing of anchors and fasteners, and details of accessories.

B. Manufacturer's Recommendations:

1. Submit two copies of the manufacturer's recommended methods of installation for aluminum doors and frames.

C. Samples:

1. Accompany the shop drawings, submit samples of the proposed aluminum finishes to the Architect/Engineer.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect the materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacement:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architects/Engineer and at no additional cost to the Owner.

1.05 GUARANTEES

A. Guarantee doors and frames against failure of materials or workmanship to include excessive leakage of air infiltration, excessive deflections, faulty operation of sash, deterioration of finish or metal in excess of normal weathering, and defects in hardware and weather-stripping.

B. Guarantee to extend for 2 years.

PART 2 - PRODUCTS

2.01 FRAMES

A. All frames shall be the product of Kawneer Co., Inc.. Equivalent products of Tubelite,Inc., YKK AP America, Inc., EFCO Corporation, Manko, and PPG Aluminum Entrances shall be

acceptable subject to approval by Architect/Engineer.

B. Framing shall be equal to Kawneer 451T (thermal break) and sized to accept 1” insulating glass.

C. Aluminum windows constructed with Kawneer 451T (thermal break) shall have horizontal/vertical intermediate rails.

PART 3 - EXECUTION

3.01 PRIOR CONDITIONS

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that all aluminum doors and frames may be installed in accordance with all pertinent codes and regulations, the original design and the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect/Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION

A. General:

1. Install all aluminum frames in strict accordance with the manufacturer's recommendations as approved by the Architect/Engineer. Conform to revised shop drawings.

3.03 MECHANICAL ASSEMBLIES

A. Fit corner joints rigid and weather-tight.

B. Fasteners concealed when door is installed and closed.

3.04 PROTECTIVE COATINGS

A. Factory applied.

B. Solvent-clean metal surface.

C. Apply bituminous paint to aluminum in contact with galvanically incompatible metal.

D. Apply zinc chromate primer to aluminum surfaces to be installed in contact with concrete or mortar.

3.05 WEATHERSTRIP

A. Weather-strip on all sides installed on door.

B. Weather-stripping to be continuous at corners.

3.06 INSPECTION

A. Assure that door openings conform to dimensions and tolerances shown on Drawings.

B. Check that surfaces to contact doors are free of debris.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

3.07 INSTALLATION

A. Comply with manufacturer's instructions for installation of units, hardware, operators, and other components.

B. Set units plumb, level and true to line, without warp or rack of frames.

C. Anchor frames solidly to surrounding construction to prevent distortion or misalignment.

D. Apply protective coating to separate aluminum from galvanically incompatible materials.

E. Use Lok-Tite on all screws.

3.08 ADJUST AND CLEAN

A. Adjust movable units to operate smoothly and to be weather-tight when closed.

B. Lubricate hardware and moving parts.

C. Clean aluminum surfaces and remove excess sealants.

D. Remove debris from Project site.

END OF SECTION

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SECTION 08 36 13
OVERHEAD SECTIONAL DOORS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. The work required in this Section includes all labor, materials and equipment for the fabrication and installation of electrically operated overhead sectional steel doors in designated locations indicated on the Drawings. It shall include making such tests of installation as required by the Owner and Architect/Engineer.

B. The Contractor will be held to have examined the Drawings and read over this Specification for work required to be done by other trades in connection with work of this Section and shall furnish and install such supplementary material as needed to properly and completely support the work furnished in this Section or as otherwise required for the complete installation.

C. The Contractor will cooperate with the Mechanical trades to avoid interference with such equipment as structure, unit heaters, ductwork, piping, etc. and provide adequate track bracing and supports.

1.02 WORK UNDER OTHER HEADINGS

A. Guard-posts at door openings will be furnished and installed under metal fabrications.

B. Interior finish painting, including touch up, shall be performed under "Painting".

C. Section 26 00 00- Electrical General Provisions

D. Section 26 00 00 - Conduit

E. Section 26 00 00 - Wire & Cable

F. Section 26 00 00 - Disconnect Switches

1.03 QUALITY ASSURANCE

A. Provide the overhead sectional doors, as complete units produced by one manufacturer, including hardware, controls, accessories, stations, mounting and installation components. The operator, track, door, hardware, mounting hardware, and safety edge to reverse shall be installed by the Door Contractor. Door Contractor shall provide to the Electrical Contractor for installation, loop detection wiring, push button controls, photo detector control, and radio transmitter receivers.

B. Manufacturers:

1. Provide overhead sectional door models as manufactured by one of the following, or as approved equal by Architect/Engineer during the bidding process:
    a. Haas Door CHT-2016 Series Sectional Doors in color T.B.D. from manufacturer’s Trinar colors.
    b. Overhead Door Corporation 592 Series, with Kynar finish in color T.B.D..

1.04 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 25 calendar days after Award of Contract submit.
2. Complete materials list of all items proposed to be furnished and installed under this Section.

3. Shop drawings for each type of overhead door units showing components, arrangements, dimensions, orientation on walls, sections of trim members, insulation resistant values, dimension elevations, grounds, motors, reinforcements, operators, controls, and accessories.

PART 2 - PRODUCTS

2.01 OVERHEAD SECTIONAL DOORS AND FRAMES

OPERATION

Operation shall be motor and/or hand chain as specified and detailed on door schedule.

SECTIONS

A. Material: Sections shall be steel sandwich construction, 2" (50.8 mm) thick, roll-formed from commercial draw quality, hot-dipped galvanized steel per ASTM A-924 and A-653. 26 gauge exterior and 26 gauge interior section skins to be constructed of galvanized steel with embossed textured finish, mechanically interlocked and bonded to a 1 7/8" (48mm) thick, polyurethane core. Hinge reinforcement plates shall be 16 gauge edge plates and 16 gauge center plates, located within section interior at every hinge location. End stiles to be 18 gauge.

B. Mounting: Sections shall be mounted in the door opening using (select from list below):

1. Lap Jamb Angle Mounting: sections shall overlap the door jambs by 1" (25mm) on each side of the door opening.
2. Between-Jamb Bracket Mounting: sections shall be mounted between the door jambs, and seal against exterior perimeter seal installed along the vertical and top horizontal edges of the jambs.

C. Polyurethane Insulation: Sections will have a minimum R-value of 17.

D. Seals: Interior and exterior skins to be separated by a continuous dual durometer vinyl seal held in place by a mechanical interlock to form an effective thermal break and a complete weatherseal along the section joint. Top of door to be provided with dual durometer vinyl standard. Bottom of door to have flexible U-shaped vinyl seal in an extruded aluminum retainer.

E. Trussing: Doors shall be designed to withstand a wind load of 12 P.S.F. Deflection of door in horizontal position to be a maximum of $1/120^{th}$ of door width.

F. Color: Interior skins to have two coats of paint, one primer coat and one finish coat. Interior skin color shall be white, exterior skin color shall be: selected by architect during submittal review, from manuacturer's trinar or kynar color charts.

TRACK

A. Material: Track shall be hot-dipped galvanized steel per ASTM A-653, fully adjustable for adequate sealing of door to jamb or weatherseal.

B. Type: Track may be configured as Normal Headroom, Low Headroom, Vertical Lift, Lift-Clearance, Incline and/or Contour, as note and detailed on door schedule. (Note: delete from list any configurations that do not apply).

C. Size: Track and Roller size shall be:

1. 3" (76mm): as optionally-provided, for promoting higher cycle life and durability.

D. Mounting: Tracks shall be angle-mounted:

1. "Floor-to-Header" Angle-Mount: Consisting of continuous angle extending from the floor up to the door header, for use with steel, wood or masonry jambs. Continuous angle size shall not be less that 2 5/16" x 5" x 3/32" (59 x 127 x 2.5mm).

E. Finish: Track finish shall be:

1. Galvanized: as normally-provided.

COUNTERBALANCE SYSTEM

A. Type: The spring counterbalance shall be provided with aircraft-type, galvanized steel lifting cables with minimum safety factor of 5. Counterbalance system shall be:

1. Torsion Springs: as normally-provided, consisting of heavy-duty oil-tempered wire torsion springs on a continuous ball-bearing cross-header shaft.

B. Cycles: Torsion spring counterbalance shall achieve:

1. 50,000 cycles

HARDWARE/ACCESSORIES

A. Hinges and fixtures: All hinges and brackets shall be made from galvanized steel.

B. Rollers: Track rollers shall have a 3" (76.2mm) diameter, consistent with track size. Rollers shall have hardened steel ball bearings.

C. Perimeter Seal: Doors shall be furnished with complete weather stripping system to reduce air infiltration. Weather stripping shall be replaceable without removal of track, mounting hardware, or door hardware.

2.02 CONTROLS AND ELECTRICAL

A. Furnish to the Electrical Contractor all overhead door controls and control wiring. See "Schedule of Door Controls" at the end of this Section.

B. Disconnect switches as shown on the Drawings shall be provided by the Electrical Contractor.

C. Photosensors shall be equivalent to a Chamberlin/ Liftmaster CPSL-NA NEMA 4 Enclosure.

1. Detection: CPSL-NA Receiver.
2. Range: Min. 10 meters
3. Light Source: Infrared LED
4. Power Supply: 24v
5. Response Time: 25 meters per second

D. Loop Detectors shall be equivalent to 326 Series Vehicle Loop Detector with concrete embedded conduit loops as manufactured by Intersection Development Corporation, IDC Systems or equal.

E. Toggle Switch: Door Supplier to furnish to the Electrical Contractor toggle switch and pilot light for each door with loop detectors. When switch is on, loop detectors are activated, and pilot light is lit.

F. Push Button control station shall be flush mounted, water resistant, NEMA 4 Open/Close/Stop.

G. Radio controller 62LM and Reciever 422LM shall be two channel receiver and transmitter w/ remote antennae for exterior installation. Provide coaxial antennae cable from remote antennae to receiver.

H. Provide three (03) transmitters per door. Transmitter shall be two channel as described in the door controller schedule of this section.

2.03 OPERATOR DESIGN

A. General

1. Overhead Doors:

a. Operator shall be Industrial Duty jackshaft Model J as manufactured by Liftmaster. Provide H.P., voltage, phase as indicated in the Electrical Drawings.

b. Door supplier shall provide all mounting pads, struts, and girts necessary for mounting overhead doors to the designed wall construction.

B. Reduction

1. Furnish heavy duty worm gear drive running in oil with additional reduction by chain and sprockets.

C. Motors

1. Provide 208 volt three phase motors. Motors shall be separate from reduction mechanism for ease of maintenance.

D. Roller Chain Drive

1. Door shall be driven by roller chain at 6" to 12" per second.

E. Adjustable Friction Clutch

1. Shall be provided to protect door and operator if door movement is obstructed.

F. Starter - Reversing Contactor Type

1. Furnish heavy duty across the line reversing type with mechanical interlock.

G. Limit Switches

1. Provide positive chain drive screw type limit switch, enclosed in electrical control box, easily accessible for precision setting.
2. Provide limit switch for interlock of ventilation system.
3. Provide limit switch for interlock of signal system.

H. Control Voltage

1. Control voltage shall be 24 volts for safety.

I. Overload Protection

1. Provide manual reset for overload protection.

J. Emergency Operation

1. A disconnect shall be provided so door can be manually operated.

K. Magnetic Brake

1. Furnish a magnetic solenoid brake for positive stop.

PART 3 - EXECUTION

3.01 COORDINATION

A. All electrical work shall comply with the latest editions of the Underwriter's Laboratory, Inc., and the National Electrical Code (NEC).

B. The electrical work specifications cover the installation of conduit, conduit fittings, supports, power wiring, and including connection.

C. Control wiring shall be concealed in conduit and the control wiring and control conduit shall be performed by the electrical contractor.

D. Receiver:

1. Make sure all connections are correct before turning on power. Mount receiver at location recommended by the manufacturer.
2. Remove protective cover on receiver for access to sensitivity adjustment, time selection, and light/dark switch. Always keep gasket in place to insure water tightness.
3. Use screws PF 1/2 when wiring with conduit.
4. After wiring, mount cover onto the terminal base by tightening screws until spring washers are flat.

5. Use dry, soft cloth for cleaning the lens and case.
6. Do not cycle on/off frequently.
7. Connect auxiliary relay for longer life.
8. Sensitivity Adjustment:
    a. Set an object to the desired position and then increase the Sensitivity Adjustment gradually from the minimum position until the indicator LED is on. Remove the object and gradually decrease the Sensitivity Adjustment from the maximum position until the LED is off. If the LED is still off even through potentiometer is at maximum position (Point B).
    b. Set potentiometer at the center between Points A and B.

3.02 MAINTENANCE

A. Maintenance and call back service for all equipment shall be provided for a period of one year after date of final acceptance of the building.

B. This service shall include regular examinations by competent and trained personnel, all necessary adjustments, greasing, oiling, cleaning, and parts to keep equipment in perfect condition, except such part made necessary by misuse, accidents or negligence not caused by the Contractor.

3.03 GUARANTEE

A. The door, motor, and controls shall be guaranteed for a period of two years. During this period the Contractor shall affect any repairs required, without cost to the Owner, due to failures caused by material, workmanship, normal usage, design or construction.

3.04 INSPECTION

A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the work. Verify spacing of door frame, motor, controls, and structure that offset installation of accessories. Do not proceed until unsatisfactory conditions have been corrected.

3.05 TESTING

A. For actual testing and reporting of tests, use only those personnel and methods approved in advance by the Architect/Engineer. All test reports shall be signed by the individual as authorized in the testing plan approved by the Architect/Engineer and submitted prior to final payment.

3.06 SCHEDULE OF DOOR CONTROLS

	Door No.	**Controls**
A.	101B	Three button momentary contact on OPEN/CLOSE/STOP, safety edge to reverse, two loop detectors required per door (approach side: open; exit side: hold-open and close), and switched lockout of loop detection control.
B.	101C	Three button momentary contact on OPEN/CLOSE/STOP, safety edge to reverse, two loop detectors required per door (approach side: open; exit side: hold-open and close), and switched lockout of loop detection control.

END OF SECTION

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SECTION 08 70 00
FINISH HARDWARE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This Section describes all finish hardware required to complete the work as indicated on the Drawings and specified herein. Provide all trim attachments, and fastening specified or required for proper and complete installation.

B. Related Work Specified Elsewhere:

1. Section 06 20 00: Finish Carpentry

1.02 QUALITY ASSURANCE

A. Standards: Comply with standards specified in this Section as listed in Section 01 42 00.

B. Qualifications of Manufacturers: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.

C. Qualification of Suppliers: The supplier shall have a qualified representative readily available to the Architect/Engineer, and/or Owner on short notice for consultation and service during the execution of this work and the warranty period.

D. Fire Rated Openings: Comply with the requirements of Underwriter's Laboratories, Inc.

1.03 SUBMITTALS

A. General: Comply with the provisions of Section 01 33 00.

B. Product Data: Within 15 calendar days after award of the Contract, submit:

C. Complete materials list of all items proposed to be furnished and delivered under this Section.

D. Identify each hardware item by manufacturer, the manufacturer's catalog number, and the location of the item in the work.

E. Make the list in form suitable for ready checking by the Architect.

F. Manufacturer's specifications, catalog cuts, and other data required to demonstrate compliance with specified requirements.

G. Approval of the hardware list by the Architect/Engineer shall not relieve the Contractor from the responsibility for furnishing all required finish hardware.

H. Samples: Within 15 calendar days after being so requested by the Architect/Engineer, deliver to the Architect/Engineer samples of each finish hardware item.

I. Templates: In a timely manner to ensure orderly progress of the work, deliver templates or physical samples of the approved finish hardware items to pertinent manufacturers of interfacing items such as door and frame.

1.04 PRODUCT HANDLING

A. Packing and Marking: Individually package each units of finish hardware, complete with proper fastening and appurtenances, clearly marked on the outside to indicate the contents and specific locations in the work.

B. Protection: Use all means necessary to protect materials of this Section before, during, and after delivery to the job site and to protect the work and materials of all other trades.

C. Replacements: In the event of damage, immediately make all repairs and replacements

necessary to the approval of the Architect/Engineer and at no additional cost to the owner.

PART 2 - PRODUCTS

2.01 LOCKS, LATCHES AND DEAD LOCKS

A. Shall be Schlage:
   1. ND Series Rhodes design Satin Chromium Plated

B. Backset shall be 2-3/4" for all locks, latches, and dead locks. Strikes shall be box type with wide enough lip projection to protect door frame but not to exceed 3/16" beyond face of frame.

C. All locks and cylinders shall be of one manufacturer and shall have not less than six (6) pins.

D. Lock function legend:
   1. Passage Lockset..... 10S
   2. Privacy Lockset..... 40S
   3. Entrance / Office Lockset..... 50PD
   4. Entrance Lockset 53PD
   5. Storeroom Lockset..... 80PD
   6. Note: Functions are noted with hardware groups. Verify all lock functions with owner at key meeting.

E. Furnish rim or mortise cylinders as required for overhead doors, folding doors, wire gates and partitions, special interior doors and coiling doors.

2.02 EXIT DEVICES

A. Devices shall be as manufactured by Von Duprin

B. Function shall be as noted in schedule.

2.03 BUTT HINGES

A. Shall be Hager, McKinney or Stanley ball bearing, non-rising loose pin, flat button tip, unless otherwise specified.

B. Provide 1-1/2 pair butts per door for doors up to 7'-6" in height. Doors over 7'-6" in height shall have two (2) pairs of butts.

C. Butt size requirements:
   1. Interior doors up to 37" wide 4-1/2 x 4-1/2.
   2. Interior doors over 37" wide 5 x 4-1/2.
   3. Exterior doors 5 x 4-1/2.

D. Door butt legend: (unless otherwise noted in Schedule)
   1. Exterior doors B1199 - NRP.
   2. Interior doors B1179 - TBB.

E. Furnish U.L. approved butts on labeled doors.

F. Spring Hinges: As manufactured by Hager, U.L. approved butts on labeled doors. Coordinate hinge requirements with door size and weight.

G. Continuous gear hinges to be Select Hinge.

H. Pivots shall be Glynn-Johnson as specified.

2.04 DOOR CLOSERS

A. Shall be LCN of proper size as described in manufacturer's schedule of sizes.

B. Where parallel arm or weather strip is specified, closers shall be one size larger than manufacturer's recommendations.

C. Closers shall have key adjusting device. Furnish six adjusting keys.

D. Mount to provide maximum opening permitted by building construction or equipment, and note on this schedule this maximum swing per location for other trades involved in reinforcement or installation.

E. Closers shall be of cast iron, of full rack and pinion construction, including two speed closing adjustment, adjustable hydraulic back-check and fully adjustable spring power plus reversible shoe feature, of type listed in schedule. Closer fluid shall be "all weather" type not subject to normal temperature changes.

F. All door closers shall be similar in design and appearance to those listed in the schedule, so far as possible, and shall be of one manufacturer. Furnish special arms and applications as indicated in hardware schedule or as dictated by structural conditions or local code requirements.

G. Door closers at labeled fire doors shall bear U.L. approval. Provide thru-bolts for mineral core doors.

H. Door closers finish to match finish hardware – standard powder coated 689 finish by LCN.

I. Where more than one door occurs in an opening, equip each door with closer, unless otherwise noted.

2.05 KICKPLATES

A. Shall be as manufactured by Hager Companies

B. All plates shall be 16-gauge (.050) with beveled sides and countersunk screw holes at intervals of not over 6" on all four sides. Screws shall be stainless steel oval head, finish to match plates. Size of kick, armor, and mop plates as noted.

C. Legend:

1. Kickplate on push side of door 16ga.

2.06 STOPS AND BUMPERS

A. Shall be Glynn Johnson 60W FB13X or overhead type indicated in the hardware schedule. Provide WB60XP bumper wherever possible. If construction prohibits the use of WB60XP, furnish FB13X type. Equal products as manufactured by Ives and Hager are also approved.

B. Install bumper behind each door.

C. Where two doors interfere with each other in swinging, provide roller bumper RB4 as required.

D. Apply with expansion shield and machine screws only.

E. Provide overhead door holders where specified.

2.07 MISCELLANEOUS HARDWARE

A. Thresholds: Nat. Guard, Reese or Zero as listed. Cope around mullions.

B. Weather-strip: Nat. Guard, Reese or Zero as listed.

C. Latch Protectors: Don-Jo NLP-110-630

D. Surface Bolts: Ives SB1630TB

2.08 FINISHES

A. Materials shall be the following. Provide with the finish designated in parenthesis ( ).

1. Knobs, locks, and latches: Satin chrome (US26D).

2. Dead locks: To Match Locksets
3. Exit devices: As indicted in hardware Groups
4. Push, pulls: As indicated in Hardware Groups
5. Kickplates: As indicated in Hardware Groups
6. Door closers: To Match Locksets
7. Door butts: nonferrous for exterior and wet areas. Ferrous for other doors.
8. Door stops and holders - Satin chrome (US26D).
9. Miscellaneous items: As indicated
10. Note: Verify all finishes with architect prior to ordering hardware.

2.09 KEYING

A. Master keying: Factory key, master key, grand-master key, and great-grand-master key all locks and cylinders. Coordination will be as directed by the Owner's representative.

B. Number of keys: Furnish three keys for each lock, twelve master keys for each set, and three grand-master keys.

C. Construction Keying: Furnish a construction master-key system with 15 keys for locks and cylinders. Use only the construction keys during construction.

D. Identification and Deliver: Factory stamp permanent keys "DO NOT DUPLICATE." Identify permanent keys with tags and send direct to the Owner by registered mail.

E. All locks and cylinders to be set to Owner's existing key system. Consult with Owner for detailed keying information.

F. Submit to Owner a steel lock-box for storage of keys.

2.10 TOOLS AND MANUALS

A. With the delivery of permanent keys, deliver to the Owner one complete set of adjustment tools and one set of maintenance manuals for locksets, latch-sets, closers, and panic devices.

2.11 HARDWARE GROUPS

Hardware Set No. 1

1 Storeroom Lockset
3 Pr. Hinges
6 Silencers
1 Closer
2 Surface Bolt
2 Kick Plates 34” Wide x 36” Tall

North leaf of double door is to receive surface bolt top and bottom. South leaf is to receive lockset and closer.

Hardware Set No. 2

1 Privacy Lockset
1½ Pr. Hinges
1 Closer
3 Silencers
1 Kick Plate 34” Wide x 36” Tall

Hardware Set No. 3

1 Entrance Lockset
1½ Pr. Hinges
1 Latch Protector
1 Closer
1 Threshold – S205A & 967C
1 Weather-stripping 778C
1 Kick Plate 34” Wide x 36” Tall

PART 3 - EXECUTION

3.01 PRODUCT HANDLING

A. Protection:
   1. Use all means necessary to protect materials of this Section before, during, and after installation, as well as the materials of other trades.

B. Replacements:
   1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect, at no additional cost to the Owner

3.02 MATERIALS

A. Loc-Tite shall be furnished for installation on all screw threads of hardware installation.

3.03 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be as selected by the Contractor, subject to the approval of the Architect.

3.04 INSTALLATION

A. Qualification of Installers:
   1. Use adequate numbers of skilled workmen who are trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of this Section.

B. Install the materials in strict accordance with the manufacturer's recommendations and schedules.

C. Anchor all screws with Loc-Tite to assure permanence of attachment.

D. All doors and hardware to be left in proper working order and cleaned.

3.05 DELIVERIES

A. Stockpile all items sufficiently in advance to ensure their availability, and make all necessary deliveries in a timely manner to ensure orderly progress of the total work.

B. All hardware shall be delivered to a destination as directed by the General Contractor with sufficient time in advance for proper inspection in order not to delay the scheduled completion date.

C. The Owner/General Contractor shall provide a lockable room with ample shelving for the storage of hardware. Upon receipt of the hardware, the Finish Hardware supplier shall unpack and place on the shelves all hardware in order of item and/or door numbers.

3.06 FINAL INSPECTION

A. The Finish Hardware supplier shall inspect the installation of all hardware furnished and shall report any installation adjustments as are necessary to have all hardware in perfect working order.

B. The Finish Hardware supplier shall verify the keying with the Owner to insure proper location of lock-sets and cylinders and shall assist the owner in correcting faulty operation of any lock or other items called to his attention. He shall have all closers checked and adjusted for closing, latching and back check by the Manufacturer's representative.

C. Prior to final acceptance of the building, the Finish Hardware supplier shall make a final inspection of all hardware furnished to verify that all adjustments and corrections have been made and that all hardware items are in good working order.

3.07 WARRANTY

A. Provide a written warranty in approved form in compliance with the related requirements of the General Conditions, covering all Finish Hardware furnished under this Section against defects in manufacturing and workmanship for a period of one (1) year from the final acceptance of the building.

B. Any material failing to comply with the above guarantee shall be removed and replaced with satisfactory material at the Finish Hardware supplier's expense, including the necessary labor for removing and replacing.

C. During the Warranty Period, the Finish Hardware supplier shall, upon request, make prompt adjustments, repairs or replacements as required to any hardware installed under this contract, other than normal maintenance service.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. This Section describes all glass and glazing accessories as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Standards:

1. General Glass Standard: FS DD-G-451; type, class, quality, style, kind and form are specified in reference to this standard.

B. Qualification of Manufacturer:

1. Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/ Engineer.

C. Qualification of Installers:

1. Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 calendar days after Award of Contract, submit:

a. Complete materials list of all items proposed to be furnished and installed under this Section;

b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements;

c. Shop drawings for each type of glass unit;

d. Samples for each type and color of glass unit.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

1.05 SAFETY GLAZING REQUIREMENT

A. All glass and glazing must comply fully with safety glazing requirements of U.S. Consumers Product Safety Commission Safety Standard for Architectural Glazing Materials. Should there be conflict(s) between this specification and government standards, the latter shall govern.

PART 2 - PRODUCTS

2.01 GLASS MATERIALS

A. Exterior Insulating Glass: 1" Insulating: ¼" tempered outside and ¼" tempered inside Low E Insulating Glass with 10 year warranty against bleeding, stress fracture, or other failure excluding vandalism or accidental breakage.

1. Acceptable Manufacturer: Pilkington, Energy Advantage, Low-E Argon Filled.

2. Shading Coefficient: 0.71

3. Summer U-Value: 0.28

4. Winter U-Value: .29

2.02 OTHER MATERIALS

A. All other material not specifically described but required for a complete and proper installation of the work of this Section shall be as selected by the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work to the approval of the Architect/Engineer. Do not proceed until unsatisfactory conditions have been corrected.

B. Check that glazing channels are free of burrs, irregularities and debris.

C. Check that glass is free of edge damage or face imperfections.

3.02 PREPARATION

A. Field Measurements:

1. Measure size of frame to receive glass.
2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces:

1. Remove protective coatings from surfaces to be glazed.
2. Clean glass and glazing surfaces, to remove dust, oil and contaminants, and wipe dry.

3.03 INSTALLATION

A. Install glass in locations as shown on the Drawings, and in accordance with the manufacturer's instructions.

B. Perform glazing when ambient temperature is above 40`F.

C. Perform glazing on dry surfaces only.

3.04 CLEANING

A. Remove excess glazing compound from installed glass.

B. Labels shall remain intact until final cleaning and acceptance, unless otherwise recommended by manufacturer.

C. Wash and polish both faces of glass.

D. Remove debris from work site.

3.05 PROTECTION OF COMPLETED WORK

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

3.06 FINAL INSPECTION

A. The manufacturer's recommended installation procedures, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the Work.

END OF SECTION

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SECTION 09 90 00
PAINTS AND COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. All exterior and interior exposed surfaces listed on the Painting Schedule in Part 3 - Execution of this Section, in accordance with the types of finish specified herein and as shown on the Drawings.

B. Related Work Described Elsewhere:

1. Priming or priming and finishing of certain surfaces are specified to be factory performed or installer performed under pertinent other Sections.

C. Work Not Included in This Section:

1. Do not include painting which is specified under other Sections.
2. Unless otherwise indicated, painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.
3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze, and similar finished materials will not require painting under this Section except as may be specified herein.
4. Do not paint any moving parts of operating units; mechanical or electrical parts such as valve operators, linkages, sinkages, sensing devices, and motor shafts, unless otherwise indicated.
5. Do not paint over any required labels or equipment identification, performance rating, name, or nomenclature plates.

D. Definitions:

1. The term "paint", as used herein, means all coating systems materials including primers, emulsions, epoxy, enamels, sealers, fillers and other applied materials whether used as prime, intermediate or finish coats.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section and as listed in Section 01 42 00.

B. Qualification of Manufacturer:

1. Product used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of successful production acceptable to the Architect/Engineer.

C. Qualification of Workmen:

1. Provide at least one person who shall be present at all times during execution of the work of this Section, who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this Section.

D. Paint Coordination:

1. Provide finish coats which are compatible with the prime coats used.
2. Review other Sections of these Specifications as required, verifying the prime coats to be used and ensuring compatibility of the total coating system for the various substrata.
3. Provide barrier coats over incompatible primers, or remove the primer and re-prime as required.

1.03 SUBMITTALS

A. General:

1. Comply with provision of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 calendar days after Award of Contract, submit:

a. Complete materials list of all items proposed to be furnished and installed under this Section.

b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.

C. Samples:

1. Following the selection of colors and glosses by the Architect/Engineer as described in Article 2.01.B. below, submit samples as requested for the Architect/Engineer review:

a. Provide two samples of each color and each gloss for each material on which the finish is specified to be applied.

1.04 PRODUCT HANDLING

A. Delivery of Materials:

1. Deliver all materials to the Project site in original, new, and unopened containers bearing the manufacturer's name and label showing the following information:

a. Manufacturer name; type of material

b. Thinning and mixing instructions.

c. Manufacturer's stock number and batch number

d. Application instructions.

e. Color: name and number.

f. Federal Spec. No., if applicable

g. Contents by volume of major pigment and vehicle constituents

1.05 JOB CONDITIONS

A. Surface Temperatures:

1. Do not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degrees F, unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect/Engineer.

B. Weather Conditions:

1. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the manufacturer's printed instructions as approved by the Architect/Engineer. Applications may be continued during inclement weather within the temperature limits specified by the paint manufacturer during application and drying periods.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Design is based on the use of paint products manufactured by Devoe (ICI Dulux), Glidden (ICI Dulux), Hallman Lindsay, Pittsburgh Paints, Sherwin-Williams, Tnemec, and Diamond Vogel Paint Products and the materials of the manufacturer named in the Painting Schedule.

B. Colors and Glosses:

1. The Architect/Engineer will select colors to be used in the various types of paint specified and will be the sole judge of acceptability of the various glosses obtained from materials proposed to be used by the Contractor.

C. Undercoats and Thinners:

1. Provide undercoat paint produced by the same manufacturer as the finish coat. Use only the thinners recommended by the paint manufacturer, and use only to the recommended limits. Insofar as practicable, use undercoat, finish coat, and thinner material as parts of a unified system of paint finish.

D. Standards:

1. Provide paint materials which meet or exceed the standards listed for each application in the Painting Schedule in Part 3 of this Section.

2.02 APPLICATION EQUIPMENT

A. General:

1. For application of the approved paint, use only such equipment as is recommended for application of the particular paint by the manufacturer of the particular paint, and as approved by the Architect/Engineer.

B. Other Materials:

1. All other materials, not specifically described, but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kinds, and as selected by the General Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Discrepancies:

1. Do not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 MATERIALS PREPARATION

A. General:

1. Mix and prepare painting materials in strict accordance with the manufacturer's recommendations as approved by the Architect/ Engineer.

3.03 SURFACE PREPARATION

A. General:

1. Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations as approved by the Architect/Engineer.
2. Remove all removable items which are in place and are not scheduled to receive paint finish, or provide surface applied protection prior to surface preparation and painting operations.
3. Following completion of painting in each space or area, reinstall the removed items by using workmen skilled in the necessary trades.

B. Preparation of Wood Surfaces:

1. Clean all wood surfaces until they are free from dirt, oil, and all other foreign substances.

2. Smooth all finished wood surfaces exposed to view, using the proper sandpaper and spackling compound. Where so required, use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface.
3. Unless specifically approved by the Architect/Engineer, do not proceed with painting of wood surfaces until the moisture content of the wood is 12% or less as measured by a moisture-meter approved by the Architect/Engineer.

C. Preparation of Metal Surfaces:
1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.
2. On galvanized surfaces, use solvent for the initial cleaning and then treat the surface thoroughly with phosphoric acid etch. Remove all etching solution before proceeding.
3. Allow to dry thoroughly before application of paint.
4. Aluminum Conduit:
a. Interior, Non-Immersion
b. Surface Preparation: SSPC-SP1 “Solvent Cleaning”, and dry.
5. Exterior Metal, Ferrous:
a. Surface Preparation: SSPC-SP6 “Commercial Blast Cleaning” – Field.
6. Interior Metal, Ferrous:
a. Surface Preparation: SSPC-SP3 “Power Tooled Cleaning” and Solvent Wiped Field.
7. Steel Joists - Interior Exposure:
a. Surface Preparation: Clean and dry, and SSPC-SP2 “Hand Tool Cleaning” – Field.

D. Preparation of Gypsum Wallboard Surfaces:
1. Preparation of Gypsum wallboard surfaces shall be as per the requirements in Section 09 29 00 - Gypsum Wallboard.

E. Preparation of Concrete and Masonry Block Surfaces to be Painted:
1. Fill cracks and irregularities with portland cement grout to provide uniform surface texture.
2. Fill concrete masonry unit surfaces with block filler.
3. Surface shall be cured, clean, and dry.

3.04 PAINT APPLICATION

A. General Requirements:
1. Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer. Test with moisture meter.
2. Apply paint, enamel, stain, and varnish with suitable brushes, rollers, or spraying equipment.
a. Rate of application shall not exceed that as recommended by paint manufacturer for the surface involved less than 10% allowance for losses.
b. Keep brushes, rollers, and spraying equipment clean, dry, free from contaminates and suitable for the finish required.
3. Apply stain by brush.
4. Comply with recommendation of product manufacturer for drying time between succeeding coats.
5. Vary slightly the color of successive coats.
6. Sand and dust between each coat to remove defects visible from a distance of five feet.

7. Finish coats shall be smooth, free of brush marks, streaks, laps or pile up of paints, and skipped or missed areas. Finished metal surfaces shall be free of skips, voids or pinholes in any coat when tested with a low voltage detector.

B. Inspection:

1. Do not apply additional coats until completed coat has been inspected by the Architect/Engineer.
2. Only inspected coats of paint will be considered in determining number of coats applied.
3. Leave all parts of moldings and ornaments clean and true to details with no undue amount of paint in corners and depressions.
4. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
5. Apply primer on all work before glazing.
6. Change colors at doors where colors differ between adjoining spaces or rooms and where door frames match wall colors.
7. Refinish entire wall where portion of finish has been damaged or is not acceptable.

C. Painted Work:

1. Back prime all interior trim.
2. Runs on face shall not be permitted.

D. Stained (and Natural) Finish:

1. Adjust natural finishes as necessary to obtain identical appearance on veneers and solid stock.

E. Cleaning:

1. Touch-up and restore finish where damaged.
2. Remove spilled, splashed or splattered paint from all surfaces.
3. Do not mar surface finish or item being cleaned.
4. Leave storage space clean and in condition required for equivalent spaces in Project.

F. Completed work shall match the approved samples for color, texture, and coverage. Remove, refinish, or repaint all work not in compliance with specified requirements.

3.05 PAINTING SCHEDULE

A. General:

1. Painting required under this Section is specified herein and shown on the Drawings.

B. Exterior Metal, Ferrous:

1. First Coat: Sherwin-Williams Kem Kromik Universal Metal Primer.
2. Finish Coats: Two coats of Sherwin-Williams Industrial Enamel (B54Z Series).

C. Interior Metal, Ferrous:

1. First Coat: Sherwin-Williams Kem Kromik Universal Metal Primer.
2. Finish Coat: Two coats of Sherwin-Williams Industrial Enamel (B54Z Series).

D. Structural Steel Frames, Girts, Bridge Crane Frame, Overhead Sectional Door steel frames, Louvers and Mechanical Penetrations; Hollow Metal Doors, Hollow Metal Door Frames and Window Frames; Metal Stairs and Rails, Guardrails, ladders and Handrails:

1. First Coat: Sherwin-Williams Kem Kromik Universal Metal Primer.
2. Second Coat: Two coats of Sherwin-Williams Industrial Enamel (B54Z Series).

E. Interior Masonry Exposed to View:
   1. Top of masonry wall down to finish floor:
      a. Primer: Sherwin Williams Loxon Block Surfacer A24W200 Series
      b. First Coat: Sherwin Williams High Performance Epoxy B67-200 Series
      c. Second Coat: Sherwin Williams High Performance Epoxy B67-200 Series

F. Interior Floor Slab Markings and Exterior Pavement Markings:
   1. First Coat: Tnemec 161 Series - White with 20% Thinner No. 4, rolled at 160 SF/Gal.
   2. Second Coat: Tnemec 161 Series – White, rolled at 160 SF/Gal

G. Door Louvers
   1. First Coat: Sherwin-Williams Kem Kromik Universal Metal Primer.
   2. Second Coat: Two coats of Sherwin-Williams Industrial Enamel (B54Z Series).

H. Exposed Mechanical and Electrical System
   1. Two coats of Sherwin-Williams Super Save-Lite Hi-Tec Dryfall Eg-Shel.

END OF SECTION

SECTION 10 14 00
INTERIOR SIGNAGE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Provide all interior signs, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section.

B. Qualifications of Manufacturer:

1. Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/ Engineer.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within fifteen (15) working days after Award of Contract, submit:
   a. Complete materials list of all items proposed to be furnished and installed under this Section;
   b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements;
   c. Shop drawings for all sign letters and sizes showing components, arrangements, dimensions, orientation on walls, letter style, mountings, finish and accessories.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Equal products of other sign manufacturers will be acceptable when approved by the Architect/Engineer in accordance with the General Conditions.

2.02 GENERAL SIGNS

A. Uni-Sex Toilet Room Sign:

1. Provide all door signage, complete, in place, specified herein, and needed for a complete and proper installation.
2. Mounting height shall be in accordance with manufacturer’s recommendations, in accordance with Americans with Disabilities Act, and Accessibility Guidelines.

3. All signage plates shall be raised letter type size 6" x 6" with 1/2" radius corners. Character height of 3 inches for the pictogram and 5/8 inch for the lettering. All lettering shall be accompanied by grade 2 Braille.
4. Provide the following signage:
    a. At Uni-Sex Toilet Room
        i. International Symbol (Uni-sex) - Symbol Height: 3.5"
        ii. Wheelchair Symbol - Symbol Height: 3.5"
        iii. Colors to be selected by Architect.
    b. Tactile “Exit” signs – One per door:
        i. Sign size: 3”H x 4”W w/ ½ radius corners.
        ii. Colors to be selected by Architect.
        iii. Sign shall have 5/8” inch lettering. All lettering shall be accompanied by grade 2 Braille.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work to approval of the Architect/Engineer. Do not proceed until satisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install signs in locations specified, above doors, and in accordance with the manufacturer's instructions. Provide all anchors, trim, spacers, and accessories for a complete installation.

3.03 FINAL INSPECTION

A. The manufacturer's recommended installation procedures, when approved by the Architect/Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.01 DESCRI-PTION

A. Work Included:

1. Provide all toilet room accessories, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section.

B. Qualifications of Manufacturer:

1. Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/ Engineer.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 working days after Award of Contract, submit:
   a. Complete materials list of all items proposed to be furnished and installed under this Section;
   b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements;
   c. Manufacturer's recommended methods of installation.
   d. Complete descriptive data on fasteners proposed for each type of wall construction, recommended mounting locations, and mounting instructions.

C. The manufacturer's recommended methods of installation, when approved by the Architect/Engineer, will become the basis for inspecting and accepting or rejecting actual installation methods used on this work.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL

A. Anchors and Fasteners:

1. Provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the accessory to be mounted, and well suited for use with the supporting construction. Where exposed fasteners are permitted, provide oval head theft resistant fasteners with finish matching the accessory.

B. Finish:

1. All accessory items shall be stainless steel with satin finish.

C. Design:

1. Design is based on use of products manufactured by the Bobrick Washroom Equipment, Inc., and catalog numbers of that manufacturer are given as an indication of the quality and style required. Equal products by Bradley Corp., GAMCO- General Accessory Manufacturing Co., ASI- American Specialties, Inc., or other manufacturers approved by the Architect/Engineer will be acceptable in accordance with the General Conditions.

2.02 ACCESSORY ITEMS

A. Furnish and install in each toilet room:

1. Toilet Tissue Dispenser B-2740 (1 required/toilet)
2. 24" w x 36" h Framed Mirror B-165 (1 required/lavatory)
3. Towel Dispenser and Waster Receptacle B-43944 (Room 103)
4. Stainless Steel Grab Bar B-6206 1x 42 (1 required/barrier-free stall)
5. Stainless Steel Grab Bar B-6206 1x 36 (1 required/barrier-free stall)
6. Stainless Steel Grab Bar B-6206 1x 18 (1 required/barrier-free stall)
7. Soap Dispenser B-5050 (mounted in Toilet Room 103)

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the work. Verify spacing of plumbing fixtures and toilet partitions that offset installation of accessories. Do not proceed until unsatisfactory conditions have been corrected.

3.02 COORDINATION

A. Throughout construction of substrate surfaces, use all means necessary to ensure proper and adequate provision for concealed support devices, and for finished openings, to receive the work of this Section.

3.03 INSTALLATION

A. Install the work of this Section in strict accordance with the manufacturer's recommendations as approved by the Architect/Engineer, anchoring all components plumb, level, square, and firmly into position for long life under hard use.

B. Drill holes to correct size and application that is concealed by item, with 1/4" tolerance.

C. Mount surface mounted accessories to back up with toggle bolts, plumb and aligned.

D. Anchor grab bars to resist 300 pound force in any direction.

3.04 ADJUST AND CLEAN

A. Adjust accessories for proper operation.

B. After completion of installation, clean and polish all exposed surfaces.

C. Deliver keys and instruction sheets to Owner.

END OF SECTION

SECTION 10 44 00
FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Provide fire extinguisher cabinets, complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section.

B. Qualifications of Manufacturer:

1. Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/ Engineer.

C. Qualifications of Installers:

1. Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 calendar days after Award of Contract, submit:
   a. Complete materials list of all items proposed to be furnished and installed under this Section;
   b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements;
   c. Shop drawings for fire extinguisher cabinets showing components, arrangements, dimensions, orientation on walls, sections of trim members, dimensioned elevations, grounds, reinforcements, and accessories.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. The fire extinguisher cabinets shall be surface mounted as shown on the Drawings and as manufactured by Potter-Roemer Tri Star, La Puente, CA; Larsen's Manufacturing Co., Minneapolis, MN; JL Industries, Inc., Bloomington, MN, or an approved equal.

B. All-Aluminum Valu-Line Extinguisher Cabinets:

1. The cabinet shall be of corrosion and weather resistant all-aluminum construction, Model No.. AL 2410 SG, painted red and with die-cast breaker hammer and aluminum mounting nuts and bolts. The interior dimension shall be 24" x 10" x 6" with a full glass door.

C. Fire Extinguishers:

1. All fire extinguishers shall be UL rated 4A 80B C multipurpose dry chemical. Nominal Capacity: 10 lbs. each.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work to approval of the Architect/Engineer. Do not proceed until unsatisfactory conditions have been corrected.

B. Install fire extinguisher cabinets in locations and at mounting heights as shown on the Drawings, and in accordance with the manufacturer's instructions. Provide all grounds, brackets, anchors, trim, and accessories for a complete installation.

3.02 FINAL INSPECTION

A. The manufacturer's recommended installation procedures, when approved by the Architect/Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

END OF SECTION

SECTION 10 80 00
MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Provide miscellaneous specialties complete, in place, as shown on the Drawings, specified herein, and needed for a complete and proper installation.

1.02 QUALITY ASSURANCE

A. Standards:

1. Comply with standards specified in this Section.

B. Qualifications of Manufacturer:

1. Use products in the work of this Section produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Architect/ Engineer.

C. Qualifications of Installers:

1. Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.03 SUBMITTALS

A. General:

1. Comply with provisions of Section 01 33 00.

B. Manufacturer's Data:

1. Within 15 calendar days after Award of Contract, submit:

a. Complete materials list of all items proposed to be furnished and installed under this Section;

b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements;

c. Shop drawings showing components, arrangements, dimensions, orientation on walls, sections of trim members, dimensioned elevations, grounds, reinforcements, and accessories.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect materials of this Section before, during, and after installation and to protect installed work and materials of all other trades.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MOP RACK

A. Mop rack shall be model 1315-3, as manufactured by ASI-American Specialties, Inc., in Utility/Storage Room #104. Coordinate installed location with owner.

2.02 OTHER MATERIALS

A. All other materials, not specifically described, but required for a complete and proper installation of the work of this Section, shall be new, first-quality of their respective kinds, and as selected by the Contractor subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the work to approval of the Architect/Engineer. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install in locations shown on the Drawings, as specified herein, and at mounting heights per manufacturer’s recommendations, and in accordance with the manufacturer's instructions. Furnish and install all grounds, brackets, anchors, trim and accessories for a complete installation.

3.03 FINAL INSPECTION

A. The manufacturer's recommended installation procedures, when approved by the Architect/Engineer, will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

END OF SECTION

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes pre-engineered metal building components of the nominal length and width indicated.

1.03 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, design, fabricate and erect the pre-engineered metal building system to withstand loads from winds, gravity, structural movement including movement thermally induced, and to resist in-service use conditions that the building will experience, including exposure to the weather, without failure.

1. Design each member to withstand stresses resulting from combinations of loads that produce the maximum allowable stresses in that member as prescribed in MBMA's "Design Practices Manual.

B. Design Loads: Basic design loads, as well as auxiliary and collateral loads, are indicated on the Drawings.

1. Basic design loads include live load, wind load, and seismic load, in addition to the dead load.
2. Auxiliary loads include dynamic live loads such as those generated by cranes and material handling equipment.
3. Collateral loads include additional dead loads over and above the weight of the metal building system such as sprinkler systems and roof-mounted mechanical systems.

C. Structural Framing and Siding Panels: Design secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturers Association's (MBMA) "Design Practices Manual."

1. Structural Steel: Comply with the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
2. Light Gage Steel: Comply with the American Iron and Steel Institute's (AISI) "Specification for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
3. Welded Connections: Comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures.

D. Metal Building System Changes/Deviations:

1. Metal building systems shown in the contract documents are the result of multi-discipline coordination, quality level required, knowledge of the owner’s requirements, knowledge of the intended use of the building, dimensional requirements, etc. All changes/deviations to the contract documents requested by the metal building system contractor/supplier will require the design professional to re-determine feasibility.
2. The design professional will determine if the change/deviation is required or if it is being requested to save cost. All changes/deviations must be approved by the design professional.
3. If the reason for the change/deviation is determined to be cost savings, the costs incurred by the design professional as a result of the time required to analyze the changes will be charged to the owner and deducted from the contractor’s contract

amount, even if the requested changes/deviations are not approved.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Sections.

B. Product data consisting of metal building system manufacturer's product information for building components and accessories.

C. Shop drawings for metal building structural framing system, siding panels, and other metal building system components and accessories that are not fully detailed or dimensioned in manufacturer's product data.

1. Structural Framing: Furnish complete erection drawings prepared by or under the supervision of a Professional Engineer legally authorized to practice in the jurisdiction where the Project is located. Include details showing fabrication and assembly of the metal building system. Show anchor bolts settings and sidewall, endwall, and roof framing. Include transverse cross-sections.
2. Siding Panels: Provide layouts of panels on walls and roofs, details of edge conditions, joints, corners, custom profiles, supports, anchorages, trim, flashings, closures, and special details. Include transverse cross-sections.
3. Building Accessory Components: Provide details of metal building accessory components to clearly indicate methods of installation.

D. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for metal siding panels with factory-applied finishes.

E. Samples for verification purposes of roofing and siding panels. Provide sample panels 12 inch (300 mm) long by actual panel width, in the profile, style, color, and texture indicated. Include clips, battens, fasteners, closures, and other panel accessories.

F. Installer certificates signed by metal building manufacturer written certification certifying that the installer complies with requirements included under the "Quality Assurance" Article.

G. Professional Engineer's certificate prepared and signed by a Professional Engineer, legally authorized to practice in the jurisdiction where Project is located, verifying that the structural framing and covering panels meet indicated loading requirements and codes of authorities having jurisdiction.

H. Submit final component design calculations and drawings as required by local, state, and federal rules and regulations applicable to work and project location. Minimum of five (5) copies shall be submitted.

I. Submit fees for local and state review. Local and state acceptance of component design is mandatory prior to fabricating components. Submittal shall include required forms, fees, calculations, registered stamps, and signatures.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer to erect the pre-engineered metal building components who has specialized in the erection and installation of types of metal buildings systems similar to that required for this Project and who is certified in writing by the metal building system manufacturer as qualified for erection of the manufacturer's products.

B. Manufacturer's Qualifications: Provide pre-engineered metal building components manufactured by a firm experienced in manufacturing metal buildings systems that are similar to those indicated for this project and have a record of successful in-service performance.

C. Single-Source Responsibility: Obtain the metal building system components, including secondary structural framing, wall covering, and accessory components, from one source from a single manufacturer.

D. Design Criteria: The Drawings indicate sizes, profiles, and dimensional requirements of the pre-engineered metal building system. Metal building systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept or intended performance. The burden of proof for equality is on the proposer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated components, sheets, panels, and other manufactured items so they will not be damaged or deformed. Package wall panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weather-tight ventilated covering. Store metal wall and roof panels so that water accumulations will drain freely. Do not store panels in contact with other materials that might cause staining, denting or other surface damage.

1.07 WARRANTY

A. Siding Panel Finish Warranty: Furnish the siding panel manufacturer's written warranty, covering failure of the factory-applied exterior finish on metal wall panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Warranty period for factory-applied exterior finishes on wall panels is 20 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with specified requirements, provide metal building systems provided by one of the following:

1. A & S Building Systems, Inc., Caryville, TN, (800) 274-2100.
2. American Buildings Co., Eufaula, AL, (334) 687-2032.
3. American Steel Building Co., Inc., Houston, TX, (800) 877-8335.
4. Armco/Steelox Systems, Inc., Mason, OH, (800) 783-3569.
5. Behlen Manufacturing Co., Columbus, NE, (800) 228-0340.
6. Butler Manufacturing Co., Kansas City, MO, (816) 968-3000.
7. Ceco Building Systems, Columbus, MS, (662) 328-6722.
8. Chief Industries, Inc., Grand Island, NE, (308) 389-7200.
9. Dean Steel Buildings, Inc., Ft. Myers, FL, (239) 334-1051.
10. Garco Building Systems, Airway Heights, WA, (800) 941-2291.
11. Gulf States Manufacturers, Inc., Starkville, MS, (800) 844-4853
12. Kirby Building Systems, Inc., Portland, TN, (615) 325-4165.
13. Mesco Metal Buildings, Southlake, TX, (800) 556-3726.
14. Southern Structures, Inc., Lafayette, LA, (800) 264-5981.
15. Space Buildings, E. Taunton, MA, (508) 823-7777.
16. Star Building Systems, Oklahoma, OK, (800) 654-3921.
17. VP Buildings, Memphis, TN, (800) 238-3246.
18. Whirlwind Building Systems, Houston, TX, (800) 324-9992.

2.02 MATERIALS

A. Steel Members Fabricated by Cold Forming: Comply with ASTM A 1008/ A 1008M, Grade 50.

B. Cold-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 1008/A 1008M or ASTM A 568/A 568M.

C. Hot-Rolled Carbon Steel Sheet: Comply with requirements of ASTM A 568/A 568M.

D. Structural Quality Zinc-Coated (Galvanized) Steel Sheet: Comply with ASTM A 653 with G90 (ASTM A 653M with Z275) coating. Grade to suit manufacturer's standards.

E. Commercial Quality Zinc-Coated (Galvanized) Steel Sheet: Comply with ASTM A 653 with G60 (ASTM A 653M with Z180) coating.

F. Bolts for Structural Framing: Comply with ASTM A 307 or ASTM A 325/ A 325M as necessary for design loads and connection details.

G. Thermal Insulation:

1. Walls: R-19 6" Glass fiber blanket insulation with vinyl reinforced vinyl scrim, complying with ASTM C 991, of 0.5 lb per cu. ft. (8 kg/cu. m) density, thickness as indicated, with UL flame spread classification of 25 or less, and 2 inch (50 mm) wide continuous vapor-tight edge tabs.
   a. Vapor Barrier: Vinyl-reinforced scrim.
   b. Retainer Strips: 26 gauge (0.55 mm) formed galvanized steel retainer clips colored to match the insulation facing.
2. Roof: Simple Saver System or approved equal with a minimum R-Value of 35.
   a. Cavity R-Value: 25.
   b. Continuous R-Value: 10.

2.03 FINISHES

A. General:
   1. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to applying and designing finishes.
   2. Finish metal fabrications after shop assembly.

B. Shop Finish
   1. Surface Preparation:
      a. SSPC-SP1: The Society for Protective Coatings "Surface Preparation Specification No. 1 – Solvent Cleaning", September 1, 2000 Edition and SSPC-SP2: "Surface Preparation Specification No. 6 – Commercial Blast Cleaning", September 1, 2000 Edition.
   2. Primer:
      a. Fast curing, universal modified alkyd, rust inhibiting shop coat with good resistance to normal atmospheric corrosion compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Primer shall comply with all federal standards for VOC, lead, and chromate levels. Color shall be manufacturer's standard unless noted otherwise.
      b. Shop prime immediately after surface preparation, applying according to manufacturer's instructions to provide a dry film thickness of not less than 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surface.
   3. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with the following requirements:
      a. ASTM A 153/A 153M for galvanizing hardware.
      b. ASTM A 123/A 123M for galvanizing both fabricated and unfabricated products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip

0.0299 inch (0.76 mm) thick or thicker.

C. Touch-Up Painting

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of the shop paint and paint all exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.
2. Galvanizing Repair Paint: High-zinc-dust-content paint for galvanizing welds and repair-painting galvanized steel, with dry film containing not less than 90 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.

D. Finish Painting

1. Finish Painting shall be performed under Division 9 Section 09 90 00 – Paints and Coatings.

2.04 STRUCTURAL FRAMING

A. Secondary Framing: Provide the following secondary framing members:

1. Sidewall and endwall girts: "C"-or "Z"-shaped sections fabricated from minimum 14 gage (1.5 mm) shop-painted roll-formed steel.
2. Flange and sag bracing.

B. Bolts: Provide shop-painted bolts except when structural framing components are in direct contact with roofing and siding panels. Provide zinc-plated or cadmium-plated bolts when structural framing components are in direct contact with roofing and siding panels.

C. Shop Painting: Clean surfaces to be primed of loose mill scale, rust, dirt, oil, grease, and other matter precluding paint bond. Follow procedures of SSPC-SP3 for power-tool cleaning.

1. Prime structural steel secondary framing members with the manufacturer's standard rust-inhibitive primer. Color shall match structural steel.

2.05 ROOFING

A. Roof Panel:

1. Batten Lok HS (High Seam) by MBCI or equal.
   a. Thickness: Standard 24 Ga.
   b. Finish: Signature 200 coating
      i. Color: Polar White.

2.06 SIDING PANELS

A. Face Sheets: Fabricate wall panel face sheets to the profile or configuration indicated from standard 26 gage, structural quality, Grade C, zinc-coated steel sheets.

1. Exterior Metal Wall Panel Type ‘A’ Profile: Panel 'PBR' as manufactured by MBCI, or equal.
   a. Color ‘A’ (Per Elevations): MBCI Signature 300 – HUNTER GREEN
2. Interior Liner Panel: Profile ‘R’ as manufactured by MBCI, or equal.

B. Insulated Wall Panels (Alternate No. 3)

1. Eco-ficient Insulated R Panel as manufactured by MBCI products.
   a. Thickness: 3”
   b. Gage: 26 Interior, 26 Exterior
   c. Exterior Color: MBCI Signature 300 – HUNTER GREEN
   d. Interior Color: USDA White

C. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Provide metal-backed neoprene washers under heads of fasteners bearing on weather side of panels.

2. Use aluminum or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.
3. Locate and space fastenings in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.
4. Provide fasteners with heads matching color of roofing or siding sheets by means of plastic caps or factory-applied coating.

D. Accessories: Provide the following sheet metal trim accessories factory-formed of the same material as the siding and finished with color: MBCI Signature 300 – BROWNSTONE. Corner Trim is to match siding color: MBCI Signature 300 – Hunter Green.
1. Flashings.
2. Closures.
3. Fillers.
4. Metal expansion joints.
5. Gutters and downspouts.

E. Flexible Closure Strips: Closed-cell, expanded cellular rubber, self-extinguishing flexible closure strips. Cut or pre-mold to match configuration of roofing and siding sheets. Provide closure strips where indicated or necessary to ensure weather-tight construction.

F. Sealing Tape: Pressure-sensitive 100 percent solids grey polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, non-sag, non-toxic, non-staining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
1. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

2.07 SHEET METAL ACCESSORIES

A. General: Provide coated steel sheet metal with coated steel siding panels.
1. Color to be: MBCI Signature 300 - Brownstone

B. Gutters: Form in 96-inch long sections, complete with end pieces, outlet tubes, and other special pieces as required. Size in accordance with SMACNA. Join sections with riveted and soldered or sealed joints. Provide expansion-type slip joint at center of runs. Furnish gutter supports spaced 36 inches on-center, constructed of the same metal as gutters. Finish to match siding panel finish. Gutter system with accessories as manufactured by Perimeter Systems, Division of Southern Aluminum Finishing Company, Inc. Profile to be no. G-2/R 8”, 20 gauge, Kynar 500 Finish, manufactured of aluminum with expansion joints at 40’- 0” intervals.

C. Downspouts: Form in 10-foot long sections or shorter, complete with elbows and offsets. Join sections with 1-½ inch telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and approximately 60 inches center to center. Finish to match wall panels. The downspouts shall be constructed of 18-gauge aluminum with Kynar 500 finish.

D. Sheet Metal Accessories: Install gutters, downspouts, and accessories in accordance with manufacturer’s recommendations for positive anchorage to building and weather-tight mounting. Adjust operating mechanism for precise operation.

2.08 FABRICATION

A. General: Design prefabricated components and necessary field connections required for erection to permit easy assembly and disassembly.
1. Fabricate components in such a manner that once assembled, they may be disassembled, repackaged, and reassembled with a minimum amount of labor.
2. Clearly and legibly mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

B. Structural Framing: Shop-fabricate framing components to indicated sizes for erection, welded in place. Provide holes for anchoring or connections shop-drilled or punched to template dimensions.
   1. Shop Connections: Provide power riveted, bolted, or welded shop connections.
   2. Field Connections: Provide bolted field connections.

PART 3 - EXECUTION

3.01 ERECTION

A. Girts: Locate and space wall girts to suit door and window arrangements and heights. Secure girts to structural framing and hold rigidly to a straight line by sag rods.

B. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical and electrical work. Securely attach to building structural frame.

3.02 SIDING

A. General: Arrange and nest sidelap joints so prevailing winds blow over, not into, lapped joints. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weather-tight enclosure. Avoid "panel creep" or application not true to line. Protect factory finishes from damage.
   1. Field cutting of exterior panels by torch shall not be permitted.

B. Wall Sheets: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for weather-proofing. Handle and apply sealant and backup in accordance with the sealant manufacturer's recommendations.
   1. Align bottom of wall panels and fasten panels with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws. When building height requires two rows of panels align lap of panels over wall panels.
   2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
   3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

C. Sheet Metal Accessories: Install sheet metal accessories in accordance with manufacturer's recommendations for positive anchorage to building and weather-tight mounting. Adjust operating mechanism for precise operation.

D. Thermal Insulation: Install insulation concurrently with installation of wall panels in accordance with manufacturer's directions. Install blankets straight and true in one-piece lengths with both sets of tabs sealed to provide a complete vapor barrier. Locate insulation on back side of wall sheets.

E. Cleaning and Touch-Up: Clean component surfaces of matter that could preclude paint bond. Touch up abrasions, marks, skips, or other defects to shop-primed surfaces with same type material as shop primer.

END OF SECTION

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SECTION 21 00 00
FIRE PROTECTION

PART 1 - GENERAL

1.01 GENERAL

A. The Fire Protection Contractor is required to read all specification sections and review all drawings related to the fire protection, mechanical, electrical, plumbing and controls work on this project prior to bidding. Full coordination of all trades shall be required within this project for the best overall installation.

1.02 DESCRIPTION

A. Work Included in this Specification:

1. Design, fabricate, furnish, install, and secure all necessary approvals for a complete building fire protection system acceptable to State and Local fire authorities, and other officials having jurisdiction, and in accordance with the standards set forth in this specification. Work includes but is not limited to the following:
   a. Hydraulically designed DRY TYPE building fire protection system based on flow test data.
   b. Building shall be sprinklered in accordance with NFPA 13, Current Edition.
2. The Plumbing Contractor will provide a water main to a flanged connection approximately 12-inches above the finished floor. All other pipe sizing shall be as specified by the Fire Protection Contractor.
3. Accelerator and Trim, if required based on design pipe capacities.
4. Double check backflow device per local requirements.
5. System shutoff valves.
6. Spare parts, tools, and spare sprinkler heads in wall mounted box located where indicated on the Construction Drawings, including in proportion all sprinkler head types used.
7. Fire department connection located where indicated on the Construction Drawings with maintenance type check valve and ball-drip.
8. Drain and test connections.
9. Riser test gages.
10. Pressure switches, flow switch and two alarm bells.
11. Chrome plated escutcheon plates for wall penetrations in exposed areas.
12. Sprinkler identification signs for use in identifying all system control, drains, inspector test valves, and wherever else required.
13. System testing.
14. All cleanup associated with this work.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. Section 22 00 00: Mechanical and Plumbing Scope of Work

B. Section 22 10 00: Plumbing

C. Section 26 00 00: Electrical Scope of Work

1.04 QUALITY ASSURANCE

A. Qualifications of Installers:

1. Contractor shall be able to demonstrate satisfactory performance in work of equal magnitude and complexity.

B. Codes and Standards:

1. Comply with all pertinent codes and regulations, including but not limited to the following:

a. National Fire Protection Association standards.

b. Wisconsin Department of Commerce requirements.

c. Requirements of Local authorities having jurisdiction.

d. Owner's insurance company requirements.

1.05 SUBMITTALS

A. Shop Drawings:

1. Within 30 days after award of Contract, and before any fire sprinkler system materials are delivered to the job site, submit complete shop drawings to the Architect/Engineer in accordance with the General Provisions of these specifications:

a. Shop drawings shall include a materials list describing all proposed materials by manufacturer's name and catalog number with catalog sheets.

B. Construction Record “As-Built” Drawings:

1. During progress of the work maintain an accurate record of all changes made in the fire sprinkler system installation from the layout and materials shown on the approved drawings. These drawings shall remain on site, kept current and available for review.

1.06 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect fire sprinkler system materials before, during and after installation and to protect the installed work of all other trades.

B. Replacements:

1. In the event of damage immediately make all repairs and replacements necessary and at no additional cost to the owner.

PART 2 - PRODUCTS

2.01 DESIGN

A. General:

1. The system shall be complete in all regards and shall include the following:

a. All areas are fully sprinklered, in full compliance with NFPA.

b. Piping in areas having interstitial ceiling space shall be concealed.

c. Exposed piping is not allowed.

d. Dry system drain-down location shall be coordinated with Architect/Engineer.

e. Inspector’s test connection location shall be coordinated with Architect/ Engineer.

f. The design shall be completed in coordination of other system installations.

B. Sprinkler Heads:

1. Sprinkler heads in areas of exposed piping shall be manufacturers standard finish and may be pendant or upright.

2. Provide head guards in areas where sprinklers are susceptible to damage.

C. Coverage Rates:

1. All areas shall be sprinklered per NFPA 13.

a. System shall be designed to meet the hazard requirements as defined in the above-referenced standard. The classifications listed here are intended only as

guidelines and do not relieve the Contractor of the responsibility to meet the occupancy requirements of NFPA:

b. Water Supply: Contact Local Water Utility for available flow rates.

2.02 MATERIALS

A. Piping, Fittings and Hangers:

1. Pipe shall be in accordance with NFPA 13. Pipe hangers, rods and attachments shall be UL listed and meet NFPA standards.

B. Double Check Backflow Device:

1. Ames Model 2000ss or 3000ss as required, maximum working pressure 175 PSI, approved for vertical installation, UL/FM approved, or approved equal.

C. Gate Valves:

1. Nibco Model F-607-RW, maximum working pressure 200 PSI, flanged ends, rising stem, outside screw and yoke, bolted bonnet, resilient wedge, UL/FM approved, or approved equal.

D. Swing Check Valve:

1. Viking Model G1, maximum working pressure 250 PSI, flanged or grooved ends, spring operated swing type, UL/FM approved, or approved equal.

E. Fire Department Connection:

1. Guardian Model 151 or Model 252 as required, single or duplex inlet exposed type wall mounted connection, polished brass finish with red wall plate and breakaway cap(s), UL/FM approved, or approved equal. Coordinate & verify with Local Fire Authorities.

F. Pressure Switch:

1. Potter Electric Signal Company Model PS10A, 1/2-inch NPT male pressure connection, operates on pressure decrease at 5 PSI, maximum differential of 1 PSI, electrical contacts to match Alarm Bell, maximum system pressure of 250 PSI, UL/FM approved, or approved equal.

G. Flow Switch:

1. Potter Electric Signal Company Model VSR-F, vane type waterflow switch with retard, 10 GPM minimum flow rate for alarm, electrical contacts to match Alarm Bell, factory retard set at 20 to 40 seconds, UL/FM approved, or approved equal.

H. Alarm:

1. Potter Electric Signal Company Horn/Strobe Model SASH-120, 120 Volts, 60 Hertz, 0.05 Amps, red powder coating finish, indoor or outdoor use, 87 decibels minimum at 10 feet, UL/FM approved, or approved equal.
2. Provide visible notification of water flow at the fire department connection location according to the requirements of the Local Fire Inspector.

I. Spare Head Cabinet:

1. Guardian, steel construction with welded joints, hinged cover, finished inside and outside with red enamel paint, including space for sprinkler wrenches, or approved equal.

J. Other Materials:

1. All other materials not specifically described but required for a complete and proper installation shall be new, first quality of their respective kinds, and subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Verify that fire sprinkler system can be installed in complete accordance with pertinent codes and regulations and the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy immediately notify the Architect/Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been resolved.

3.02 INSTALLATION

A. Coordinate all electrical requirements with electrical contractor.

B. Install the fire sprinkler system in accordance with all codes and regulations and the requirements of authorities having jurisdiction.

C. Locking or anchoring fittings shall be installed in accordance with manufacturer's recommendations.

D. Critical locations of fire protection mains are indicated on the Construction Drawings.

E. Alarms:

1. Provide and install the pressure switch, flow switch and alarm bells.
2. Electrical Contractor shall provide all necessary wiring to and from the switches and alarm bells.

F. When dry system equipment is utilized, electrical contractor shall provide power for all air compressors, pertinent equipment, and other devices.

G. Interferences:

1. In the event of interference between fire protection sprinkler piping and the work of mechanical, electrical, plumbing, structural, or architectural trades, the General Contractor and Architect/Engineer shall be notified. The interference will be evaluated and the General Contractor shall decide which contractor shall be responsible for changes. The Fire Protection Contractor and all other contractors are responsible for coordinating their work with other trades.

3.03 TESTING

A. Upon completion of the fire sprinkler system installation furnish all personnel and equipment necessary to test the complete system per NFPA 13R and 13. Make all adjustments necessary to secure the required approvals. Protect municipal systems from cross connection and damage.

3.04 CLEANING UP

A. Prior to acceptance thoroughly clean all exposed portions of the work. Remove all labels and all traces of foreign substance. Use only cleaning solutions approved by the manufacturer of the item being cleaned, being careful to avoid all damage to finished surfaces.

3.05 ACCEPTANCE

A. After the fire sprinkler system has been approved secure a letter of final acceptance from the authority having jurisdiction. Deliver three copies of the letter to the Architect/Engineer.

B. Deliver three copies of Construction Record “As-Built” drawings to the Architect/Engineer. Full payment will not be authorized until Construction Record drawings are received by the Architect/Engineer.

3.06 TRAINING AND SERVICE

A. Provide three copies of clear and thorough written instructions on the operation of the fire protection system to the Architect/Engineer.

B. Schedule and execute a meeting with the Owner to review the written instructions along with a walk-through of the completed system.

END OF SECTION

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SECTION 22 00 00
MECHANICAL AND PLUMBING SCOPE OF WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

Contractor shall provide all labor, materials, equipment, permits, inspection fees, supervision, utility company charges, and other items noted in Contract General Conditions necessary to yield completely operable and tested systems as shown on the Drawings and specified herein. The work includes, but is not limited to, the following areas:

A. Site Work:
   1. Site storm water including piping, catch basins and manholes as required and connection to existing systems.
   2. Sanitary sewer drainage piping from 5' outside the building to existing municipal system.
   3. Potable water service and fire protection sprinkler water service from existing municipal water main to the building.
   4. Coordination with the utility company and cost of natural gas service to the building.

B. Building Work:
   1. Plumbing:
      a. Sanitary drain, waste, and vent systems from all points of discharge and connections, including backwater valve and garage catch basins to exterior drainage system 5' outside the building. Trench drains are by the General Contractor.
      b. Domestic hot and cold water distribution systems to all points of use, including water heater. Include meter and capped connection for irrigation water.
      c. Fire protection service from five feet outside the building, including providing one 6-inch flanged connection approximately 12” above finished floor for fire protection.
      d. Domestic hot, cold, and recirculated water distribution systems from new service to all points of use. All cross connection control equipment and piping as required by the State of Wisconsin Plumbing Code, and in accordance with local requirements.
      e. New plumbing fixtures and trim.
      f. Condensate drain system from furnaces.
      g. Testing to verify compliance with lead regulatory requirements in completed domestic systems.
   2. Mechanical Piping Systems:
      a. Natural gas distribution piping from new natural gas service at 10-inch w.c., including pressure regulators, strainers and accessories to all points of use.
   3. Fire protection dry sprinkler system for entire facility.
   4. HVAC
      a. Makeup air systems and associated air distribution system and exhaust system.
      b. Electric Unit Heaters
      c. Gas Fired Unit Heaters
      d. Air distribution systems including ductwork, supply and exhaust grilles, registers and diffusers, louvers, hoods, balancing and control dampers and related accessories.

5. Mechanical insulation for piping systems, ductwork, and equipment as specified.
6. Complete controls and instrumentation.
7. System startup, testing, adjusting and balancing.
8. Piping and duct cleaning and pressure testing.
9. All pressure and temperature instrumentation not a part of any control system.

C. Equipment schedules are provided as a convenience to the Contractor, but do not relieve him of his responsibility to furnish all items shown on the Drawings and indicated in the Specifications.

D. Coordination with other trades.

E. Touch-up painting of damaged materials furnished by this Contractor and damaged by this Contractor. Each Contractor shall be responsible for replacement/patching of all finish materials which have been disrupted and/or damaged as a result of their construction procedures. All materials shall match original and all work shall be done by experienced field tradesmen.

F. One year labor and equipment guarantee on completed installation.

G. Cleanup associated with work of respective trades.

H. Flushing, cleaning, and pressure testing of installed systems.

I. No asbestos-containing materials or materials capable of discharging lead into potable water or air systems shall be used.

END OF SECTION

SECTION 22 01 00
MECHANICAL AND PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.01 STANDARDS

A. All work shall be executed in a professional manner and shall be coordinated with other work being performed at the site. The Architect/Engineer reserves the right to direct the removal and replacement of any item which in his opinion will not present an orderly and reasonably neat or workmanlike appearance. Such removal or replacement shall be at the Contractor's expense.

B. The Contractor shall pay all taxes, fees, licenses, permits and inspection costs required in connection with the work.

1.02 COMPLIANCE

A. All work and materials shall comply with all applicable laws and building codes and shall conform to the applicable sections of the following codes and standards. Where standards or codes are mentioned in these specifications, the edition or revision in effect during construction of this project shall be followed; hence, the specified numbers may be superseded by new numbers.

1. American Disabilities Act
2. Air Moving and Conditioning Associations, Inc. (AMCA)
3. Air-Conditioning and Refrigeration Institute (ARI)
4. American National Standards Institute (ANSI)
5. American Society of Civil Engineers (ASCE)
6. American Society for Testing Materials (ASTM)
7. American Society of Mechanical Engineers (ASME)
8. American Water Work Association (AWWA)
9. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE)
10. Applicable Codes of the State of Wisconsin and local agencies having jurisdiction
11. Cast Iron Soil Pipe Institute
12. Institute of Boiler and Radiator Manufacturers (IBR)
13. International Approval Services (IAS) (formerly AGA)
14. NAFM - Sound Test Codes
15. National Board of Fire Underwriters
16. National Electrical Code (NEC)
17. National Electrical Manufacturers Association (NEMA)
18. National Fire Protection Association (NFPA)
19. OSHA Standards, particularly #1910
20. Sheet Metal and Air-Conditioning Contractors National Association (SMACNA)
21. Standards of the Hydraulic Institute
22. Underwriters' Laboratories (UL)
23. The Instrument Society of America

1.03 SUBSTITUTIONS AND CHANGES

A. Comply with applicable requirements of Division 1 including Section 01 33 00 Submittal Procedures and Section 01 25 13 Product Substitution Procedures.

B. It shall be the responsibility of the contractor to notify all parties concerned of any changes or substitutions he has been authorized to make, and he must include in his notice a full description, including drawings, if necessary, of any deviation from dimension shown on the plans or applicable to manufacturer's named on schedules and named in specifications.

C. If equipment is provided other than that upon which the design is based, contractor shall coordinate the installation with the work of all other trades and with the space available for installation. Contractor shall pay for any changes caused to other trades as a result of this substitution, plus the additional cost of any required engineering needed to incorporate the proposed alternates.

D. Elevation of piping, ductwork and equipment indicated on drawings are to be used as guidelines to assist Contractor with installations. Minor changes to these elevations may be necessary to eliminate unforeseen interferences. The Contractor shall obtain the Architect/Engineer's written approval before proceeding with any changes in elevations.

1.04 EQUIPMENT LISTS AND IDENTIFICATION

A. Each Contractor supplying equipment items shall furnish three sets of construction books and spare parts list recommended for the proper operation and maintenance of the equipment. State exact quantity so there is no ambiguity.

B. All major parts of built-up equipment or devices shall bear the manufacturer's nameplate; giving name of manufacturer, description, size, type, serial number, electrical characteristics, and related data.

1.05 EXAMINATION OF PLANS, SPECIFICATION, AND SITE

A. Before submitting a bid the contractor shall be familiar with all features of the building and site which may affect the execution of his work. No additional payment will be allowed for work resulting from the failure to obtain this information. The contractor shall clarify any omissions or errors in the plans specifications with architect or engineer before submitting his bid.

1.06 DRAWINGS

A. Due to the scale of the drawings, it is not always possible to indicate all offsets, fittings, valves, and similar items which may be required. This Contractor shall carefully investigate the structural and finish conditions affecting his work and shall plan accordingly, furnishing such valves, fittings, offsets, vents, drains and specialties as may be required to meet such conditions. All piping shall be installed as closely as possible to walls, ceiling, columns, and other structures (consistent with the proper space for covering, removal of pipes, valve access, and other maintenance relationships) so as to occupy a minimum of space and all offsets, fittings, valves, and similar items required to accomplish this must be furnished by the Contractor without additional expense to the Owner. In case interferences develop, the Architect/Engineer shall decide which work is to be relocated regardless of which was first installed.

B. Before submitting his proposal, the Contractor shall examine the architectural, electrical and mechanical drawings and, if any discrepancies occur between them and this specification, he shall report same to the Architect/Engineer in writing prior to bidding and obtain written instructions for changes in the work.

C. In case of a difference between the plans and specifications, or between specifications, the decision of the Architect/Engineer shall prevail.

D. The Contractor shall keep a set of prints on which each he will mark line and grade and other changes made during installation. All changes shall be made through the Construction Manager with Architect/Engineer approval. At the end of the job, or when requested, he will make this information available to the Architect/Engineer for revision of the design drawings for records. Comply with the requirements of Section 01782 Project Record Documents.

1.07 SITE AND JOB CONDITIONS - DIMENSIONS AND MEASUREMENTS

A. Before submitting proposals, bidders shall visit premises, verify site conditions and conditions under which work under this contract must be conducted. Submission of proposal signifies that bidder has visited premises, has made said examinations and verifications and is fully conversant with all said conditions. No claims for additional compensation will be considered or paid, due to failure to be so informed.

B. Before commencing work, examine all spaces, surfaces and areas indicated on drawings to receive work. Report necessary corrections in writing immediately to the Architect/Engineer. Do not proceed until corrections (if any required) have been made. Commencing work signifies acceptance of said spaces, surfaces, areas and of job conditions.

C. Verify all dimensions shown on the drawings and obtain all measurements required for proper execution of work.

D. Information pertaining to preliminary investigations, such as test borings, location of utilities, existing structures and existing grades appear on the drawings. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing or that unforeseen developments may not occur. The interpretation of results of such investigation shall not be the responsibility of the Architect/Engineer. Where underground services, utilities, structures, buried tanks and other concealed items are located on the drawings or information is provided at the site, this data is based on available records, but not guaranteed to be complete or correct. They are merely given for assistance.

1.08 RIGGING; SUPPORTS AND FOUNDATIONS

A. The respective Contractor shall furnish and be responsible for delivery into the premises and erection of any equipment furnished.

B. Brackets, hangers, curbs, supports, and miscellaneous steel as required in connection with distributing piping loads and equipment supports shall be provided by the Contractor for equipment and piping which he installs.

C. Contractor shall furnish and install all foundations and supports as may be necessary for the respective equipment manufacturer's recommended installation procedures, and shall be responsible for their locations and size whether or not shown on the drawings. Grout under floor mounted equipment bases, or block under roof or elevated steel platform mounted equipment bases, so that same are plumb and level.

D. All fixtures, equipment and materials shall be supported and fastened in a manner satisfactory to the engineers. Ample backing shall be provided where plumbing fixtures, control panels or other items are supported on walls or partitions. Phillips, A & J, or Ramset anchors shall be used for block or tile walls. Toggle bolts shall be used only when other fastening systems are not suitable. Inserts shall be used wherever possible in concrete.

1.09 ELECTRICAL WORK

A. This Contractor shall furnish all electrical devices requiring mechanical connections such as pressure switches, float switches, thermostatic switches, limit switches, solenoid valves, motor operated valves, other in-line items, and also including motors, unless otherwise indicated. Motors for all mechanical equipment shall be mounted by Mechanical Contractor. Provide magnetic motor starters where specified on packaged equipment.

B. All electric motors shall be high efficiency.

C. Equipment furnished shall comply with Electrical Specifications.

1.10 PIPE AND DUCT SLEEVES AND ESCUTCHEONS

A. Provide sleeves for all piping and duct work passing through walls, floors, ceiling and partitions. Sleeves shall be 18 gauge galvanized sheet metal unless otherwise specified. Sleeves through boiler room or fire-rated areas roofs, walls, floors and foundation shall be standard weight steel pipe or cast iron pipe sleeves for piping or 1/8" plate and angle iron for

ductwork unless otherwise specified. Pipes passing through walls below grade shall utilize Clow F1429 or U.S. Pipe mechanical joint wall sleeve where applicable, and be caulked with lead and Oakum. Link-Seal bolted rubber materials may also be used to seal pipe to sleeve on cold piping where fire rating is not required.

B. Sleeves shall be flush with walls unless otherwise indicated.

C. Conceal all pipe sleeves with chrome plated escutcheons in finished areas.

D. In unfinished areas, sleeves shall project one (1) inch above finished floor line and be sealed watertight to the floor unless higher projection are indicated.

E. Sleeves passing through walls or floors below grade above a finished floor line shall be made watertight with a plastic material as approved by the Architect/Engineer.

F. All openings around duct and pipes and all sleeves where floors, fire rated walls and smoke barriers are penetrated shall be caulked smoke tight with 3M Fire Barrier CP-25, 3M Putty, and FS-195 Wrap/strip or approved equal by Hilti meeting U.L. System 91 and ASTM E-814 (UL-1479), installed per manufacturer's recommendations for horizontal and vertical penetrations. Fiberglass is not acceptable. Where vapor barriers must be continued on cold piping, they shall remain intact through the penetration and also sealed with 3M material per U.L. 91.

1.11 ACCESSIBILITY FOR REPLACEMENT; MAINTENANCE AND REPAIR

A. The respective contractors shall provide access covers or doors for equipment which is concealed and must be serviced, operated or maintained. Equipment shall include, but not be limited to valves, traps, cleanouts, critical dampers, control devices, filter, strainers, and related devices. Minor deviations from drawings may be made to allow for better accessibility, but major changes shall not be made without approval of the Architect/Engineer.

B. Furnish and install Milcor, Babcock-Davis, Bilco, Cessco or American Hatch Corporation access panels of proper style to match adjacent finish and approved sizes. Locations shall be approved by the Architect/Engineer or as shown on the plans. Use stainless steel access panels in ceramic tiled walls. Access panels in fire walls or rated ceiling assemblies shall be UL labeled with a rating equal to that of the wall in which it is installed.

C. Access panels shall be size large enough to allow proper maintenance of respective equipment for which they are installed.

D. Access panels shall be provided by responsible trades, who shall then coordinate installation of the access panel with the effected trade.

1.12 CUTTING AND PATCHING

A. All cutting and patching shall be performed only by workmen skilled in the type of work involved.

B. No structural members shall be cut without the consent of the Architect/Engineer and all such cutting, when authorized, shall be done in strict accordance with the instructions of the Architect/ Engineer. Where piping must pass through structural members and the Architect/Engineer has approved the burning of holes in such member, the Contractor shall provide approved welded steel reinforcement of suitable dimensions adjacent to the hole to effectively offset the weakening effect of the hole upon the member.

C. The size and location of roof and wall openings shall be the responsibility of the particular mechanical trade coordinated with other trades. Cracks and rough edges left following installation of equipment shall be caulked or covered with suitable escutcheons or framing by the Contractor.

1.13 EXCAVATION AND BACKFILL

A. General:

1. The respective contractors shall do all trench and pit excavation and backfilling required for his work inside and outside of the building, including all required shoring, bracing, pumping, and all protection for safety of persons and property. Materials to be excavated shall be non-classified and shall include all earth or other materials encountered.
2. Unless otherwise shown or specified, provide separate trenches for each utility. Lay all piping in open trench except when the Architect/Engineer gives written permission for tunneling.
3. The Contractor, in making or causing to be made any trench or excavation on public property or property to which the public has access, shall enclose, support and barricade his work, display warning devices, including red illumination at night and take all necessary precautions to protect the public at large from accidents while the excavation is open.
4. See Division 31 of the Specifications for additional requirements.

B. Method of Excavation: All excavation shall be open cut from the surface, except in special cases as designated on the plans. All excavations for trenches, for sewer, water and other piping, and for associated appurtenances shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting of the sides of the excavation, for pumping and draining of groundwater and sewage which may be encountered, and for the removal from the trench of all materials excavated. Special care must be taken so that the soil below the bottom of the structure to be built shall be left undisturbed so that a firm bed will be provided for the structure.

C. Limits of Excavation and Subgrade Preparation:
1. Trenches for pipe shall be excavated so that there will be a minimum clearance of six (6) inches on each side of the barrel of the pipe, and a maximum width of trench at the level of the top of the pipe of not more than sixteen (16) inches greater than the O.D. of the pipe, for pipe thirty (30) inch I.D. or smaller. They shall be at all times of sufficient width to permit the pipe to be laid and to permit proper construction methods to be used.
2. Sufficient space shall be provided in the trench to permit the joint to be properly made. Joint holes may be provided in the excavation with overhanging sides, provided the material excavated is of such a nature as to make this procedure safe for the workmen. Bottom of trenches shall be evenly graded to insure uniform bearing for the length of the pipe except where joint holes are necessary. Excavate all rock, cemented gravel, old masonry or other hard material to a depth of at least four (4) inches below pipe bearing grade and fill with sand or fine gravel firmly compacted to 95% Modified Proctor.

D. Amount of Opening: In excavating for sewers the excavation shall at all times be finished to the required grade for an adequate distance in advance of the completed sewer, but unless otherwise permitted by the Architect/Engineer, not more than one hundred (100) feet of trench shall be open at one time in advance of the sewer.

E. Bracing and Sheeting: The Contractor shall furnish, put in place and maintain such sheeting, bracing and shoring as may be required to properly support the sides of any excavation and to prevent any movement of earth which could in any way injure the work under construction or other adjacent property or workmen. If the Architect/ Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he may order additional supports at the expense of the Contractor, but neither the placing of such additional supports by the order of the Architect/Engineer, nor the failure of the Architect/Engineer, to order such additional supports placed, shall release the contractor from his responsibility for the sufficiency of such supports and the integrity of the work. In the removing of sheeting and bracing after construction, special care shall be taken to prevent any caving of the sides of the excavation and injury to the completed work or to adjacent property. OSHA and applicable state requirements shall be followed.

F. Timber Left in Trench: no sheeting, bracing or other timber shall be left in the trench upon completion of the structure, without order of the Architect/Engineer. All timber must be removed as the backfilling of the trench goes forward unless otherwise ordered by the Architect/Engineer. The Contractor shall leave such sheeting, bracing or timber, as the Architect/Engineer orders in writing, for the purpose of preventing injury to the completed structure, adjacent structures, property or workmen. In no case shall ends of timber, sheeting, or bracing left in the trench be allowed to come nearer than two feet from the established finished grade.

G. Disposal of Excavated Material: All suitable excavated material shall be used in backfilling over the sewer and appurtenances or distributed otherwise by the Contractor. All excavated material in excess of the quantity required for backfilling shall be hauled away by the Contractor and disposed of by dumping offsite. The Contractor shall provide all necessary labor and equipment for the spreading of all such excess material at the place of dumping and shall keep the dumping ground in neat condition satisfactory to the Architect/ Engineer.

H. Extra Earth Excavation: In case soft material is encountered in the bottom of a trench or underneath a special structure, which is not indicated by soil boring data and which in the opinion of the Architect/Engineer is not suitable, the Architect/Engineer may order the removal of this soft material and its replacement with concrete or other material in order to make a suitable foundation for the construction of the sewer or structure. Any extra excavation made at the order of the Architect/Engineer will be paid for on the basis of the actual quantity of material excavated.

I. Extra Sand Backfill: Any extra sand backfill made at the order of the Architect/Engineer will be paid on the basis of compacted volume in place. The sand furnished by the contractor for payment under this item, shall be natural sand free from organic matter, clay balls and stones having a diameter greater than one inch.

J. Extra Sand Bedding: Any extra sand bedding made at the order of the Architect/Engineer will be paid for on the basis of the compacted volume, in place. The sand furnished by the contractor for payment under this item, shall be natural sand free from organic matter, clay balls and stones having a diameter of greater than one inch. This item is intended to provide sand as a bleeding material when unsuitable material is encountered below pipe grade.

K. Concrete Work: All concrete work for monolithic concrete sewer construction, reinforced concrete pipe, manholes, catch basins, and all other concrete structures shall be made in accordance with the Standard Specifications for Highway Construction, latest edition.

L. Backfill:

1. Backfill trenches only after piping has been inspected, tested and locations of pipe and appurtenances have been recorded. Subsidence shall take place after backfilling. Backfill by hand around pipe with sand or fine gravel from the bottom of the pipe excavation to a level one (1) foot above the top of the pipe unless shown otherwise on the plans or as may be directed by the Architect/Engineer during the course of the work. Tamp firmly in layers not exceeding six (6) inches in thickness, taking care not to disturb the backfill, using equipment suitable for the kind of soil being compacted. Under floors, pavements, walks, and other surfacing, the backfill material shall be sand, back run gravel or limestone screenings compacted with a vibrating compactor for the full depth in layers not thicker than six (6) inches. Backfilling from above the pipe to the top of the trench excluding surface restoration for trenches located in, along, or within ten (10) feet of permanent pavements shall be backfilled with sand or fine gravel. This material shall be placed in thin layers and mechanically compacted with suitable equipment. This sand or gravel material shall be brought up to finish grade unless surface restoration has been shown. All backfilling shall be compacted to 95% Modified Proctor Density as established by the American Association of State Highway Officials. When laying pipe in impervious clay and backfilling with sand, the top two (2) feet of backfill shall be clay to seal the trench and reduce the possibility of water collecting in the trench. This must be done as soon as possible after laying the pipe.

M. Surface Restoration: No basic surface restoration within the Owner's property will be necessary for the construction of the utilities except as per the backfilling specifications above. In particular, all topsoil shall be replaced and the area shall be left in a natural condition.

N. Clean-up Limitation:

1. The Contractor will be expected to maintain cleanup operations within a reasonable distance of the sewer being placed in the trench. Cleanup shall consist of leveling and backfill, removal of excess excavation and construction debris, and gravel repair of roads and driveways.
2. If the Contractor does not maintain cleanup, as specified, the construction will be stopped until cleanup is carried out to the satisfaction of the Architect/Engineer.

1.14 EXISTING SERVICES

A. Where existing services such as sewers, domestic and heating piping, gas, electric or other services are encountered, each affected Contractor shall take adequate steps to protect such services.

B. If such existing services require relocation, make written request for ruling from the Architect/Engineer. Do not proceed on such portions of the work until written instructions are received. Costs involved shall be negotiated.

C. Inactive services shall be plugged, capped or removed. Notify utility companies, municipal agencies having jurisdiction or Owner's Representative. Protect or remove as directed.

D. Interruptions:

1. Where existing services (e.g., water supply, fire protection, and sanitary sewers) must be interrupted for connections by this Contractor, such interruptions shall be scheduled a minimum of one (1) week in advance with Owner's Representative.
2. Where line interruptions are required to make connection (e.g., steam and condensate), the Contractor shall make arrangements with the Owner's Representative to complete connection AFTER normal working or occupancy hours.

1.15 BASIC MATERIALS AND METHODS - GENERAL

A. All materials and equipment required for the work shall be new, of first class quality and shall be furnished, delivered, erected, connected and finished in every detail and shall be so selected and arranged as to fit properly in the building spaces. Where a specific kind or quality of material is not specified, a first class standard article as approved by the Architect/Engineer shall be furnished.

B. Each Contractor shall furnish the services of one or more experienced superintendents who shall be in charge of the installation of his work together with all skilled workmen, fitters, plumbers, metal workers, electricians, welders, helpers, and laborers required to unload, transfer, erect, connect, adjust, start, operate and test each system.

1.16 LUBRICATION

A. Upon completion of the work and before turning same over to the Owner, Contractor shall clean and lubricate bearings in pumps, air handling equipment and other rotating machinery, except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer.

1.17 PAINTING

A. All manufactured mechanical equipment shall be furnished with the manufacturer's standard shop finish unless specified otherwise in other sections of this specification.

B. All equipment furnished and installed by this Contractor with a factory applied baked enamel finish shall not be painted, but any damaged spots shall be touched up to match.

C. All prime and finish painting specified, except as noted above, shall be done by the Painting Contractor.

1.18 EQUIPMENT AND SYSTEM IDENTIFICATION

1. Reference the following specification sections for equipment and system identification requirements:
   a. Section 22 05 53 – Plumbing Identification
   b. Section 23 05 53 – HVAC Identification

1.19 GUARANTEE

A. Each Contractor shall guarantee his installation for a period of one (1) year from the date of final acceptance against all defects in material and/or workmanship and ordinary wear and tear. He shall make any and all adjustments to the system and minor alterations as required to place the system in satisfactory operating condition at no extra cost to the Owner.

1.20 EQUIPMENT FURNISHED BY THIS CONTRACTOR

A. The intent of these specifications is to allow the manufacturer's standard design and construction where suitable. The equipment should have the basic quality, however, as specified. See specific equipment sections for additional requirements.

B. All manufacturers offering equipment for this project shall furnish to the Architect/Engineer complete information describing the design performance, equipment experience, and other pertinent information necessary for review. In addition, the location of the manufacturer's Service Engineer who will be responsible for servicing the equipment furnished shall be provided. Additional information may be required by the Architect/Engineer after submittal.

C. Prices shown in the proposal for alternative equipment shall include all structural, mechanical or electrical changes from that shown on the plans which will be required for the installation of the alternate equipment. The plans and specifications have been prepared on the basis of equipment manufactured by those firms listed in the drawing schedules and specifications. All equipment listed in the proposal will be considered carefully on the basis of advantages, disadvantages, and economics.

D. The Contractor shall guarantee all equipment installed for one (1) year from the date of acceptance by the Owner's Representative. If prior to the duration of one year, any equipment of parts thereof are found to be defective, the Contractor shall replace the part at no cost.

E. Manufacturer's Services:
   1. All equipment shall be given one (1) coat of shop prime, unless otherwise indicated.
   2. Lubrication facilities shall be located for convenient servicing. Lubrication, maintenance instructions and one (1) year supply of recommended lubricant, properly labeled, shall be furnished with all equipment.
   3. Any special tools, including special grease guns, required for maintenance or adjustment of the equipment shall be furnished with the equipment.
   4. Upon completion of the installation of the equipment or before initial operation, three (3) bound sets of complete operating and lubricating instructions for all equipment shall be furnished to the Owner by the Contractor. Included with the operating instructions shall be a complete set of all equipment drawings including shop drawings, repair instructions, complete parts list, lubrication instructions and recommended lists of lubricants.

1.21 SHOP DRAWINGS

A. Contractor shall provide shop drawings as required by Section 01 33 00 – Submittal Procedures of these specifications

B. Shop Drawings shall provide complete details of the material or equipment they describe including dimensions, gauges of materials, weights, finishes, motor horsepower, voltage, current, starting characteristics, operating characteristics, building location room number, capacities, rough-in connections, installation requirements, and complete internal and external wiring diagrams showing all connections, along with fan and pump curves where applicable.

C. In particular, shop drawings on the following equipment items shall be furnished within 15 working days from work of contract to maintain Proposal Schedule.

1. Roof or Floor Mounted Equipment affecting Building Structure (e.g. air handling units, exhaust fans, ventilators).
2. Floor, wall, or beam column mounted equipment requiring special foundations or supports (e.g. boilers, drainage equipment, tanks, etc.).

1.22 TEMPORARY HEAT

A. Use of permanent equipment for temporary heating shall be only as allowed by the General Requirements section of these specifications.

1.23 SAFETY

A. Contractor shall be responsible for job site safety.

B. Contractor shall comply with OSHA regulations for confined space entry locations.

END OF SECTION

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SECTION 22 02 00
PIPING PRESSURE TEST REPORT

Line Number or System: _____

Date of Test: _____ / _____ / _____

Test Medium: WATER AIR NITROGEN OTHER - SPECIFY _____

Test Pressure: _____ PSI _____ FT

Time Held at Test Pressure:_____ HOURS_____ MINUTES

CHECKLIST TO BE COMPLETED AFTER PRESSURE TEST		
	NOT APPLICABLE	**COMPLETED**
System Drained		
System Air Dried		
Temporary Equipment (e.g. pressure gauges, blind flanges, caps, etc.) Removed		
Permanent Equipment (e.g. safety valves, relief, valves, gauges, etc.) Replaced		
Valving Returned to Proper Configuration		

REMARKS:

I certify this system to be leak free and structurally sound as of the date of the test.

FIELD TECHNICIAN (sign and print): _____

SYSTEM ACCEPTED:

_____ _____
OWNER'S REPRESENTATIVE DATE

Use this form (or equal) for domestic water, storm, sanitary, and gas systems.

END OF SECTION

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SECTION 22 05 53
PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Identification of products installed under Division 22.

1.02 REFERENCES
1. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
2. ASTM B-1, B-3, and B-8 for copper conductors.
3. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof
4. Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated
5. Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kv Cables.
6. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.
7. U.S. Green Building Council LEED 2009 Reference Guide for Green Building Design and
8. Construction, First Edition including addenda. www.usgbc.org

1.03 RELATED SECTIONS
1. Section 22 00 00 – Mechanical & Plumbing Scope of Work

1.04 SUBMITTALS
1. Submit shop drawings under provisions of Section 22 05 00. Include list of items identified, wording, letter sizes, and color coding.

2. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.02 MATERIALS
3. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths
4. and letter sizes shall be at least the following:

O.D. of Pipe or insulation	Marker Length	Size of Letters
Up to and including 1-1/4”	8”	1/2”
1-1/2” to 2”	8”	3/4”
2-1/2” to 6”	12”	1-1/4

Plastic tags may be used for outside diameters under 3/4".

B. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

D. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.

E. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

F. Tracer Wire:
    1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
    2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
    3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

PART 3 - EXECUTION

3.01 NSTALLATION

A. Install all products per manufacturer's recommendations.
B. Degrease and clean surfaces to receive adhesive for identification materials.
C. Valves:
    1. All valves (except shut-off valves at equipment) shall have numbered tags.
    2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
    3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner's representative prior to ordering tags.
    4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
    5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
    6. Number all tags and show the service of the pipe.
    7. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner's Representative prior to laminating final copies. Laminated copies shall have brass eyelet in at least one corner for easy hanging.
D. Pipe Markers:
    1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
    2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
    3. Stencil Painted Pipe Markers:
        i. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
        ii. Apply primer on non-insulated pipes before painting.
        iii. Use background and letter colors as scheduled later in this section.
    4. Apply markers and arrows in the following locations where clearly visible:
        i. At each valve.
        ii. On both sides of walls that pipes penetrate.
        iii. At least every 20 feet along all pipes.
        iv. On each riser and each leg of each "T" joint.
        v. At least once in every room and each story traversed.
    5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:
   1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
   2. Provide engraved plastic tags at all hydronic or steam system makeup water meters.

F. Tracer Wire:
   1. Tracer wire shall be installed on top of all non-metallic buried utilities.
   2. Tracer wire shall be taped directly to plastic water or drain pipe.
   3. Tracer wire shall not be fastened directly or indirectly to gas piping.
   4. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.
   5. Tape shall be Polyken “930-35”, Protecto-Wrap “310”, or approved equal.
   6. Tracer wire shall be continuous between boxes and shall be tested for continuity.
   7. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. **Wire nuts shall not be used.**
   8. The tracer wire shall daylight to grade through a 2” PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

3.02 SCHEDULE

G. Pipes to be marked:

Pipe Service Lettering	Color Background	Color
Condensate Drain	Black	Yellow
Compressed Air	Black	Yellow
Domestic Cold Water	White	Green
Domestic Hot Water - 115°F	Black	Yellow
Domestic Hot Water Circulating - 115°F	Black	Yellow
Sanitary Sewer	Black	Yellow
Vent	Black	Yellow
Propane	Black	Yellow
All Underground Pipes	Varies	Varies
Tracer Wire - Water Pipe Lines	---	Blue
Tracer Wire - Propane Pipe Lines	---	Yellow
Tracer Wire - All other buried types	---	Green

END OF SECTION

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SECTION 22 07 00
INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included: Insulation required for this work includes, but is not necessarily limited to the following:

1. Piping and In-Line Equipment:
    a. Storm water piping above ground. Insulate all horizontal piping, and all vertical piping within 8' of exterior.
    b. Above ground condensate drains not in mechanical rooms. This also includes overhead floor drain or open site drain piping draining condensate from air conditioning units and any other concealed cold drain.
    c. Domestic hot and cold water above ground.
    d. Domestic hot and cold water and drain piping under handicapped lavatories. Refer to Section 22 10 00.
    e. Heating hot water systems including all piping, equipment and accessories.
    f. Chilled water systems including all piping, equipment and accessories.
    g. Refrigerant suction piping and specialties both exterior and interior.
    h. Plenum fire barrier wrap insulation on PVC piping installed in air plenums.
2. Ductwork
    a. HVAC supply that is not double wall insulated duct.
    b. Insulate all outside air ductwork from exterior opening to makeup air unit including mixed air portions of duct. Insulate outside air plenums and back of unused portions of outside air louvers.
    c. Insulate exhaust ductwork beginning 2 feet upstream of exhaust fan shutoff damper and continuing to relief louver.

B. Related Work Described Elsewhere:

1. Section 22 10 00: Plumbing
2. Section 23 52 00: Hot Water Heating Systems
3. Section 23 00 00: Heating, Ventilating, & Air Conditioning

1.02 QUALITY ASSURANCE

A. Qualifications of Installers:

1. For the actual installation and testing of work under this section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.
2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of installers.

1.03 SUBMITTALS

A. Materials List:

1. Within 15 days after award of Contract, and before any of the materials of this section are delivered to the job site, submit complete materials list to the Architect/Engineer in accordance with the provisions of Section 01 33 00- Submittal Procedures of these specifications. The list shall identify all materials and equipment proposed to be furnished and installed under this portion of the work, giving manufacturer's name, catalog number, and catalog cut for each item where applicable. Submittals shall

include a description of insulation materials, heat transfer data, thicknesses, jackets, adhesives, and methods of application on pipe, duct, fittings and surfaces.

B. Manufacturer's Recommendations:

1. Accompanying the materials list, submit the manufacturer's current recommended method of installation for the insulation required in this work.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect the materials of this section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacement:

1. In the event of damage by this Contractor, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. All insulation, unless otherwise indicated, shall have composite (insulation, jacket and adhesive used to adhere the jacket to the insulation) Fire and Smoke Hazard ratings as tested under procedure ASTM E-84, NFPA 255 and UL 723, not exceeding:

Flame Spread	25
Smoke Developed	50
Fuel Contributed	50

Accessories, such as adhesives, mastics, cements and cloth to fittings shall have the same component ratings as listed above. Paper laminate jackets shall be permanently fire and smoke resistant. Chemicals used for treating paper in jacket laminates shall not be water soluble and shall be unaffected by water and humidity. The insulation contractor shall verify in writing, prior to installation, that all products to be used meet the above criteria.

B. Contractor shall provide all adhesives, mastics mechanical fasteners, etc., as specified herein and as required. Adhesives, equal to those specified, shall be provided and applied in accordance with manufacturer's published recommendations, and shall be as manufactured by Dow Corning, Foster Products, Johns Manville, Owens Corning, or approved equal.

C. Preformed insulated fittings and jackets shall be as made by Proto PVC Corporation or Johns Manville. PVC covers such as Proto or Zeston, may be used throughout the piping systems.

D. NFPA 90-A and NAIMA standards shall be met as applicable.

2.02 PIPING INSULATION

A. Plumbing Systems

1. Preformed fiberglass pipe insulation manufactured in accordance with ASTM C-547, with a 'K' factor of 0.23 Btu-in/hr-sf/ F @ 75 F mean temperature, shall have a pre-applied all service jacket. A vapor barrier shall be maintained on cold piping by sealing all staples and raw insulation ends and fittings. Insulation shall be as made by Johns Manville Micro-Lok 850-AP or AP-T, or equal by Owens-Corning, Knauf, or Manson Insulation.

2. Fittings, Valves, Flanges, Strainers, Flexible Connectors, Suction Diffusers, Unions, etc.:

a. Hot Piping: Fittings shall be insulated by applying factory precut insulation inserts to the fitting per Manville Hi-Lo Temp insulation insert recommendations

and covered with 25/50 PVC covers. Other piping components shall be insulated with approved insulating cement of thickness equal to adjoining pipe insulation, with glass fabric cover adhered and finished with fire resistive lagging adhesive. Contractor may also insulate with mitered segments of fiberglass pipe insulation, secured with No. 20 gauge galvanized steel wire, and finished with smoothing coat of insulating cement and glass fabric, as above. Cover all sizes with applicable pre-molded PVC insulation fittings, as made by Proto PVC Corporation and Johns Manville. Wrap other areas not suitable for pre-molded PVC fittings with fiberglass cloth and insulating mastic.

b. Cold Piping: Insulate same as hot piping but maintain continuous vapor barrier with mastic, including sealing all staples and raw insulation ends at fittings.

B. Thickness Schedule:

		Pipe Size	Thickness
1.	Domestic hot and cold water above ground, overhead condensate drains	all	1"
2.	Roof conductors and roof sumps	all	1"

Note: Where pipe chase dimensions or interference problems make use of the specified thickness impossible, local reductions in thickness may be made with Architect/Engineer approval.

2.03 DUCTWORK INSULATION

A. Exposed Ducts:

1. Ductwork shall be insulated with rigid fiberglass board of 3.0 lbs. per cubic foot density equal to Johns Manville 814 Spin-Glas with FSK facing and vapor barrier and covered with fiberglass cloth and lagging adhesive.
2. Outside air ductwork shall be insulated with 1-1/2 inch thickness to makeup air unit.
3. Exhaust air ductwork shall be insulated with 1-1/2 inch thickness beginning 2 feet upstream of exhaust fan shutoff damper and continuing to relief louver.
4. Any unused portions of louvers shall be covered with 16 gauge sheet metal and the back side insulated with 2 inch thickness fiberglass and faced with mastic and fiberglass cloth and lagging adhesive.

2.04 OTHER MATERIALS

A. All other materials, not specifically described, but required for a complete and proper installation of the work of this section, shall be new, first quality of their respective kinds, and subject to approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that all the work of this section may be installed in accordance with all pertinent codes and regulation, the original design, and the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect/Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 INSTALLATION

A. General:

1. Contractor shall be responsible for examination and acceptance of all surfaces and conditions prior to delivery and installation.
2. Install all insulation in strict accordance with the respective manufacturers' recommendations as approved by the Architect/Engineer.
3. Insulation shall be applied on clean, dry surfaces and after inspection and release for insulation application. All insulation shall be continuous through wall and ceiling openings and sleeve. Pipe insulation shall be continuous through pipe hangers. All joints shall be butted firmly together. Longitudinal jacket laps and butt strips shall be smoothly secured according to manufacturer's recommendations.
4. When covering is terminated at equipment, specialties, or access doors; or where jackets are pierced by metal parts such as thermometers or pressure gauges, covering material shall be neatly tapered and jacket securely sealed to pipe or other metal part.

B. Piping Insulation Installation:

1. Piping insulation shall be installed with all joints tightly butted; with overlapping longitudinal joints integral with jacket, and with 3" wide separate butt strips; tightly sealed with adhesive. Exposed insulated piping shall be provided with a finish suitable for a final coat of paint. Concealed insulation will not be painted nor will aluminum jacketed pipe.
2. Insulation covering on heated piping shall be neatly trimmed where penetrated by support shoes where slides are used or support inserts where rollers are used.
3. Insulation on all cold surfaces where vapor barrier jackets are used must be applied with a continuous unbroken vapor seal. Hangers, supports, anchors and guides that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation. Stapling of vapor barrier jackets on cold piping will be permitted only if the staples are sealed within approved vapor barrier mastic or vapor barrier tape.
4. Rigid insulation inserts shall be installed at outside hangers and pipe resting on structural steel. Inserts between pipe and pipe supports shall consist of Johns Manville Thermo-12 or Calsilite rigid pipe insulation for services below 35°F or wood blocks equal to "Buckaroos" for services above 35°F. The inserts shall be of thickness equal to the adjoining insulation and shall be provided with vapor barrier where required. Inserts shall be of sufficient density to avoid crushing of insulation and damage to vapor barrier. Insulation inserts shall not be less than the following lengths, unless otherwise specified:

1/2" to 2-1/2" pipe size	10" long
3" to 6" pipe size	12" long
8" to 10" pipe size	16" long
12" and over	22" long

Galvanized metal protection shields equal to Grinnel Fig. 167 or equivalent by "Buckaroos" shall be applied between hangers or supports and the pipe insulation. Shields shall be formed to fit the insulation and the length specified for the hanger inserts less 4 " to allow for vapor sealing butt joints in each side of the shields. On piping 6 inches and above pipe covering protection saddles equal to Grinnel Figures 160 through 165 shall be used

Insulation inserts and shields shall be provided by the respective piping Contractor; such as plumbing, process piping, heating and cooling, etc.

5. Specified adhesives, mastics and coatings shall be applied at the manufacturer's recommended minimum coverage per gallon.
6. Where metal jackets are used, installation on pipe, fittings, valves, flanges, and other piping accessories shall conform to Pabco recommendations.
7. Install Armaflex or Manville Aerotube per manufacturer's recommendation.

C. Duct Insulation Installation:
1. Rigidboard:
a. Impaling over pins (exposed):
i. All insulation shall be applied with edges tightly butted. Insulation shall be impaled on stick clips or pins welded to the duct, and secured with speed clips. Spacing of pins shall be as required to hold insulation firmly in place in accordance with minimum SMACNA or manufacturer's standards. All joints and penetrations of the vapor barrier shall be sealed with a 3" wide strip of matching pressure sensitive tape.
b. Other methods of securement:
i. If, through space or size restriction or other causes, the welded pin method is impossible, the insulation shall be secured to the duct with adhesive that meets NFPA 90-A 25-50 Code as recommended by the manufacturer. The adhesive shall cover the entire surface of the sheet metal when applied to underside of horizontal duct, but may be applied in strips or spots for application to top and sides with a minimum of 50% coverage..
2. Installation of duct liner board shall conform to manufacturer's recommendation (e.g., 0/C Bulletin A6, 1-MS-3557-E.)
3. Exposed insulated ducts shall be provided with a finish suitable for a final coat of paint. Concealed insulation will not be painted.

3.03 TESTS

A. Insulation shall not be completely installed until pressure/leak tests of piping and ductwork systems have been completed. Straight lengths of pipe may be installed before pressure testing. Verify with ductwork contractor that ductwork integrity has been verified prior to insulating ductwork.

END OF SECTION

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SECTION 22 10 00
PLUMBING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The plumbing work includes, but is not necessarily limited to:

1. Work summarized in Section 22 00 00, Mechanical and Plumbing Scope of Work.

B. Related Work Described Elsewhere:

1. Section 22 02 00: Piping Pressure Test Report
2. Section 22 01 00: General Conditions
3. Section 22 07 00: Insulation
4. Division 33: Utilities

1.02 QUALITY ASSURANCE

A. Qualifications of Workers:

1. Use a sufficient number of journeyman plumbers and competent supervisors in the execution of this portion of the Work to ensure proper and adequate installation of plumbing throughout and inside building.

B. Compliance with Specifications:

1. Whenever required during progress of the work, and after completion of construction, immediately furnish proof acceptable to the Architect/Engineer that all items of plumbing installed equal or exceed all requirements specified for this work.
2. In the event that such proof is not available or is not acceptable, the Architect/Engineer may require the Contractor to remove the item or items and replace with material meeting the specified requirements and to repair all damage caused in the removal and replacement, all at no additional cost to the Owner.

C. Codes and Standards:

1. Comply with all Wisconsin Administrative Code and local requirements.

1.03 SUBMITTALS

A. Shop Drawings:

1. Within fifteen working days after award of contract, and before any plumbing materials are delivered to the job site, submit shop drawings in accordance with the provisions of Division 1 of the General Requirements showing all the plumbing system and plumbing materials, products proposed to be furnished and installed.

B. Construction Record “As-Built” Drawings:

1. During progress of the work maintain an accurate record of all changes made in the plumbing installation from the layout and materials shown on the approved shop drawings. The location of shutoff valves for the various services and proper identification of services must be shown.

1.04 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect plumbing materials before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacements:

1. In the event of damage caused by this Contractor, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer all at no additional

cost to the Owner.

PART 2 - PRODUCTS

2.01 PIPE

A. Storm Drainage:

1. Exterior: Standard weight cast iron soil pipe and fittings meeting ASTM C564 or C76, or Schedule 40 PVC ASTM D2665 solvent welded plastic pipe, or corrugated polyethylene with smooth interior liner meeting AASHTO M294 and having a State of Wisconsin alternate approval as Hancor Sure-Lok or TiteLine or Advance Drainage Systems ADS N-12.
2. Interior: Standard weight cast iron soil pipe or no-hub pipe with fittings meeting ASTM C564 (neoprene push-on or no-hub joints) or Schedule 40 PVC ASTM D2665 solvent welded plastic pipe.

B. Sanitary Drainage:

1. Exterior: Sanitary drainage piping shall be Schedule 40 PVC ASTM D2665 solvent welded plastic pipe and fittings through 4-inch size. Above 4-inch contractor may use same or SDR 35 ASTM 3034 PVC with push-on rubber joints equal to J-M Ring-Tile PVC gravity sewer pipe and fittings, suitable for depth of bury and soil and compaction conditions.
2. Interior: Domestic waste, vent drain piping shall be standard weight cast iron hub or no-hub soil pipe and fittings meeting ASTM C564 with neoprene push-on or no-hub joints, or Schedule 40 PVC ASTM D2665 solvent welded plastic pipe and fittings.

C. Potable Water Piping (Hot/Cold/Recirculation):

1. Potable water piping underground through 3-inch shall be ASTM B-88 type K soft copper meeting AWWA specifications, with bronze compression fittings, or for exterior use only, NSF rated cross-linked polyethylene 160 psi AWWA approved water service pipe. Piping larger than three-inches shall be ductile cast iron push-on joint equal to Clow F-172D meeting ANSI A21.51, class 52. Fittings shall be 250 lb. push-on joint meeting ANSI A21.20 with ANSI 21.11 gaskets. Mechanical joint anchoring fittings may be used in lieu of thrust blocks and tie-rods per UL-FM requirements. Pipe and fittings shall be cement mortar lined per ANSI A21.4 and shall be coated with a bituminous coating of either coal tar or asphalt one mil thick. Brass wedges shall be used where applicable.
2. Potable water piping aboveground through 3-inch shall be hard drawn copper tube type L copper meeting ASTM B-88 with wrought or forged copper fittings and lead free solder.

D. Condensate Drain Piping:

1. Condensate drain piping shall be equal to piping specified for potable water piping above ground or schedule 40 PVC, ASTM D2665.

2.02 VALVES

A. All gate, globe, check and ball valves shall be Milwaukee, Nibco, or Hammond as listed below, or other approved equal. Shutoff valves for general service purposes shall be ball valves, not gate valves. Valves used in potable water service shall not be capable of placing dissolved lead into the potable water stream.

TYPE	SIZE RANGE	VALVE NUMBER		
		Milwaukee	Nibco	Hammond
Gate (screwed)	2" and below	1151	T134	IB629
Gate (sweat)	2" and below	1169	S134	IB648
Gate (flanged)	Above 2"	F-2885A	F617-O	IR1140
Globe (screwed)	2" and below	590T	T235-Y	IB413T
Globe (sweat)	2" and below	1590T	S235-Y	IB423
Globe (flanged)	Above 2"	F-2981A	S718-B	IR116
Swing Check (screwed)	2" and below	510T	T433Y	IB946
Swing Check (sweat)	2" and below	1510T	S433Y	IB945
Swing Check (flanged)	Above 2"	F-2974A	F918-B	IR1124
Ball Valve (threaded)	2" and below	BA-100	T-585-70	8501
Ball Valve (sweat)	2" and below	BA-150	S-585-70	8511

2.03 PIPE SLEEVES AND ESCUTCHEONS

A. Provide sleeves for all plumbing passing through walls, floors, ceilings and partitions. Sleeves shall be 18 gage galvanized steel, or where permitted by code, PVC schedule 40 is acceptable. Pipes passing through walls below grade shall utilize Clow F1429 or equal U.S. Pipe mechanical joint wall sleeve. Sleeves shall be caulked watertight with mastic or applicable silicone sealant. Sleeves passing through fire-rated structures shall maintain that fire rating. Conceal pipe sleeves in finished areas with chrome plated escutcheons.

2.04 HANGERS, ANCHORS AND SUPPORTS

A. Hangers and supports shall be Unistrut, Fee and Mason, Michigan Hanger, or Grinnell Company and suitable for size and type of pipe to be supported.

B. No piping shall be hung from the piping of other trades or systems. Hangers shall be same material as the piping such that neither the hanger nor suspended piping is subject to electrolytic decay.

C. Piping two-inch and smaller may be supported with hook plates wherever it runs adjacent to a side wall. Piping larger than two-inch shall be supported by a wall bracket and either a clevis or roller type hanger.

D. Special pipe materials (e.g., plastics) shall be supported per manufacturer recommendation.

E. The following is a schedule of maximum spacing for hangers and supports and size of suspension rods for all steel and copper piping unless otherwise indicated or required. Rods shall meet ASTM A 575.

PIPE SIZE	ROD DIAMETER	MAX. SPACING
up to 1-1/4"	3/8"	6'-0"
1-1/2" to 2"	3/8"	9'-0"
2-1/2" to 3"	1/2"	11'-0"
4" to 5"	5/8"	14'-0"
6"	3/4"	17'-0"

F. Drainage piping support shall meet requirements of respective pipe manufacturer and local codes.

G. Locate hanger supports and accessories to support pipe lines, valves, joints, and additional concentrated loads. Hangers shall not restrict free thermal expansion unless otherwise shown.

H. Hangers on insulated piping systems shall be oversized to accommodate insulation thickness indicated in Insulation Specification Section 22 07 00. Provide pipe covering

protection saddles for applicable insulated piping as also specified in Section 22 07 00, equal to Grinnell Fig. 167.

2.05 VENT FLASHING, SIZING, AND SLOPE

A. Vent stack installation shall be coordinated with Architectural Chimneys. Grade horizontal vent lines one-eighth-inch per foot, minimum.

2.06 VACUUM BREAKERS, CHECK VALVES, AND BACKFLOW PREVENTERS

A. Provide approved vacuum breakers, check valves, and backflow preventers as required by applicable plumbing codes at all possible cross-connections. This applies to any location where a hose connection is possible such as wall hydrants, hose bibbs, and service sinks. Comply with local health department requirements.

2.07 ELECTROLYTIC ISOLATION

A. Isolate all dissimilar piping materials with insulating couplings equal to V-line, Walter Valet, Stockham, or Viking.

2.08 MANHOLES AND CATCH BASINS

A. Garage Catch Basin GCB shall be Model BZM Big Easy fiberglass catch basin or equal.

B. Frame and Grate shall be round heavy duty catch basin frame and open grate equal to Neenah Foundry R-2501.

2.09 ACCESS DOORS

A. Provide access doors by Milcor, Babcock-Davis, Bilco, Cessco, or American Hatch where valves, traps, and other items needing access are concealed and must be serviced, operated, or maintained. Access doors shall match adjacent finish and shall be equipped with Allen key device for locking purposes.

2.10 PLUMBING FIXTURES

A. General:

1. Furnish fixtures of Class "A" vitreous china or acid resisting porcelain enameled cast iron as specified. Fixtures shall be unmarked, clean, smooth, bright, and guaranteed not to crack, discolor, scale, or craze.
2. Fixtures shall be caulked to floors and walls in compliance with Technical Specification Section 07 92 00 Sealants.
3. All fixtures shall be white unless otherwise specified.
4. No materials may be used which will place dissolved lead into the potable water stream.
5. Provide shutoff valves or stops at all fixtures. Use ball valves, not gate valves, as shutoff valves.

2.11 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation shall be new, first quality of their respective kinds, and subject to the approval of the Architect/Engineer.

2.12 BACKWATER VALVE SCHEDULE

A. Backwater Valve BWV-1 shall be equal to Zurn Z-1095-BC, dura-coated cast iron body, flapper type with bolted cover, with 12” cleanout ferrule and plug equal to Zurn Z-1440 with

gas and watertight ABS tapered thread plug. Provide only if required by local authorities or there is a risk of high water.

2.13 EMERGENCY SAFETY EQUIPMENT SCHEDULE

A. Emergency Eye/Face Wash EEW-1: HALO S19224 Series: Bradley Manufacturing Corp.
   1. Provide a thermostatic mixing valve: Bradley Corp. Navigator S19-2000 EFX8.
   2. Exceeds American National Standard Z358.1-2009 Specifications
   3. Self-Draining
   4. Separate Supply and Waste Pipes – Meets CEN and Plumbing Requirements
   5. Ergonomic Hand Activation Eyewash Paddle – Easy to Reach from Any Direction
   6. Barrier Free
   7. Fully-Assembled and Factory-Tested Eyewash or Eye/Face Wash with Hinged Dust Covers
   8. Yellow Transparent Plastic Bowl Cover
   9. Antimicrobial Protection
   10. Universal Identification Sign and Inspection Tag Included

2.14 FLOOR CLEANOUT SCHEDULE

A. Floor Cleanout FCO-1 shall be equal to Josam Series 56040-1/56050-1, Jay R. Smith 4100/4111 Series, or Zurn ZN-1400 Level-trol, adjustable floor cleanout, cast iron body with anchor flange, gas and watertight ABS tapered thread plug, and round scoriated nickel bronze top adjustable to finished floor.

2.15 FLOOR-DRAIN SCHEDULE

A. Floor Drain FD-1: Where plumbing specialties of this designation are indicated, provide products complying with the following:
   1. Applicable Standard: ASME A112.21.1M.
   2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. 30000-S Series; Josam Co.
      b. Figure 2005; Jay R. Smith Mfg. Co.
      c. 1100G; Tyler Pipe, Wade Div.
      d. ZN-415-6S; Zurn Industries, Inc., Hydromechanics Div.
   3. Duty: Light Duty.
   4. Body Material: Cast Iron.
   5. Seepage Flange: Required.
   6. Membrane Clamp: Required.
   7. Outlet: Bottom.
   8. Sediment Bucket: Not required.
   9. Top of Body and Strainer Finish: Nickel brass or nickel bronze.
   10. Top Shape: Square, centered in and orthogonally aligned with floor tile.
   11. Top Dimensions: 6-inch square to fit bathroom tile.
   12. Pipe Outlet Size: As indicated on the Construction Drawings.

2.16 TRENCH-DRAIN SCHEDULE

A. TRENCH Drain TD-1: Where plumbing specialties of this designation are indicated, provide products complying with the following:

1. Applicable Standard: ASME A112.21.1M.
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. S100K Trench Drain System – ACO Polymer Products, Inc.
3. Duty: Heavy Duty.
4. Channel Material: Polymer sloped at .6% pitch.
5. Outlet: Bottom.or end
6. Sediment Bucket: Not required.
7. Grates: Manufacturers standard locking grates.
8. Installation: Coordinate top of grate elevations with General Contractor.

2.17 HOSE BIBB WALL HYDRANT SCHEDULE

A. Hose Bibb Wall Hydrant HB-1: Non-freeze, automatic draining, anti-backflow: Where plumbing fixtures of this designation are indicated, provide products complying with the following:

1. Applicable Standard: ASSE 1019.
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Series HY-1000; Mifab, Inc.
   b. Series HY42; Watts Industries, Inc., Watts Regulator Div.
   c. Model 65 Series; Woodford Manufacturing Co.
   d. Z-1310 Ecolotrol; Zurn Industries, Inc., Hydrodynamics Div.
3. Type: Recessed, exposed.
4. Finish: Chrome.
5. Operation: Include operating key for each hydrant.
6. Inlet: 3/4- or 1-inch NPS (DN20 or DN25) threaded or solder-joint inlet.
7. Outlet: ASME B1.20.7 garden-hose threads.
8. Faucet Pitch: Downward pitch toward nozzle to facilitate draining feature.

B. Hose Bibb Wall Hydrant HB-2: Interior, anti-backflow: Where plumbing fixtures of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   a. Fig. No. 73 or 74; Nibco, Inc.
   b. BD2C boiler drain: Watts Industries, Inc., Watts Regulator Div.
2. Type: Projecting, exposed water source.
3. Cross Connection Control: Hose Connection Vacuum Breaker, non-removable, ASSE 1011, Watts No. 8A or equivalent.
4. Finish: Brass.
5. Operation: Metal Wheel handle.
6. Inlet: 3/4-inch NPS (DN20) threaded or solder-joint inlet.
7. Outlet: ASME B1.20.7 garden-hose threads.

2.18 LAVATORY SCHEDULE

A. Lavatory LAV-1: Where plumbing fixtures of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Vitreous-China Lavatory:
   a. Z5340 Wall Hung Lavatory; Zurn Industries.
      Equal Products by American Standard or Kohler are acceptable.
3. Faucet, ADA Compliant:
   a. Single Control Faucet Z81000: Zurn Industries.
      Equal Products by American Standard or Kohler are acceptable
4. Fitting Insulation Kit:
   a. IK/IW7 Series; Engineered Brass Co., Inc.
   b. PRO WRAP PW 2000 Series; McGuire Manufacturing Co., Inc.
5. Fixture Color: White.
6. Fixture Dimensions: 20 by 18 inches (508 by 457 mm),
7. Fixture Faucet-Hole Spacing: 3 holes, centered and 2 inches (51-mm) each side of center.
8. Mounting: Wall Hung
9. Faucet Construction: Center set with inlets on 4-inch (102-mm) centers, cast brass, and with pop-up waste.
10. Faucet Valve Operation: Manual, adjustable.
11. Faucet Mounting Position: Centered on fixture deck.
12. Faucet Components: Include the following:
    a. Accessible-Fixture Operation: Manual.
    b. Handle: Single, push-pull and twist.
    c. Spout: Integral with body.
    d. Spout Outlet: Manufacturer Standard.
    e. Finish: Polished chrome.
13. Supply Inlets: 1/2-inch NPS (DN15) copper tubing.
14. Supply Stops: Manufacturer's standard brass, angle or straight, compression, wheel-handle type, same size as supply inlet and with outlet matching supply riser.
15. Supply Risers: 3/8-inch NPS (DN10) rigid with knob-end tailpiece.
16. Drain: Grid Drain with 1-1/4-inch NPS (DN32) offset waste and tailpiece.
17. Tubular Trap: 1-1/2-by-1-1/4-inch NPS (DN40 by DN32), 0.045-inch (1.1-mm) wall thickness, tubular brass, with slip-joint inlet and wall flange.
18. Supply Insulation Kit: Molded, soft-plastic covering for supplies from wall to fixture with removable covering for stops and handles. Include manufacturer's standard fasteners, straps and adhesives.
19. Drain Insulation Kit: Molded, soft-plastic covering for drain piping from fixture to wall. Include manufacturer's standard fasteners, straps and adhesives.
20. Provide Concealed Arm Carrier.

2.19 SERVICE SINK SCHEDULE

A. Sink S-1: Where plumbing fixtures of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. 14 gage Seamless Stainless-Steel Sink:

a. A-18665; Just Manufacturing Co
b. Wall Hung Single Compartment Service Sink.

3. Faucet: B-0660-POL: T & S Brass and Bronze Works, Inc.
   a. Wall brace and pail hook
   b. Grid Drain: Just J-35
   c. Tubular Trap: 1-1/2 NPS (DN40 by DN32), 0.045-inch (1.1-mm) wall thickness, tubular brass, with slip-joint inlet and wall flange.

2.20 WATER CLOSET SCHEDULE

A. Accessible Water Closet WC-1: Where plumbing fixtures of this designation are indicated, provide products complying with the following:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Vitreous-China Water Closet:
   a. Madera 2305.100; American Standard, Inc.
   b. Hymont, Jr. 3-816; Crane Plumbing.
   c. Signature 111-2145; Eljer Industries.
   d. Highcliff K-4368; Kohler Co.
3. Flushometer Valve:
   a. Flushboy 402-1; Coyne & Delany Co.
   b. Regal 111 XL; Sloan Valve Co.
   c. Z-6000XL-WS1; Zurn Industries, Inc.; Flush Valve Operations.
4. Toilet Seat:
   a. American Standard, Inc.
   b. Bemis Mfg. Co.
   c. Church Seat Co.
   d. Eljer Industries.
   e. Kohler Co.
   f. Olsonite Corp.
   g. Sperzel.
5. Fixture Color: White.
6. Bowl Type and Operation: Top spud, elongated, siphon jet.
7. Mounting and Outlet: Floor mounted, floor outlet.
8. Fixture Bolt Caps: White, plastic or china.
9. Rim Height: 16-1/8 to 17-1/2 inches.
10. Accessible-Fixture: Modified as required for lever mounting on side that will be on wide side of fixture compartment.
11. Design Water Consumption: 1.6 gal. (6 L) per flushing cycle.
12. Flushometer Valve: Cast-brass body, brass or copper pipe or tubing inlet with wall flange and tailpiece with spud, diaphragm operated, screwdriver check stop, and vacuum breaker, lever-handle actuation, non-hold-open feature.
13. Flushometer Valve Finish: Polished, chrome-plated, exposed metal parts.

14. Toilet Seat: Solid-plastic, water-closet seat with bumpers and hardware, compatible with water closet and as follows:
    a. Color: White.
    b. Class: Commercial, Standard.
    c. Size: Elongated.
    d. Pattern: Open front without cover.
    e. Hinge Type: Self-sustaining check (SC).

2.21 WALL CLEANOUT SCHEDULE

A. Wall Cleanout, finished WCO-1 shall be equal to Josam Series 58890, Jay R. Smith Fig. 4472 or Zurn model Z-1468 access cover and plug, round stainless steel wall access cover complete with securing screw and slotted or raised head bronze plug.

2.22 DOMESTIC HOT WATER HEATER SCHEDULE

A. Water Heater WH-1 Mobius tankless water heater shall be Model T-M32 ASME as manufactured by Takagi Industrial Company, Inc.
    1. The Mobius water heater(s) shall be a copper coil integral fin and tube construction with quick release brass or bronze waterways.
    2. Heater will be factory assembled and tested.
    3. The heater shall be vented with 4" Stainless steel Category III vent pipe a distance not to exceed 50' (equivalent) feet terminating vertically or horizontally as prescribed. Intake air with optional direct vent kit may be of such material as PVC not to exceed a total of 50' (equivalent).
    4. The heater(s) shall be controlled by onboard solid state printed circuit board monitoring incoming and outgoing temperatures with factory installed thermistors, sensing and controlling flow rate to set point temperature with control both air and gas mixture inputs to maintain thermal combustion efficiency. Unit also consists of ground fault interrupter, inline fusing, spark ignition and sensor system, aluminized stainless steel burners, air-fuel ration rod, Hi limit switch, modulating and proportional gas valves, freeze protection sensor and heating block and overhead cut-off fuses.
    5. The water heater(s) shall be CSA listed, exceeds the energy efficiency requirements of ASHRAE 90. 1b-1992.

2.23 WATER HAMMER ARRESTER SCHEDULE

A. Water Hammer Arrester WHA shall be Sioux Chief Hydra-Rester, Watts No. 15, Precision Plumbing Products SC Series, or equivalent. Water shock absorbers are constructed of seamless hard drawn or rolled type L copper with dual or triple O-ring piston, FDA approved #111 Silicone sealant, ASSE 1010 certified. Selection and location shall be in accordance with Plumbing and Drainage Institute Standard PDI-WH201, and where located on the Construction Drawings.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. General:
    1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
    2. Verify that plumbing may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies:
    1. In the event of discrepancy, immediately notify the Architect/Engineer.

2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 PLUMBING SYSTEM LAYOUT

A. General:

1. Layout the plumbing system in careful coordination with the approved shop drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactory functioning system.
2. Follow the general layout shown on the approved shop drawings in all cases except where other work may interfere.

B. Enclosure of Pipes:

1. Except where specifically permitted by the Architect/Engineer, lay out all pipes to fall within partition, ceiling, or roof cavities and to not require furring other than that shown on the approved shop drawings.

3.03 TRENCHING AND BACKFILLING

A. Perform all trenching and backfilling associated with the plumbing installation in strict accordance with provisions of Division 31 of these specifications.

3.04 EXISTING SERVICES

A. Where existing sewers, piping, gas, electric or other services are encountered in areas in which their presence was unknown by best available information, including information from local utility companies, each affected Contractor shall take adequate steps to protect such services.

B. If such existing services require relocation, make written request for ruling from the Architect/Engineer. Do not proceed on such portions of the work until written instructions are received.

C. Inactive services shall be plugged, capped or removed. Notify utility companies, municipal agencies having jurisdiction and the Architect/Engineer. Protect or remove as directed.

3.05 INSTALLATION OF PIPING AND EQUIPMENT

A. General:

1. Install all piping, promptly capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
2. Provide uniform pitch of 1/4" per foot when possible and 1/8" per foot minimum for all horizontal waste and soil piping within the building. Pitch all vents for proper drainage.
3. Cushion all straps and bearings to minimize transfer of sound. Firmly anchor all pipes in position. Provide complete isolation of dissimilar metals.
4. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions. Promptly remove all defective material from the job site.
5. Install pipes to clear all beams and obstructions. Do not cut into or reduce the size of load carrying members without the approval of the Architect/Engineer.
6. Locate all vent pipe discharges in accordance with plumbing and mechanical codes having jurisdiction relative to distances from air intakes, windows, and other situations where their presence constitutes a hazard. Generally at least ten feet horizontal distance from or three feet vertical distance above air intakes is required.

B. Joints and Connections:

1. Threaded Joints: Joints in threaded piping shall be made with graphite and oil joint compound, or specified lubricant, applied to the male thread only. Care shall be used to keep the inside of the pipe clean from joint compound, cuttings, scale and other

foreign material. Pipe shall be reamed full size. Leaking joints shall be repaired by replacement with new threaded materials.

2. Welded Joints:
   a. Where welding is called for, it shall be of the fusion process and shall consist of welding by means of either the oxy-acetylene or electric arc process.
   b. All welding shall conform to the ASME Code for Power Boilers, or the ANSI code for Pressure Piping (latest edition).
   c. The connections to a welded pipe 2" and larger shall be made with a welding tee or Weld-0-Let of butt, socket, or threaded type as required.
   d. Only welding ells may be used for changing pipe directions of welded pipe lines. Mitered joints will not be permitted.
3. Where PVC pipe is used, joints shall be made by solvent cementing method, performed in strict accordance with manufacturer's written instructions except where other types of joints are shown or specified.
4. Pack all joints in cast iron soil and waste pipe and fittings, using approved material and method, securing fully and properly caulked and smoothly finished, except where compression-type neoprene or no-hub fittings are permitted and used.
5. Make all aboveground joints in copper tube with lead-free solder applied in strict accordance with the manufacturer's recommendations.

3.06 INSTALLATION OF VALVES

A. Gate and globe valves shall not be installed with stem below the horizontal.

B. Gate or ball valves shall be provided in all main branches of the piping and where necessary to dismantle, drain, and repair the systems.

3.07 INSTALLATION OF PLUMBING FIXTURES

A. The rims, fronts and all exposed parts of lavatories, service sinks, water closets, drinking fountains and other fixtures shall be covered and protected with suitable guards and building paper until completion of the work. This protection is to be installed immediately at the time of setting plumbing fixtures and to be removed only when the completed project is turned over to the Owner.

B. All fixtures shall be sealed gas and watertight at walls and floors in accordance with manufacturer’s recommendation. Manufacturer's recommended hold down bolts shall be used and shall be equipped with nuts and washers.

C. Roughing in dimensions shall be determined only from fixture brochures approved by the Architect/Engineer.

D. Mounting of fixtures shall meet ADA accessibility guideline requirements where applicable.

3.08 INSTALLATION OF UNDERGROUND PIPING

A. Sewer Pipe:
   1. The trench shall be dry during the pipe laying operation. If dewatering is needed, it shall be this contractor's responsibility. The trench bottom shall be prepared as previously specified. Bell holes shall be excavated to that after placement, the barrel of the pipe will have full hearing on the trench bottom.
   2. Pipe shall be protected during handling against impact shocks and free fall.
   3. The laying of the pipe shall commence at the outlet and proceed up grade with spigot ends pointing in the direction of flow.
   4. The socket of the pipe last laid shall be wiped clean and the spigot end of the pipe to be laid shall then be centered and pushed home against the base of the socket. The pipe shall be centered so that they will form a sewer with a uniform invert. The joints shall be made as previously described.

5. All pipe shall be laid to the line and grade called for on the plans or minimum slope necessary to satisfy plumbing code. Each pipe, as laid, shall be checked the contractor with a suitable sighting level beam to insure that this result is obtained.
6. After the pipe is laid, sharp sand or fine gravel shall be carefully deposited along the sides of the pipe. Backfill shall be carefully tamped under the haunches of the pipe. Care shall be taken during backfilling and tamping so that the line and grade of the pipe are not disturbed. Any pipe found off grade or out of line shall be re-laid properly by the contractor. Additional sand, gravel or stone shall then be placed until the entire width of the trench is filled to not less than one foot above the top of the pipe. If sand is used for back fill around the pipe, it shall be thoroughly compacted with a vibratory compactor; hand compaction will not be acceptable. The remainder of the backfilling may be done in the manner presented elsewhere in these specifications.
7. Minimum cover for exterior piping shall be six feet unless otherwise specified. Interior piping shall have a minimum distance of six-inches from top-of-pipe to bottom-of-floor slab.

3.09 CLEANING SANITARY SEWERS

A. Verification: Prior to putting systems into use and before the sewer is tested thoroughly flush the sewers and verify that all new and existing sanitary sewers are free of construction debris. If this simple flushing procedure does not readily verify the piping is intact and clean, the sewer shall be cleaned as follows:

B. The Contractor shall furnish an inflatable rubber ball of a size that will inflate to fit snugly into the sewer to be tested. The ball shall be placed in the upstream manhole and water shall be introduced behind it. The ball shall pass through the pipe with only the force of the water propelling it. All debris flushed out ahead of the ball shall be removed at the first manhole where its presence is noted.

C. In the event debris stops the ball, the Contractor shall remove the obstruction by further flushing or cleaning. In the event a damaged pipe stops the ball, the Contractor shall repair the sewer.

D. Cleaning may also be accomplished by the use of a high-pressure water jet.

3.10 CLOSING IN UNINSPECTED WORK

A. General:
   1. Do not cover up or enclose work until it has been properly and completely tested, inspected, and approved.

B. Non-Compliance:
   1. Should any of the work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect/Engineer all at no additional cost to the Owner.

3.11 TESTING

A. General Procedures:
   1. Furnish all required personnel and equipment and make all tests required to receive the approval of the Architect/ Engineer and all agencies having jurisdiction.
   2. Piping shall be tested at a hydrostatic pressure to fifty-percent over the system design pressure or at 125 psig, whichever is greater, except that plumbing fixtures and drainage piping shall be tested according to code requirements. Systems shall have no significant pressure loss for 24 hours. If defects are found, repeat tests after defects have been corrected.
   3. Concealed pipe shall be tested in sections in such a manner that will not leave any pipe or joint untested.

4. Control devices, air vents and other parts not designated to stand pressures used in testing piping shall be removed or otherwise protected before testing the piping systems.
5. Use Piping Pressure Test Report form in Section 22 02 00 for record purposes where applicable.
6. Full payment will not be authorized unless all piping pressure test reports or signed certifications of complete leak free systems are submitted to the Architect/Engineer.

B. Additional Testing Requirements:

1. All fabricated piping shall, as a minimum, meet the examination, inspection and testing requirements of ANSI B31.3.
2. Inspectors representing the Owner shall have access at all times while work on their contract is being performed to all sections of the worksite that concern the fabrication and erection of the piping on their contract. The inspectors shall be afforded all reasonable facilities to satisfy them that the work is being performed in accordance with the requirements of applicable specifications and procedures.
3. All welding performed under this specification shall be subject to visual inspection. This visual inspection shall include an examination of joint details prior to welding, inspection for defects during welding and for defects, undercut, overlay and reinforcement dimensions after welding.
4. As far as is practicable, all pressure tests shall be complete system tests conducted in the presence of Architect/Engineer representative. All pressure vessels, instruments and equipment connected to the piping shall be excluded from the tests.
5. Every precaution shall be taken during testing to insure the safety of the operator. Systems to be pressurized will be provided with appropriate gages and pressure relieving devices.
6. All joints, including welds, are to be left un-insulated, unpainted, and exposed for examination during testing.
7. Equipment which is not to be subjected to the pressure test shall be either disconnected from the piping or isolated by blinds or other means during the test. Valves may be used provided that the valve is suitable for the proposed test pressure.
8. Expansion joints shall be provided with temporary restraint, if required, for the additional pressure load under test, or shall be isolated from the test.
9. Pressure relief and thermal relief valves shall be excluded from these tests.
10. Before every test the piping systems shall be visually inspected to assure that there are not visual defects and that all connections are tight.
11. Control valves, unless being tested, shall be set and maintained in the wide open position.
12. Lines that are spring or counterweight supported and all vapor or gas lines shall be temporarily supported during test in order to support the test fluid load, if necessary.
13. Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.
14. All in-line instruments, gage glasses, flow meter pot, liquid level float gages, and all other pressure parts of instruments shall be excluded from these tests.
15. Pneumatic testing of fiberglass reinforced plastic, glass, or plastic piping is not permitted.
16. Joints found to be defective shall be repaired and retested.
17. Retesting of lines after repairs shall be done at pressures originally specified for the test.
18. When pneumatic or hydrostatic tests are not appropriate, tests shall be as specified by the Architect/Engineer.

C. Test Reports: The Contractor shall make a record of the test applied to each piping system, which shall consist of the following data: Note: Full payment will not be authorized unless all piping pressure test reports or signed certifications of complete leak free systems are submitted to the Architect/Engineer.

1. Line designation number.
2. Date of test.
3. Type of test, pressure applied, and length of time at test pressure.
4. Tested by:
5. Comments, if any:
6. Piping Pressure Test Report form in Section 22 02 00 to be completed.

D. Hydrostatic Tests:

1. The hydrostatic test pressure shall be calculated in accordance with applicable section of ANSI B31.3, but shall not exceed the maximum test pressure of any component included in the test.
2. Temperature and head adjustments shall be made in accordance with ANSI B31.3, Paragraphs 337.4.1 and 337.4.2.
3. Hydrostatic test pressures for fiberglass reinforced plastic, glass or plastic pipe, must not exceed manufacturer's recommended working pressure.
4. All hydrostatically tested systems shall be tested to one and one-half times the design pressure or to a minimum pressure of fifty psig, whichever is greater. All test pressures shall be maintained a minimum of ten minutes before visual examination of joints begins.
5. Hydrostatic test pressures shall not be applied until the piping system and the testing medium have reached thermal equilibrium.
6. During the tests, hydrostatic pressures shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure the test pressure shall be kept within five psig or one percent, whichever is greater, of its intended value. All joints shall be visually examined for leakage during the test.
7. Tested systems shall be vented and drained immediately upon successful completion of the test. All process and solvent lines shall be dried by passing clean dry oil-free air through them until they are dried to the satisfaction of the Architect/Engineer or the Architect/Engineer representative.
8. No repair welding shall be done on any section of piping that contains water.

E. Pneumatic Tests:

1. Air tests shall be performed with clean, dry, oil-free air, or nitrogen, as required. The source shall be equipped with appropriate pressure relief valves and gages.
2. Air tests shall be performed at a test pressure in accordance with the applicable section of ANSI B31.3. The minimum test pressure shall be fifty psig.
3. Pneumatically tested systems shall include a preliminary check at not more than fifty psig. The system shall then be brought up to test pressure in twenty-five psig increments. Enough time shall be left between steps to allow the system to equalize strains, to inspect for leaks by soap and water method and to allow test media to reach thermal equilibrium.
4. During the test, pressures shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure, the test pressure shall be kept within five psig of its intended value.
5. Tested systems shall be vented immediately upon successful completion of the test.
6. No repair welding shall be performed on a pressurized system.
7. Where both hydrostatic and pneumatic tests are run on a section of pipe, the hydrostatic test shall precede the pneumatic.

F. Standing Water Test

1. All portions of the system shall be filled with water.
2. Water shall stand for a period of not less than eight hours.
3. The leak rate shall be as specified by "Sewer Design and Construction" - ACME M&R No. 37. Steel piping systems shall be leak tight.
4. If the system loses water faster than the rate specified, the leaking component shall be repaired and the system retested.

3.12 STERILIZATION OF PIPES

A. General:

1. After preliminary purging of the system, chlorinate the entire potable water system, both site and in building, in accordance with the current recommendations of the American Water Works Association and in accordance with pertinent codes and regulations.
2. Chlorinate when building is unoccupied and before water is used for human consumption. Post signs at all taps stating water is unsafe. Remove signs after chlorination.

B. Flushing:

1. Upon completion of the sterilization, thoroughly flush the entire potable water system.
2. When sterilization and flushing are complete arrange with agencies having jurisdiction for all required tests on mains and systems.
3. Contractor shall repeat chlorination and flushing if tests show water is unsafe until safe levels are verified.

3.13 POTABLE WATER SYSTEM TESTING

A. After completion of the work and prior to owner occupancy, contractor shall utilize the services of an independent testing laboratory to verify that concentrations of dissolved lead in the potable water system meet the guidelines of US EPA and State and local Health Departments.

B. Testing shall include representative sampling from all areas of the building, typically sampling the incoming water, at the end of each major piping supply loop, and at domestic hot water returns to water heater systems. Testing shall sample the first one-half gallon at each location after systems have been idle for at least six hours.

C. If testing indicates levels higher than standards allow, contractor shall take appropriate steps to resolve the problem, typically a series of flushing with very hot water and then retesting.

D. Submit to Architect/Engineer three copies of letters from agencies having jurisdiction documenting the safety and acceptance of the potable water system.

3.14 CLEANING UP

A. Prior to acceptance of the work thoroughly clean all exposed portions of the plumbing installation. Remove all labels and all traces of foreign substance, using only a cleaning solution approved by the manufacturer of the plumbing item, being careful to avoid all damage to finished surfaces.

END OF SECTION

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SECTION 23 00 00
HEATING, VENTILATION, & AIR CONDITIONING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included:

1. Heating, ventilating, and air conditioning required for this work is indicated on the drawings and includes, but is not necessarily limited to:
   a. HVAC work included under HVAC systems in Section 22 00 00 Scope of Work.
   b. Responsibility for operation, startup and guarantee of installed systems and equipment.
   c. All necessary permits and approvals associated with installation of this work.
   d. Provide dampers, if so indicated, under Equipment Specifications. Note that at least one damper motor must be provided for each 48 inch x 48 inch damper, unless other motors are already indicated to meet the required function of the dampers.
   e. Install all automatic dampers. Dampers shall be set free of binding. Frames of dampers shall not be used to square duct work and shall be caulked for tight seal. Access doors or panels shall be furnished and installed by sheet metal workers to allow access to automatic control dampers.
   f. Assemble multiple section dampers with required interconnecting linkages, shafts and brackets and extend the required number of shafts through the ducts for externally-mounted damper motors. Jack shafts will be assembled with sealed roller or ball bearings of stainless steel construction.
   g. Dampers, louvers, grilles, diffusers, and other specified items.
   h. Include one set of spare filters for startup. After operating systems, and balancing airflow, replace with clean filters prior to turning over facility to owner.
   i. Startup and coordination with Testing and Balancing (TAB) Contractor.

B. Related Work Described Elsewhere:

1. Section 22 00 00: Scope of Work
2. Section 22 01 00: General Provisions
3. Section 01 73 16: Equipment Erection
4. Section 22 07 00: Insulation
5. Section 22 10 00: Plumbing
6. Section 23 09 00: Controls & Instrumentation
7. Division 26: Electrical

1.02 QUALITY ASSURANCE

A. Qualifications of Installers:

1. For the actual fabrication, installation, and testing of work under this section, use only thoroughly and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.
2. In acceptance or rejection of the finished installation, no allowance will be made for lack of skill on the part of installers.

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in "Duct Construction Standards" 2005 edition, as published by the Sheet Metal and Air Conditioning Contractors Association (SMACNA), on all systems.

2. Comply with NFPA 90A, UL Standard 181, and SMACNA.
3. ASHRAE Handbook, particularly most recent Systems Volume Chapter on Sound and Vibration Control.

1.03 SUBMITTALS

A. Shop Drawings:
1. Within 15 days after award of contract, and before any materials of this section are delivered to the job site, submit complete shop drawings to the Architect/Engineer in accordance with the provisions of Section 01 33 00 of the General Requirements.

B. Materials List:
1. Accompanying the shop drawings, submit a complete list of all materials proposed to be furnished and installed under this section, giving manufacturer's name and catalog number for each item; this shall in no way be construed as permitting substitution except as specifically provided in Section 01 33 00 of the General Requirements.

C. As-Built Drawings:
1. During progress of the work, maintain an accurate record of all changes made in the system from the layout and materials shown on the approved submittals or plans.

1.04 PRODUCT HANDLING

A. Protection:
1. Use all means necessary to protect the materials of this section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Replacements:
1. In the event of damage caused by this contractor, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. General:
1. All equipment shall be of the capacity and type shown on the equipment schedule in the drawings and shall be as manufactured by one of the manufacturers designated herein or shall be an equal approved in advance by the Architect/Engineer.

B. Single Source:
1. For ease of maintenance and parts replacement, use equipment of a single manufacturer to the maximum extent possible.
2. Indicate on proposal form the equipment manufacturers to be used on this project.

2.02 NATURAL GAS PIPING

A. Above ground gas piping shall be Schedule 40 black steel ASTM A53 with 150 pound malleable iron screwed or 150 pound welded fittings.

B. Underground gas piping shall be X-Tru-Coat Plastic Coated Schedule 40 steel pipe meeting ASTM A-53 with welded hot wrapped joints grounded with magnesium anodes at appropriate intervals (approximately 20 feet). Underground gas piping installed by municipal gas utility, up to meter may be plastic pipe meeting local codes and requirements of municipal gas utility.

C. AGA (IAS) rated ball valves shall be used on gas service through 2" size, equal to Legend Model T-3000 Blue Top gas ball valve or Hammond 875, rated at 175 psig WOG.

D. Gas Pressure Regulator: Per ANSI Z21.18, single-stage steel-jacketed, corrosion-resistant pressure regulator. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 F for 2" NPS and smaller piping. Regulator shall be capable of reducing owners service pressure to 7" W.C. Contractor shall verify owner's service pressure.

E. Install piping per installation guidelines set forth in section 22 10 00.

2.03 DUCTWORK

A. Rectangular Ductwork:

1. Rectangular ductwork shall be constructed to meet all functional criteria defined in Section VII, of the SMACNA "HVAC Duct Construction Standards Metal and Flexible" 1985 (not 1995) Edition (SMACNA Manual), and shall comply with all local, state, and federal code requirements.

2. Rectangular ductwork shall be galvanized iron, fabricated, joined, and supported in accordance with SMACNA recommended procedures, 2" w.g. maximum pressure. See Section 15.250 for Insulation. All ducts within ten feet of the floor shall be constructed of 16 gauge material.

B. Round Ductwork:

1. Round ductwork shall be galvanized steel meeting SMACNA low pressure requirements, 2" w.g.

2. Round fittings shall be United Sheet Metal Uni-Form manufactured from galvanized steel meeting ASTM A-527-71 and SMACNA high pressure requirements with continuous welds. Standing seam fittings meeting these requirements are also acceptable.

2.04 DIRECT FIRED MAKEUP AIR UNIT (MAU-1 and MAU-2)

A. Direct fired makeup air units shall be Greenheck size and performance as indicated on the equipment schedule, or equivalent commercial/industrial units by Modine. Unit shall meet ANSI Z83.4 standards and shall be suitable for indoor installation makeup air applications.

B. Direct-fired horizontal heating and ventilating units, completely gas piped and wired, 20-100% outside air, with outside air filter section.

C. Heater housing shall be a minimum of 20 gauge galvanized steel enclosure. Burner area shall be insulated. Lifting lugs shall be provided as required for rigging. Base channel shall be provided. Finish shall be prime coat with two coats of finish paint.

D. Blower shall be double width, double inlet, forward curved centrifugal type fan, dynamically balanced, permanently lubricated ball bearings. Bearings shall have a L-10 rated life of 100,000 hours.

E. Motor shall be mounted on an adjustable base and shall be open drip proof, class B wire insulation, minimum 1.15 service factor, 1750 rpm, standard NEMA frame. Access shall be provided to all controls and fan shaft.

F. Motor and drive shall be factory installed, heavy duty high efficiency with its maximum operating speed not exceeding 75% of its first critical speed of the fan shaft. Motor shall be mounted on an adjustable base and shall be open drip proof, class B wire insulation, minimum 1.15 service factor, 1800 rpm, standard NEMA frame.

G. Control of the unit shall be provided as described in the equipment schedule and the controls specifications. Controls shall include remote panel and auxiliary relays as required to carry out the interface with other equipment as specified.

H. Burner shall be cast aluminum with stainless steel mixing plates with a dual stage burner. Burner controls shall include high temperature safety control, flame safety control and electric spark pilot ignition.

I. Optional features shall be as described in the equipment schedule.

2.05 CEILING EXHAUST FANS (EF-4)

A. Fans shall be based on Greenheck or Carnes series indicated in the equipment schedule, size and capacity as shown on the plans with the following characteristics:

1. Galvanized steel scroll and housing.
2. Installation shall allow accessibility and removal of motor and blower without removing housing from the system, with blowers and motors easily taken down by removable fasteners. Filters shall be easily accessible.
3. Motor shall be permanently lubricated. Units shall have internal accessible internal wiring box with receptacle.
4. White designer non-yellowing grille.
5. Round outlet duct collar with integral backdraft damper.

2.06 CENTRIFUGAL IN LINE EXHAUST FANS (EF-1 thru EF-3)

A. Fans shall be based on Greenheck or Carnes series indicated in the equipment schedule, size and capacity as shown on the plans with the following characteristics:

1. Galvanized steel box and housing, acoustically insulated for quiet operation.
2. Fan shall be oriented with side discharge.
3. Installation shall allow accessibility and removal of motor and blower without removing housing from the system, with blowers and motors easily taken down by removable fasteners.
4. Motor shall be permanently lubricated. Units shall have internal accessible internal wiring box with receptacle.
5. Design of outer box shall be such that "in-field" change of discharge position, horizontal or vertical, is accomplished by moving interchangeable panel by use of removable fasteners.

2.07 GAS FIRED UNIT HEATERS (GFUH-1 thru GFUH-4)

A. Sealed Combustion Units shall be by Modine or equal by Reznor or Trane as indicated in the equipment schedule. with power vented, low static axial fan, aluminized steel heat exchanger, aluminized steel burners, draft diverter, factory installed 24 volt controls, wall mounted thermostat, spark ignition, fan time delay, totally enclosed motors with thermal overload protection, and adjustable louver fin diffusers.

1. Provide separate combustion air and flue vents routed per the manufacturers recommended best practices and terminate with wall cap. Concentric vents are not allowed.

2.08 ELECTRIC UNIT HEATERS (EUH-1)

A. Berko unit heater or equal by Modine, Reznor, Trane or Sterling of the size and capacity listed in the equipment schedule. Unit shall be UL listed for safe operation. Unit shall have factory installed 24 volt controls, wall mounted thermostat, totally enclosed motors with thermal overload protection, and adjustable louver fin diffusers.

2.09 DAMPERS AND SPLITTERS

A. All dampers or splitters required for this work shall be sufficiently stiffened to prevent noise or vibration and in no case shall be lighter than twenty (20) gauge galvanized iron and shall be fitted with accessibly located adjuster. Dampers and regulators shall be as manufactured by Ruskin, Honeywell, Penn/Johnson Controls, or approved equal. Control damper shall be opposed blade as made by Ruskin, Honeywell or Johnson Controls, of 16 gauge construction. Shutoff dampers shall be "Zero leakage type". Dampers for field constructed mixing boxes shall be parallel blade with blades oriented to promote mixing, equal to Ruskin CD50.

2.10 TURNING VANES

A. Turning vanes shall meet SMACNA HVAC Duct Construction Standards sufficiently stiffened to prevent vibration. Turning vanes shall be equal to Harper, double wall turning vanes, fabricated from the same material as the duct. Tab spacing shall be SMACNA standard. Rail systems with non-standard tab spacings shall not be accepted. All tabs shall be used, do not skip tabs. Mounting rails shall have friction insert tabs which align the vanes automatically. Vanes shall be subjected to tensile loading and be capable of supporting 250 lbs. when fastened per the manufacturer's instructions, equal to Ductmate PRO-Rail.

2.11 LOUVERS

A. Louvers shall be drainable blade, heavy duty of anodized aluminum with custom Kynar finish selected by Architect. Louvers shall be rated according to AMCA Standard 500. Louvers shall be sized at 500 FPM maximum air velocity where not sized on plans. Manufacturer shall be Ruskin or equal by American Warming and Ventilating, Louvers and Dampers, Dowco, or Greenheck. Where aluminum comes in contact with steel, the steel shall be insulated from direct contact with the aluminum by a heavy coat of alkali-resistant paint or synthetic resin zinc chromate primer. Provide sixteen (16) gauge 1/2 x 1/2 mesh bird screen with a removable frame installed at the inner face of the louver.

2.12 ACCESS

A. Provide hinged access panels in ducts and in walls or ceiling where concealed adjacent to all dampers, fire dampers, splitters and temperature control devices. Fasteners shall be Camlock type for ready access and tight locked shutoff. Units shall be UL approved or contractors shall furnish an affidavit for units through rated walls and ceilings. Location of access panels shall be coordinated with the other trades subject to the approval of the Owner or Architect/ Engineer.

2.13 VIBRATION, ISOLATORS AND FLEXIBLE CONNECTORS

A. Type 2 Hangers: Model SFH by Peabody Consolidated Kinetics, or equal by Korfund Vibration Mounting and Control, Inc., or Mason combination spring and fiberglass hangers, incorporating 2" thick neoprene jacketed pre-compressed molded fiberglass inserts in series with springs, all encased in welded steel brackets. The outside spring diameter shall be a minimum of 0.8 times the designed spring operating height, and shall have a minimum additional travel of 50% between the design height and solid height.

B. Ductwork Connections: All junctions between ductwork and makeup air units or fans shall be made with flexible connections to eliminate vibration transmissions, "Thermafab" flexible connections by Duro-Dyne Corporation, Farmingdale, New York, or approved equal by Ductmate. Material shall be a high strength fiberglass fabric-coated on one side with an inorganic elastomeric compound, nonporous, fireproof, with high tensile strength, low smoke emissions to withstand 500`F continuous duty. Allow 2" gap between ends being joined.

C. Vibration isolation equipment selection shall also comply with Table 42 of Chapter 43, ASHRAE Applications Volume, on Sound and Vibration Control.

D. Where air handling unit non-fan sections or ductwork plenums are set on concrete pads, isolate from the concrete using continuous 1/2 inch thick Korfund or equal composition rubber isolation pad. Fan sections must be installed with internal or external spring isolation.

E. See Part 3 for installation.

2.14 OTHER MATERIALS

A. All other materials not specifically described or listed but required for a complete and proper installation of the work of this section, shall be as selected by the Contractor, subject to the approval of the Architect/Engineer.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that the work of this section may be installed in accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect/Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

C. Field Measurement:

1. Measurements of actual field conditions must be made by contractor to verify equipment and ductwork installation requirements.

3.02 INSTALLATION OF EQUIPMENT

A. General:

1. Install all equipment where indicated on the approved shop drawings.
2. Avoid interference with structure and the work of other trades; do not cut into load carrying members without the specific approval of the Architect/Engineer.

B. Inspection:

1. Check each piece of equipment in the system for defects, verifying that all parts are properly furnished and installed, that all items function properly, and that all adjustments have been made.

3.03 INSTALLATION OF DUCTS

A. Fabrication of Rectangular Ducts:

1. Fabricate and install all ducts in strict accordance with the approved shop drawings and the referenced standards.
2. On sheet metal ducts, cross-break or roll form all flat surfaces to prevent vibration.

B. Duct Layout:

1. All duct sizes shown on the drawings are net dimensions inside the insulation; wherever obstructions require a change in duct size, maintain equivalent areas.
2. On rectangular duct, make all duct elbows right angle type with elbow turns or turning blades, or make elbows with a radius of 1-1/2 times the duct width.
3. Fabricate transitions using a 30` angle (max.) when reducing a dimension and 45` angle (max.) when increasing a dimension.
4. One (1") inch diameter test openings shall be furnished in ductwork where required for proper adjustment of all supply and exhaust systems. Provide suitable pressure-tight coverings for openings when not in use.

C. Dampers and Splitters:

1. The Contractor shall strategically locate dampers, splitters, or volume controllers to accurately regulate the flow of air.
2. Install opposed blade balancing dampers where shown on the plans and in the fresh air intake and return air ducts at each unit, unless already furnished with the equipment. Dampers shall be constructed of not less than twenty (20) gauge galvanized steel, blades shall not be over twelve inches (12") wide or forty-eight (48") inches long. Damper blades shall be close fitting with blade shaft riding on Oilite or

nylon bearings all mounted in heavy gauge channel iron. Use standard mixing boxes where shown.

3. Furnish and install volume regulators and dampers at all branch take-offs to diffusers and supply registers.
4. After dampers have been finally adjusted, the open and closed position of each damper shall be marked on the duct adjacent to the damper quadrant. Also, Contractor shall scribe end of damper shaft parallel to open direction of damper to denote damper orientation.

D. Openings:

1. The Contractor shall advise all parties concerned as to the proper size and shape of all necessary openings for ductwork, grilles, exhaust fans, gravity relief vents, and other system components, and shall direct said contractor in their proper placement. All voids around conduit, ductwork, tubing, and other items penetrating walls and floors of smoke barriers and rated walls shall be filled with Dow Corning Firestop Sealant or approved equal.

E. Ductwork Support:

1. Hang and support ductwork as defined by SMACNA, Section IV, 1995 Manual, Second Edition, or as defined within. Hanger spacing shall not exceed 8 feet. Contractor must verify adequacy of supporting structures. In all cases, ductwork shall be securely and permanently installed in a rigid manner.
    a. Horizontal, rectangular duct above 60" - use angle iron on each side and one across top and bottom of duct, welded or bolted together and spaced on 10 foot centers.
    b. Horizontal, round duct above 36" dia. - use 1" x 16 gauge continuous U-shaped strap passing under duct and anchored to support in two places.
    c. Vertical ducts shall be supported at each floor with angles. 12" x 12" or equivalent ducts shall have supports riveted to duct. Larger ducts shall be flanged and supports bolted to flange.
    d. Where it is not convenient to support ductwork at the desired location, additional structure shall be provided by this contractor to meet the span and load requirements.
2. Access Doors
    a. Furnish and install sheet metal doors in ducts where shown on the drawings and at each other point where access to concealed equipment or control devices must be made through the ductwork.
    b. Make all such doors air-tight with neoprene stripping and provide latch on each door that can be opened from inside and outside the duct. No access door shall be smaller than duct width x 12" up to 12" duct. Duct 12" will have access door 12" x 24" and increase with duct width to 24" x 24". Access doors shall be hinged one side, open inside and outside, swing to seal tight from or by air pressure and meet necessary fire ratings as applicable.
    c. Ductmate Sandwich Type Access Doors may also be used meeting either above minimum size requirements or of adequate size to allow easy access to equipment which must be maintained.
    d. Also see specifications for access panels in Section 2.
    e. Install access doors adjacent to duct silencers to allow access for inspection or cleaning.

3.04 INSTALLATION OF VIBRATION ISOLATORS AND FLEXIBLE CONNECTORS

A. The first three supports of ductwork on the discharge of makeup air units shall be isolated from the structure using Type 2 vibration isolators to minimize transmission of airflow generated vibration to the structure.

END OF SECTION

SECTION 23 05 53
HVAC IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES
A. Identification of products installed under Division 23.

1.02 REFERENCES
A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.
B. ASTM B-1, B-3, and B-8 for copper conductors.
C. ASTM D-1248 for Polyethylene Extrusion Materials, ICEA S-70-547 Weatherproof Resistant Polyethylene Conductors, ICEA S-61-402/NEMA WC5 Thermoplastic Insulated Wire & Cable, ICEA S-95-658/NEMA WC70 Non-Shielded 0 – 2kv Cables.
D. CGA Pamphlet C-9, Standard Color-Marking of Compressed Gas Cylinders for Medical Use.
E. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.
F. U.S. Green Building Council LEED 2009 Reference Guide for Green Building Design and Construction, First Edition including addenda. www.usgbc.org

1.03 RELATED SECTIONS
A. Section 22 01 00 – Mechanical and Plumbing General Provisions

1.04 SUBMITTALS
A. Submit shop drawings under provisions of Section 23 05 00. Include list of items identified, wording, letter sizes, and color coding.
B. Include valve chart and schedule listing valve tag number, location, function, and valve manufacturer's name and model number.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. 3M, Bunting, Calpico, Craftmark, Emedco, Kolbi Industries, Seton, W.H. Brady, Marking Services.

2.02 MATERIALS
A. All pipe markers (purchased or stenciled) shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

O.D. of Pipe or insulation	Marker Length	Size of Letters
Up to and including 1-1/4”	8”	1/2”
1-1/2” to 2”	8”	3/4”
2-1/2” to 6”	12”	1-1/4”

Plastic tags may be used for outside diameters under 3/4".

B. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

C. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

D. Stencil Painted Pipe Markers: Use industrial enamel spray paint per ANSI Standard A13.1. Indicate fluid conveyed and flow direction.

E. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

F. Tracer Wire:

1. Single copper conductors shall be solid or stranded annealed or hard uncoated copper per UL83 and ASTM requirements. Tracer tape or copper-coated steel wire is not acceptable.
2. Conductor shall be insulated with HMWPE as specified and applied in a concentric manner. The minimum at any point shall not be less than 90% of the specified average thickness in compliance with UL 83.
3. Tracer wire shall be continuously spark tested at 7500 Volts DC. Other electrical and mechanical tests shall be in accordance with UL 1581.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install all products per manufacturer's recommendations.
B. Degrease and clean surfaces to receive adhesive for identification materials.
C. Valves:

1. All valves (except shut-off valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner's Representative prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem. On lever operated valves, drill the lever to attach tags.
6. Number all tags and show the service of the pipe.
7. Provide two sets of laminated 8-1/2" x 11" copies of a valve directory listing all valves, with respective tag numbers, uses, and locations. The directory shall be reviewed by the Owner's Representative prior to laminating final copies. Laminated copies shall have
brass eyelet in at least one corner for easy hanging.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Stencil Painted Pipe Markers:
    a. Remove rust, grease, dirt, and all foreign substances from the pipe surface.
    b. Apply primer on non-insulated pipes before painting.
    c. Use background and letter colors as scheduled later in this section.
4. Apply markers and arrows in the following locations where clearly visible:
    a. At each valve.
    b. On both sides of walls that pipes penetrate.
    c. At least every 20 feet along all pipes.
    d. On each riser and each leg of each "T" joint.
    e. At least once in every room and each story traversed.
5. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags

listing name, function, and drawing symbol. Do not label exposed equipment in public areas.

2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.

F. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.

2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

G. Tracer Wire:

1. Tracer wire shall be installed on top of all non-metallic buried utilities.
2. Tracer wire shall be taped directly to plastic water or drain pipe.
3. Tracer wire shall not be fastened directly or indirectly to gas piping.
4. Tracer wire when attached shall be secured to the pipe a minimum of every 10 feet and at all changes of direction.
5. Tape shall be Polyken “930-35”, Protecto-Wrap “310”, or approved equal.
6. Tracer wire shall be continuous between boxes and shall be tested for continuity.
7. Splices in tracer wire shall be made with a water proof splice kit to prevent corrosion. **Wire nuts shall not be used.**
8. The tracer wire shall daylight to grade through a 2” PVC conduit, at the point of the utility entrance to building. PVC conduit shall be capped and labeled as future contact point to locate the utility.

3.02 SCHEDULE

Pipes to be marked:

Pipe Service Lettering	Color	Background Color
Heating Water Supply	Black	Yellow
Heating Water Return	Black	Yellow
Condensate Drain	Black	Yellow
Compressed Air	Black	Yellow
Propane	Black	Yellow
All Underground Pipes	Varies	Varies
Refrigerant (Liquid, Suction or Hot Gas)	Black	Yellow
Tracer Wire - All other buried types	---	Green

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Testing, Adjusting and Balancing (TAB) shall include all work specified within this section including coordination with Mechanical and Controls Contractors.

B. Furnish all required personnel and equipment and perform all tests required to secure approval of the installation from all agencies having jurisdiction.

C. Balancing:

1. The contractor shall balance and adjust air moving equipment and air distribution and exhaust systems. All instruments used by the contractor shall be accurately calibrated and maintained in good working order. Balance and adjust the air system in accordance with the recommendations contained in "Standards for Field Measurements and Instrumentation, Total System Balance" of the Associated Air Balancing Council or the NEEB Manuals.
2. Upon completion of the system balancing, the contractor shall submit to the Architect/Engineer five (5) typewritten air balance reports with all pertinent data, including actual operating conditions report. Utilize standard NEEB or AABC forms or equal forms.

1.02 DRAWINGS AND SPECIFICATIONS

A. All portions of the project specifications are a part of these specifications as stated above. It shall be the balancing contractor's responsibility to properly coordinate the requirements of these provisions with the Mechanical Contractor.

1.03 GENERAL

A. The Mechanical Contractor shall select and employ an impartial, independent balancing agency will provide testing and balancing services for the heating, ventilating, and air conditioning (HVAC) systems of this project. These services shall be paid for by the Mechanical Contractor. Final approval of the balancing contractor shall be by the Engineer.

B. The schedule for testing and balancing the HVAC systems shall be established by the Mechanical Contractor in coordination with the balancing agency (on a critical path network). It is the balancing agency's responsibility to initiate this continuing coordination to determine his schedule for final testing and balancing services and the periodic inspections required during construction.

C. The balancing contractor will have a contractual relationship with the Mechanical Contractor but will be responsible to the Engineer for the satisfactory execution of testing and balancing the HVAC systems. The Mechanical Contractor shall have allowed sufficient funds in his project cost estimate for the testing and balancing phases.

1.04 QUALIFICATIONS OF THE BALANCING AGENCY

A. The balancing agency should be a member of the Associated Air Balance Council (AABC) or NEBB.

B. The balancing agency shall submit records of experience in the field of air and hydronic system balancing or any other data as requested by the Engineer. The supervisory personnel for the firm shall have at least five (5) years' experience, and all the employees used in this project shall be qualified technicians in this specific field.

C. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of

the balancing agency may be required by the Engineer to determine the balancing agency's performance capability.

1.05 STANDARDS

A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's or NEBB's standards and procedures including revisions, to the date of the contract.

B. All terms in this specification shall have their meaning defined as stated in the Standards.

C. If these specifications set forth more stringent requirements than the AABC or NEBB Standards and procedures, these specifications shall prevail.

1.06 DOCUMENTS

A. The Mechanical Contractor will provide the balancing agency one copy of the following documents:

1. Project drawings and specifications.
2. Approved construction revisions pertaining to the HVAC systems.
3. Approved submittal data on HVAC equipment and systems to be installed by the mechanical subcontractor.
4. Approved HVAC shop drawings.
5. Approved HVAC wiring diagrams, control diagrams, and equipment brochures, as appropriate.

1.07 COORDINATION

A. It will be necessary for the balancing agency to perform his services in close coordination with the Mechanical Contractor.

B. The plans and specifications have indicated meters, valves, dampers, and other devices for the purpose of adjusting the system to obtain optimum operating conditions. It will be the responsibility of the Mechanical Contractor to install these devices in a manner that will leave them accessible and readily adjustable. The balancing agency shall provide guidance if there is a questionable arrangement of a control or balancing device.

C. The General Contractor, Mechanical Contractor, Controls Systems Contractor, and the suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide all necessary data on the design and proper application of the system components. In addition, they shall furnish all labor and materials required to eliminate any system deficiencies.

1.08 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR

A. The Mechanical Contractor shall complete the installation and start all HVAC systems to ensure they are working properly, and shall perform all other items as described hereinafter to assist the balancing agency in performing the testing and balancing of the HVAC systems.

B. Air Distribution systems:

1. Verify installation for conformity to design.
2. Terminate all supply-, return- and exhaust ducts, and pressure test them for leakage, as required by specification.
3. Ensure that all volume-, splitter-, extractor-, and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside-, return-, relief-, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.
4. Verify that all supply-, return-, exhaust-, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operations.

5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.
6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.
7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost.
8. Install clean filters.

1.09 RESPONSIBILITIES OF THE CONTROLS SYSTEMS CONTRACTOR

A. The Controls Systems Contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The temperature control contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.
   1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
   2. Verify that all controlling instruments are calibrated and set for design operating conditions.
   3. Calibrate room thermostats after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.
   4. The Controls Contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.

1.10 NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

A. The Mechanical Contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The mechanical contractor shall attest that he has completed all items as described in these specifications.

B. If, upon commencing the work, the balancing contractor finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the balancing agency shall request an inspection to be made by the Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Should the inspection reveal the notification to have been premature, all costs for the inspection and work previously accomplished by the balancing agency shall be paid for by the general contractor. Furthermore, such items that are not ready for testing and balancing shall be completed and placed in operational readiness before testing and balancing services shall again be requested.

1.11 QUANTITIES

A. In all cases where a device, operation, procedure, tool, equipment, or part of the equipment is herein referred to in the singular number, it is intended that such reference shall apply to as many such devices, as are required to complete the testing and balancing specified herein.

1.12 STORAGE

A. In coordination with the general agency, the balancing contractor shall arrange for an area of ample size and convenient location for storage of tools, equipment, and other items as required.

1.13 PRO-RATE EXPENSE

A. The balancing contractor shall not be responsible in whole or in part for any pro-rate expense for utilities, or expense of any nature relating to the rest of the building or other contractor's work.

PART 2 - BALANCING SPECIFICATIONS AND RESPONSIBILITIES OF THE BALANCING AGENCY

2.01 SCOPE

A. In accordance with Project Drawings and Specifications and as specified herein, the balancing agency shall provide all supervision, personnel, instruments, calibration equipment, and all other materials and services necessary to perform all testing and balancing of the heating, ventilating, and air conditioning systems. All test data including all pertinent calculations shall be reported on appropriate forms.

2.02 GENERAL

A. The testing and balancing of the heating, ventilating, and air conditioning systems shall be performed by an independent balancing agency approved by the Engineer. The balancing agency shall have a minimum of five (5) years specialized experience in air- and hydronic system balancing, and possess calibrated instruments, qualified test-and-balance engineers, and skilled technicians to perform all required tests.

B. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems. The balancing agency shall then make available to the Owner's representative such instruments and technicians as are required for spot checks of the system.

C. The balancing agency shall not instruct or direct the mechanical contractor in any of the work. Any proposed changes or revision in the work shall be submitted to the Engineer in writing. The Engineer shall then process the proposal as appropriate.

2.03 AIR SYSTEM PROCEDURES

A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council National Standards or NEBB Standards:

1. Fan Speeds: test and adjust fan RPM to achieve design CFM requirements.
2. Current and Voltage: measure and record motor current and voltage.
3. Pitot-tube Traverse: perform a Pitot-tube traverse of main supply and return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation why a traverse was not made must appear on the appropriate data sheet.
4. Outside Air: test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat or compression and motor heat where applicable.
5. Static Pressure: Test and record system static pressures, including suction and discharge static pressure of each fan and pressure drop across components including coils, filters, mixing boxes and silencers.
6. Air Temperature: Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.

7. Main Ducts: Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
8. Tolerances: Test and balance each diffuser, grille, and register to within 10% of design requirements.
9. Identification: Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.
10. Description: record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
11. Minimizing Drafts: Adjust all diffusers, grilles, and registers to minimize drafts in all areas.
12. Prove tightness of duct construction by operating air handling equipment and physically verifying absence of air leakage, both audibly and manually.

2.04 SPECIAL SYSTEMS PROCEDURES

A. As required, special systems procedures must be specified separately.

2.05 VERIFICATION OF TEMPERATURE CONTROL

A. The balancing agency shall be assisted by the temperature control contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted.
   1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
   2. Verify that all controlling instruments are calibrated and set for design operating conditions.
   3. Calibrate the room thermostats after installation and before thermostat control verification tests are performed. The balancing contractor shall prove the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

2.06 TEST-AND-BALANCE REPORT

A. The test-and-balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified accurate and complete by the balancing agency's certified test-and-balance engineer.

B. Five (5) copies of the test-and-balance report are required and shall be submitted to the Engineer.

C. The report shall contain the following general data in a format selected by the balancing contractor.
   1. Project number
   2. Contract number
   3. Project title
   4. Project location
   5. Project Architect
   6. Project Mechanical Engineer
   7. Test & balance agency
   8. Test & balance engineer
   9. General contractor
   10. Mechanical subcontractor
   11. Dates tests were performed

12. Certification

D. The test-and-balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards or NEBB Standards. At a minimum, the report shall include:

1. Preface: A general discussion of the system, any abnormalities and problems encountered.
2. Instrumentation list: The list of instruments including type, model, manufacturer, serial number, and calibration dates.
3. System Identification: In each report, the VAV boxes, zones, supply, return, and exhaust openings, and traverse points shall be numbered and/or lettered to correspond to the numbers and letters used on the report data sheets.
4. Air handling equipment test-report forms: Record the following on each air-handling equipment test form:
   a. Manufacturer, model number, and serial number.
   b. All design and manufacturer-rated data.
   c. Total actual CFM by traverse if practical; if not practical, the sum of the outlets may be used, or a combination of each of these procedures. For specific systems, such as ones with diversity, see the AABC National Standards.
   d. Suction and discharge static pressure of each fan, as applicable.
   e. Outside-air and return-air total CFM.
   f. Actual operating current, voltage, and brake horsepower of each fan motor.
   g. Final RPM of each fan.
   h. Fan and motor sheave manufacturer, model, size, number of grooves, and center distance.
   i. Belt size and quantity.
   j. Static-pressure controls' final operating set points.

2.07 FINAL ACCEPTANCE

A. At the time of final inspection, the balancing agency shall recheck, in the presence of the Owner's representative, specific and random selections of data recorded in the certified test-and-balance report.

B. Points and areas for recheck shall be selected by the Owner's representative.

C. Measurements and test procedures shall be same as the original test and balance.

D. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.

E. If random tests demonstrate a measured flow deviation of 10% or more from that recorded in the certified test-and-balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test-and-balance report submitted, and a new inspection test made, all at no additional cost.

2.08 OPPOSITE SEASON TEST

A. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

END OF SECTION

SECTION 23 90 00
Temperature Control System (TCS) and Facility Management Control System (FMCS)

PART 1 - GENERAL

1.1. SUMMARY

A. Furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management system (FMCS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only.
B. All labor, material, equipment and software not specifically referred to herein or on the plans, that is required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.
C. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).
D. Contractor shall provide Integration of of system into existing WEBs supervisor per owner instructions.

1.2. SYSTEM DESCRIPTION

A. The entire Temperature Control System (TCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via LonMark™/LonTalk™ and/or BACnet™ communication protocols to a Network Area Controller (NAC). Temperature Control System products shall be by approved manufacturers.
B. The Temperature Control Systems (TCS) consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and perform functions specified.
C. The Facility Management and Control System (FMCS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be ac-

complished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonMark™/LonTalk™ (IDC) and/or BACnet™ (IBC) controllers and other open protocol systems/devices provided elsewhere.

D. The Facility Management and Control System (FMCS) as provided in this Division shall be based on a hierarchical architecture incorporating the Niagara AX Framework™. Equivalent products must be approved in writing by the consulting Engineer and be submitted for approval ten (10) days prior to the date of the bid submittal. Systems not developed on the Niagara AX Framework™ platform are unacceptable.

E. The Facility Management and Control System (FMCS) shall monitor and control equipment as called for by the "Sequence of Operation" and points list.

F. The Facility Management and Control System (FMCS) shall provide full graphic software capable of complete system operation for up to 34 simultaneous Thin-Client workstations.

G. The Facility Management and Control System (FMCS) shall provide full graphic operator interface to include the following graphics as a minimum:
   1. Home page to include a minimum of six critical points, i.e. Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW etc.
   2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
   3. Detail graphics for each mechanical system to include; AHUs (Air Handling Units), ERUs (Energy Recovery Units), TUs (Terminal Units), EFs (Exhaust Fans), Chillers and associated controls, Boilers, and Converters as a minimum.
   4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.

H. The Facility Management and Control System (FMCS) shall provide the following data links to electronically formatted information for operator access and use:
   1. Project control as-built documentation; to include all TCS drawings and diagrams converted to Adobe Acrobat .pdf filers.
   2. TCS Bill of Material for each system, i.e. AHU, RTU, FCU, Boiler etc.
   3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.
   4. Sequence of operation for all TCS provided systems.

I. The FMCS shall provide automated alarming software capable of sending messages to email compatible cellular telephones and pagers via the owner's e-mail service. The email alarm paging system shall be able to segregate users, time schedules, and equipment, and be capable of being programmed by the owner.

J. It is preferable that any dedicated configuration tool required for controller configuration have the capability to be launched from within the applicable Network Management Software. If the configuration tool(s) cannot be launched from the Network Management Software, any software required for controller configuration shall be included as a leave-behind tool with enough license capability to support the installation.

K. The contractor shall provide the appropriate quantity of legal copies of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be generally available in the market. No closed and/or unavailable tools will be permitted. Contractor shall convey all software tools and their legal licenses at project close out.

L. All necessary software to form a complete operating system, as described in this specification, shall be provided as an integral part of the supervisory controller, and shall not be dependent upon higher level computer for execution.

1.3. CONTRACTOR QUALIFICATION

A. The contractor shall be certified and trained by the TCS and FMCS manufacturer and shall be ACI (Authorized Controls Integrator) Honeywell Contractor. The firm must be specializing and experienced in DDC control system installation for no less than 5 years. All engineering and commissioning work shall be done by qualified employees of this manufacturer, or qualified employees of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturer's control equipment.

B. Where installing contractor is an authorized representative of the control equipment manufacturer, submit written confirmation of such authorization. Indicate in letter of authorization that the installing contractor has successfully completed all necessary training required for the engineering, installation, and commissioning of equipment and systems to be provided for the project and that such authorization has been in effect for a period of not less than three years. The letter of authorization should also indicate that the installing contractor is authorized to install the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly subcontracted and under the supervision of the manufacturer or Authorized Representative.

C. The contractor must have a service office within 20 miles of the building location. This requirement applies to the actual office location the individuals working on controls work out of. Response Time During warrantee period, must be four (4) hours or less, 24-hours/day, 7 days/week.

1.4. SUBMITTAL

A. Copies of shop drawings of the components and devices for the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions for all controllers, valves, dampers, sensors, routers, etc. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package:
   1. Damper Schedule: Damper and actuator sizing shall be performed, and a schedule created by the manufacturer. The schedule shall include a separate line for each damper and a column for each of the damper attributes: Damper Identification Tag, Location, Damper Type, Damper Size, Duct Size, Arrangement, Blade Type, Velocity, Pressure Drop, Fail Position, Actuator Identification Tag, Actuator Type, and Mounting.
   2. Valve Schedule: Valve sizing shall be performed, and a schedule created by the valve manufacturer. The schedule shall include a separate line for each valve and a column for each of the valve attributes: Valve Identification Tag, Location, Valve Type, Valve Size, Pipe Size, Configuration, Flow Characteristics, Capacity, Valve C_V, Calculated C_V, Design Pressure Drop, Actual Pressure Drop, Fail Position, Close off Pressure, Actuator Identification Tag, and Actuator Type.

B. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media, and protocol. The Systems Integrator shall be responsible for integrating those diagrams into the overall trunk cable schematic diagrams for the entire Wide Area Network (WAN) and/or Local Area Network (LAN) utilized by the FMCS.

C. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system expansion with minimal infrastructure modifications.

D. Submittal shall also include a complete point list of all points to be connected to the TCS and FMCS. Contractors shall provide necessary point lists, protocol documentation, and factory support information for systems provided in their respective divisions but integrated into the FMCS.

E. Submittal shall also include a copy of each of the graphics developed for the Graphic User Interface including a flowchart (site map) indicating how the graphics are to be linked to one another for system navigation. The graphics are intended to be 80% - 90% complete at this stage with the only remaining changes to be based on review comments from the A/E design team and/or Owner.

F. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Sub- and other contractors shall provide as-builts for their portions of work. The contractor shall be responsible for as-builts pertaining to overall TCS and FMCS architecture and network diagrams. All as-built drawings shall also be installed into the FMCS server in a dedicated directory.

1.5. SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

DDC	Direct Digital Controls
FMCS	Facility Management and Control System
GUI	Graphical User Interface
IBC	Interoperable BACnet Controller
IDC	Interoperable Digital Controller
LAN	Local Area Network
NAC	Network Area Controller
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement
PMI	Power Measurement Interface
POT	Portable Operator's Terminal
TCS	Temperature Control System
WAN	Wide Area Network
WBI	Web Browser Interface

1.6. AGENCY AND CODE APPROVALS

A. All products of the TCS and FMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable:
   1. UL-916; Energy Management Systems
   2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "signal Equipment"
   3. CE
   4. FCC, Part 15, Subpart J, Class A Computing Devices

1.7. SOFTWARE LICENSE AGREEMENT

A. The Owner shall agree to the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS, and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

C. The owner, or his appointed agent, shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and /or configured for use within Niagara AX Framework (Niagara) based controllers and/or servers and any related LAN / WAN / Intranet and all connected routers and devices.

1.8. Utility Meter Monitoring

A. Electric Metering: Contractor shall arrange with the project electric utility for providing an isolation relay at the service electric meter to allow independent pulse signals to be monitored by the DDC control system for electric utility KWH power usage and peak KW demand. Cost for adding the isolation relay shall be paid for by the contractor.
   1. Contractor shall provide power for the utility meter
   2. The contractor shall obtain the pulse signal multipiers from the utility

B. Natural Gas Metering: Contractor shall arrange with the project natural gas utility for providing a pulse transmitter at the service gas meter to allow independent pulse signals to be monitored by the DDC control system for gas utility gas consumption. Cost for adding the isolation relay shall be paid for by the contractor.
   1. Contractor shall provide power for the utility meter
   2. The temperature control contractor shall obtain the pulse signal multipiers from the utility

PART 2 - MATERIALS

2.1. GENERAL

A. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall be comprised of a network of interoperable, stand-alone digital controllers, a computer system, graphical user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

2.2. ACCEPTABLE MANUFACTURERS

A. Basis-of-Design: Honeywell WEBs-AX™. Subject to compliance with requirements, provide either the product named or an alternate product by one of the other manufacturers specified.

B. Honeywell Spyder Controllers

2.3. OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet™, LonWorks™ technology, MODBUS ™, OPC, and other open and proprietary communication protocols into one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-2001, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

C. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

D. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. Systems requiring proprietary database and user interface programs shall not be acceptable.

E. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable:

1. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for local network connected user interfaces.
2. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.4. NETWORKS

A. The Local Area Network (LAN) shall be a 1000 Megabit/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 100 Base-T, UTP-8 wire, category 5
3. Minimum throughput; 1000 Mbps.

2.5. NETWORK ACCESS

A. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The Owner shall provide a connection to the Internet to enable this access via high speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP).

2.6. NETWORK AREA CONTROLLER (NAC)

A. The contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided specified here and elsewhere.

B. The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

1. Calendar Functions
2. Time of day scheduling
3. Holiday Scheduling
4. Optimal Start
5. Optimal Stop
6. Demand Limiting
7. Load Rolling
8. Heating / Cooling Interlock
9. Trending
10. Alarm monitoring and routing
11. Time synchronization
12. Integration of LonWorks controller data and BACnet controller data
13. Network Management functions for all LonWorks and/or BACnet based devices

C. The Network Area Controller shall provide the following hardware features as a minimum:

1. One Ethernet Port – 10/100/1000 Mbps
2. One RS-232 port
3. One LonWorks Interface Port – 78KB FTT-10A if Lon controllers are used and/or
   One RS-485 port if BACnet controllers are used.
4. Battery Backup
5. Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)

6. The NAC must be capable of operation over a temperature range of 32 to 122°F
7. The NAC must be capable of withstanding storage temperatures of between 0 and 158°F
8. The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing
9. The NAC shall provide multiple user access to the system and support for ODBC or SQL. A database resident on the NAC shall be an ODBC-compliant database or must provide an ODBC data access mechanism to read and write data stored within it.
10. The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 32 simultaneous users.
11. Event Alarm Notification and actions
12. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
13. The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network, or remote via dial-up telephone connection or wide-area network.
14. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:
    a. In alarm
    b. Return to normal
    c. Fault condition
    d. Provide for the creation of a minimum of eight alarm classes for the purpose of routing types and/or classes of alarms, i.e.: security, HVAC, Fire, etc.
    e. Provide timed (schedule) routing of alarms by class, object, group, or node.
    f. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

D. Controller and network failures shall be treated as alarms and annunciated.

E. Alarms shall be annunciated in any of the following manners as defined by the user:
1. Screen message text: All alarm or point change reports shall include the English language description of each point and the time and date of the occurrence.
2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority levels shall be provided.
3. Users shall have the ability to manually inhibit alarm reporting for each point.The user shall also be able to define conditions under which point changes need to be acknowledged by an operator and/or logged for analysis at a later date.
4. Each supervisory controller shall be capable of storing a library of at least 100 messages. Each message may be assignable to any number of points in the panel.
5. Email of the complete alarm message to multiple recipients via the owner's e-mail service. Provide the ability to route and email alarms based on:
    a. Day of week
    b. Time of day
    c. Recipient
    d. Pagers via paging services that initiate a page on receipt of email message via the owner's e-mail service
    e. Graphic with flashing alarm object(s)
    f. Printed message, routed directly to a dedicated alarm printer

F. The following shall be recorded by the NAC for each alarm (at a minimum):
1. Time and date
2. Location (building, floor, zone, office number, etc.)
3. Equipment (air handler #, access way, etc.)
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

G. Alarm actions may be initiated by user defined programmable objects created for that purpose.

H. Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

I. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

J. Provide a "query" feature to allow review of specific alarms by user defined parameters.

K. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

L. An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

M. Supervisory controllers shall be able to execute configured processes defined by the user to automatically perform calculations and control routines. It shall be possible to use any of the following in a configured process:
1. Any system-measured point data or status
2. Any calculated data
3. Any results from other processes
4. Boolean logic operators (and, or)
5. Configured processes may be triggered based on any combination of the following:
6. Time of day
7. Calendar date
8. Other processes
9. Events (e.g., point alarms)

N. A single process shall be able to incorporate measured or calculated data from any and all other ASC's.

O. A single process shall be able to issue commands to points in any and all other programmable controllers and ASC's on the local network.

2.7. DATA COLLECTION AND STORAGE

A. The NAC shall have the ability to collect data for any property of any object and store this data for future use.

B. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:
1. Designating the log as interval or deviation.

2. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
3. For deviation logs, the object shall be configured for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.
4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full, or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

C. All log data shall be stored in a relational database in the NAC and the data shall be accessed from a server (if the system is so configured) or a standard Web browser.
D. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.
E. All log data shall be available to the user in the following data formats:
1. HTML (deal breaker)
2. XML (deal breaker)
3. Plain Text
4. Comma or tab separated values
5. PDF

F. The NAC shall have the ability to archive its log data either locally (to itself), or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties, at a minimum:
1. Archive on time of day
2. Archive on user-defined number of data stores in the log (buffer size)
3. Archive when log has reached its user-defined capacity of data stores
4. Provide ability to clear logs once archived

G. Measured and calculated analog and binary data shall be assignable to user definable trends for the purpose of collecting operator specified performance data over extended periods of time. Sample intervals of 1 minute to 24 hours, in one minute or one hour intervals, shall be provided. Each supervisory controller shall have a dedicated buffer for trend data and shall be capable of storing 16 trend logs. Each trend log shall have up to four points trended at 48 data samples each. Data shall be stored at the supervisory controller and up-loaded to the DDC system server when archiving is desired.
H. Supervisory controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis, user defined, for user-selected analog and binary pulse input type points.
1. Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g., KWH, gallons KBTU, tons, etc.).
2. The totalization routine shall have a sampling resolution of one minute.
3. The user shall have the ability to define a warning limit. Unique, user specified messages shall be generated when the limit is reached.
4. The information available from pulse totalization shall include, but not be limited to, the following:
5. Peak demand, with date and time stamp
6. 24-hour demand log
7. Accumulated KWH and therms for day
8. Sunday through Saturday KWH and therm usage
9. Demand KW annual history for past 12 periods
10. KWH and therm annual history for past periods

I. Supervisory controllers shall have the ability to count events, such as the number of times a pump or fan system is cycled on and off.
J. The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

2.8. AUDIT LOG

A. Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:
1. Time and date
2. User ID
3. Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

2.9. DATABASE BACKUP AND STORAGE

A. The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.
B. Copies of the current database and, at the most recently saved database shall be stored in the NAC. The age of the most recently saved database is dependent on the user-defined database save interval.
C. The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

2.10. ADVANCED UNITARY CONTROLLER

A. The controller platform shall be designed specifically to control HVAC – ventilation, filtration, heating, cooling, humidification, and distribution. Equipment includes: constant volume air handlers, VAV air handlers, packaged RTU, heat pumps, unit vents, fan coils, natural convection units, and radiant panels. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the "Sequence of Operation" as outlined in Section 4.
B. Minimum Requirements:
1. The controller shall be capable of either integrating with other devices or stand-alone operation.
2. The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
3. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
    a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.

b. Accuracy: ±1 minute per month at 77° F (25° C).
c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).

4. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
5. The controller shall have an internal DC power supply to power external sensors.Power Output: 20 VDC ±10% at 75 mA.
6. The controller shall have a visual indication (LED) of the status of the devise:
   a. Controller operating normally.
   b. Controller in process of download.
   c. Controller in manual mode under control of software tool.
   d. Controller lost its configuration.
   e. No power to controller, low voltage, or controller damage.
   f. Processor and/or controller are not operating.
7. The minimum controller Environmental ratings
   a. Operating Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
   b. Storage Temperature Ambient Rating: -40° to 150° F (-40° to 65.5° C).
   c. Relative Humidity: 5% to 95% non-condensing.
8. The controller shall have the additional approval requirements, listings, and approvals:
   a. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
   b. CSA (LR95329-3) Listed
   c. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
   d. Meets Canadian standard C108.8 (radiated emissions).
   e. Conforms to the following requirements per European Consortium standards:
      EN 61000-6-1; 2001 (EU Immunity)
      EN 61000-6-3; 2001 (EU Emissions)

C. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).
D. The controller shall have sufficient on-board inputs and outputs to support the application.
   a. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.
   b. Triac outputs shall be capable of switching 30 Volts at 500 mA.
   c. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.
   d. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).
E. The controller shall provide for "user defined" Network Variables (NV) for customized configurations and naming using Niagara AX Framework™.
F. The controller shall support 62 Network Variables with a byte count of 31 per variable.
G. The controller shall support 1,922 separate data values.
H. The controller shall provide "continuous" automated loop tuning with an Adaptive Integral Algorithm Control Loop.
I. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized "sequence of operations" as outlined in Section 4.
   1. Discharge air control and low limit
   2. Pressure-dependent dual duct without flow mixing.
   3. Variable air volume with return flow tracking.
   4. Economizer with differential enthalpy.
   5. Minimum air flow coordinated with CO2.
   6. Unit ventilator cycle (1,2,3) 2-pipe.
   7. Unit ventilator cycle (1,2,3) 2-pipe with face/bypass.

2.11. ADVANCED VARIABLE AIR VOLUME CONTROLLER

A. The controller platform shall be designed specifically for room-level VAV control – pressure-independent air flow control, pressure dependent damper control, supply and exhaust pressurization/de-pressurization control; temperature, humidity, complex CO2, occupancy, and emergency control. Equipment includes: VAV terminal unit, VAV terminal unit with reheat, Series fan powered terminal unit, Parallel fan powered terminal unit, Supply and Exhaust air volume terminals, and Constant volume dual-duct terminal unit. The controller platform shall provide options and advanced system functions, programmable and configurable using Niagara AX Framework™, that allow standard and customizable control solutions required in executing the "Sequence of Operation" as outlined in Section 4.
B. Minimum Requirements:
   1. The controller shall be capable of either integrating with other devices or stand-alone room-level control operation.
   2. The controller shall have an internal velocity pressure sensor.
      a. Sensor Type: Microbridge air flow sensor with dual integral restrictors.
      b. Operating Range: 0 to 1.5 in. H2O (0 to 374 Pa).
      c. Accuracy: ±2% of full scale at 32° to 122° F (0° to 50° C); ±1% of full scale at null pressure.
   3. The controller shall have an FTT transformer-coupled communications port interface for common mode-noise rejection and DC isolation.
   4. The controller shall have an internal time clock with the ability to automatically revert from a master time clock on failure.
      a. Operating Range: 24 hour, 365 day, multi-year calendar including day of week and configuration for automatic day-light savings time adjustment to occur on configured start and stop dates.
      b. Accuracy: ±1 minute per month at 77° F (25° C).
      c. Power Failure Backup: 24 hours at 32° to 122° F (0° to 50° C).

5. The controller shall have Significant Event Notification, Periodic Update capability, and Failure Detect when network inputs fail to be detected within their configurable time frame.
6. The controller shall have an internal DC power supply to power external sensors.Power Output: 20 VDC ±10% at 75 mA.

C. The controller shall have a visual indication (LED) of the status of the devise:
1. Controller operating normally.
2. Controller in process of download.
3. Controller in manual mode under control of software tool.
4. Controller lost its configuration.
5. No power to controller, low voltage, or controller damage.
6. Processor and/or controller are not operating.

D. The minimum controller Environmental ratings:
1. Operating Temperature Ambient Rating: 32° to 122° F (0° to 50° C).
2. Storage Temperature Ambient Rating: -40° to 122° F (-40° to 50° C).
3. Relative Humidity: 5% to 95% non-condensing.
4. The controller shall have the additional approval requirements, listings, and approvals:
5. UL/cUL (E87741) listed under UL916 (Standard for Open Energy Management Equipment) with plenum rating.
6. CSA (LR95329-3) Listed
7. Meets FCC Part 15, Subpart B, Class B (radiated emissions) requirements.
8. Meets Canadian standard C108.8 (radiated emissions).
9. Conforms to the following requirements per European Consortium standards:
   a) EN 61000-6-1; 2001 (EU Immunity)
   b) EN 61000-6-3; 2001 (EU Emissions)
10. The controller housing shall be UL plenum rated mounting to either a panel or DIN rail (standard EN50022; 7.5mm x 35mm).

E. The controller shall provide an integrated actuator option.
1. Actuator type: Series 60 Floating.
2. Rotation stroke: 95° ±3° for CW or CCW opening dampers.
3. Torque rating: 44 lb-in. (5 Nm).
4. Run time for 90° rotation: 90 seconds at 60 Hz.

F. The controller shall have sufficient on-board inputs and outputs to support the application.

G. Analog outputs (AO) shall be capable of being configured to support 0-10 V, 2-10 V or 4-20 mA devices.

H. Triac outputs shall be capable of switching 30 Volts at 500 mA.

I. Input and Output wiring terminal strips shall be removable from the controller without disconnecting wiring. Input and Output wiring terminals shall be designated with color coded labels.

J. Universal inputs shall be capable of being configured as binary inputs, resistive inputs, voltage inputs (0-10 VDC), or current inputs (4-20 mA).

K. The controller shall provide for “user defined” Network Variables (NV) for customized configurations and naming using Niagara AX Framework™.

L. The controller shall support a range of Network Variables to 62 with a byte count of 31 per variable.

M. The controller shall support 1,922 separate data values.

N. The controller shall provide continuous automated loop tuning with an Adaptive Integral Algorithm Control Loop.

O. The controller shall have a loop execution response time of 1 second.

P. The controller platform shall have standard HVAC application programs that are modifiable to support both the traditional and specialized “sequence of operations” as outlined in Section 4.
1. VAV terminal unit.
2. VAV terminal unit fan speed control.
3. Series fan.
4. Parallel fan.
5. Regulated air volume (room pressurization/de-pressurization).
6. CV dual-duct
7. Room CO2 control
8. Room Humidity
9. TOD occupancy sensor stand-by setpoints

2.12. GRAPHICAL USER INTERFACE SOFTWARE

A. Operating System: GUI shall be web-based (computer with browser supplied by owner) and capable of running of Windows Operating systems XP, Vista and 7 professional.

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu-pull downs, and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with a minimal knowledge of the HVAC Control System and basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line), that displays the location and the selected object identification.

C. Real-Time Displays. The GUI, shall at a minimum, support the following graphical features and functions:
1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file format. Use of proprietary graphic file formats shall not be acceptable. In addition to, or in lieu of, a graphic background the GUI shall support the use of scanned pictures.
2. Graphic screens shall have the capability to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URL’s, and links to other graphic screens.
3. Graphics shall support layering and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and set points shall be accomplished in a graphical manner.

a. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
b. Holidays shall be set by using a graphical calendar without requiring any keyboard entry from the operator.

5. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry shall be required.
6. Adjustments to analog objects, such as set points, shall be done by right-clicking the selected object and using a graphical slider to adjust the value. No text entry shall be required.

D. System Configuration. At a minimum, the GUI shall permit the operator to perform the following tasks, with proper password access:
1. Create, delete, or modify control strategies.
2. Add or delete objects to the system.
3. Tune control loops through the adjustment of control loop parameters.
4. Enable or disable control strategies.
5. Generate hard copy records or control strategies on a printer.
6. Select points to be alarmable and define the alarm state.
7. Select points to be trended over a period of time and initiate the recording of values automatically.

E. On-Line Help. Provide a context sensitive on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for the currently displayed screen. Additional help information shall be available through the use of hypertext. All system documentation and help files shall be in HTML format.

F. Security. Each operator shall be required to log on to the system with a user name and password in order to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall have the ability to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operators' access for viewing and/or changing each system application, full screen editor, and object. Each operator shall automatically be logged off the system if no keyboard or mouse activity is detected for a specified time. This auto log-off time shall be set per operator password. All system security data shall be stored in an encrypted format.

G. System Diagnostics. The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. The failure of any device shall be annunciated to the operator.

H. Alarm Console:
1. The system shall be provided with a dedicated alarm window or console. This window will notify the operator of an alarm condition and allow the operator to view details of the alarm and acknowledge the alarm. The use of the Alarm Console may be enabled or disabled by the system administrator.
2. When the Alarm Console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and unacknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator shall not be acceptable.

2.13. WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™ or Firefox. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacture-specific browsers shall not be acceptable.

B. The Web browser software shall run on any operating system and system configuration that is supported by the Web browser. Systems that require specific machine requirements in terms of processor speed, memory, etc., in order to allow the Web browser to function with the FMCS, shall not be acceptable.

C. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphical User Interface (if used). Systems that require different graphic views, different means of graphic generation, or that require different means of interacting with objects such as schedules, or logs, shall not be permitted.

D. The Web browser client shall support at a minimum, the following functions:
1. User log-on identification and password shall be required. If an unauthorized user attempts access, a blank web page shall be displayed. Security using Java authentication and encryption techniques to prevent unauthorized access shall be implemented.
a. Graphical screens developed for the GUI shall be the same screens used for the Web browser client. Any animated graphical objects supported by the GUI shall be supported by the Web browser interface.
b. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
2. Storage of the graphical screens shall be in the Network Area Controller (NAC), without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
3. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
4. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
5. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
6. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
7. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
8. Commands to start and stop binary objects shall be done by right-clicking the selected object and selecting the appropriate command from the pop-up menu. No text entry shall be required.
9. View logs and charts
10. View and acknowledge alarms
11. Setup and execute SQL queries on log and archive information
12. The system shall provide the capability to specify a user's (as determined by the log-on user identification) home page. Provide the ability to set a specific home page for each user. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.
13. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on Intranet sites, by specifying the Uniform Resource Locator (URL) for the desired link.

2.14. SERVER FUNCTIONS AND HARDWARE

A. A server is provided by the owner. The contractor will enable access to and from the server.

2.15. SYSTEM CONFIGURATION TOOL

A. The Workstation Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

B. A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

C. Programming Methods:

1. Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
2. Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
5. The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.16. LonWorks NETWORK MANAGEMENT

A. The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

B. Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

C. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

D. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

E. The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

2.17. LIBRARY

A. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

B. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

C. In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

D. All control objects shall conform to the control objects specified in the BACnet specification.

E. The library shall include applications or objects for the following functions, at a minimum:

1. Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
2. Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
3. Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals
4. Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
5. Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
6. Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that

will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

F. The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
   1. Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
   2. Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
   3. Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
   4. Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
   5. PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
   6. Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
   7. Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
   8. Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
   9. Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.
   10. Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
   11. Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

G. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:
   1. LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
   2. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file and documentation for the device to facilitate device integration.
   3. For BACnet devices, provide the following objects at a minimum:
      a. Analog In
      b. Analog Out
      c. Analog Value
      d. Binary
      e. Binary In
      f. Binary Out
      g. Binary Value
      h. Multi-State In
      i. Multi-State Out
      j. Multi-State Value
      k. Schedule Export
      l. Calendar Export
      m. Trend Export
      n. Device
   4. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
   5. For BACnet devices, provide the following support at a minimum:

a. Segmentation
b. Segmented Request
c. Segmented Response
d. Application Services
e. Read Property
f. Read Property Multiple
g. Write Property
h. Who-has
i. I-have
j. Who-is
k. I-am
l. Media Types
m. Ethernet
n. BACnet IP Annex J
o. MSTP
p. BACnet Broadcast Management Device (BBMD) function
q. Routing

2.18. DDE DEVICE INTEGRATION

A. The Network Area Controller shall support the integration of device data via Dynamic Data Exchange (DDE), over the Ethernet Network. The Network Area Controller shall act as a DDE client to another software application that functions as a DDE server.
B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of these devices into the FMCS. Objects provided shall include at a minimum:
   1. DDE Generic AI Object
   2. DDE Generic AO Object
   3. DDE Generic BO Object
   4. DDE Generic BI Object

2.19. MODBUS SYSTEM INTEGRATION

A. The Network Area Controller shall support the integration of device data from Modbus RTU, ASCII, or TCP control system devices. The connection to the Modbus system shall be via an RS-232, RS485, or Ethernet IP as required by the device.
B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the Modbus system data into the FPMS. Objects provided shall include at a minimum:
   1. Read/Write Modbus AI Registers
   2. Read/Write Modbus AO Registers
   3. Read/Write Modbus BI Registers
   4. Read/Write Modbus BO Registers
C. All scheduling, alarming, logging and global supervisory control functions, of the Modbus system devices, shall be performed by the Network Area Controller.
D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment utilizing Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning

2.20. OPC SYSTEM INTEGRATION

A. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP as required by the device. The OPC client shall support third party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.
B. Provide the required objects in the library, included with the Graphical User Interface programming software, to support the integration of the OPC system data into the BAS. Objects provided shall include at a minimum:
   1. Read/Write OPC AI Object
   2. Read/Write OPC AO Object
   3. Read/Write OPC BI Object
   4. Read/Write OPC BO Object
   5. Read/Write OPC Date/Time Input Object
   6. Read/Write OPC Date/Time Output Object
   7. Read/Write OPC String Input Object
   8. Read/Write OPC String Output Object
C. All scheduling, alarming, logging and global supervisory control functions, of the OPC system devices, shall be performed by the Network Area Controller.
D. The FMCS supplier shall provide an OPC client communications driver. The equipment system vendor that provided the equipment utilizing OPC shall provide documentation of the system's OPC server interface and shall provide factory support at no charge during system commissioning.

2.21. GRAPHICAL USER INTERFACE COMPUTER HARDWARE (DESKTOP)

A. Will be provided by owner.
B. Contractor shall provide 2 network ports in or near mechanical room. Exact location to be provided by owner on site.

2.22. OTHER CONTROL SYSTEM HARDWARE

A. Space Temperature Wall Module: Temperature sensing modules mounted on the wall in occupied spaces. Optional setpoint, indication, and override switches must be provided as specified.
   1. Manufacturers:
      a. Honeywell
   2. Wall module shall have a thermistor temperature sensor with operating range of 25 to 99 deg. F. under a locking cover/enclosure designed for mounting on a standard electrical switch box.
   3. Each zone shall have thermostat with LCD display and user adjustability. Display shall show outdoor temperature, set space temperature and actual space temperature. In zones with multiple thermometers (for averaging) only one device requires a display.
   4. Space temperature sensors shall be accurate to plus or minus 0.5 deg. F at 77 deg. F.
   5. Where specified, space temperature sensors shall have a setpoint knob calibrated for warmer-cooler adjustments and shall be calibrated to allow plus or minus adjustments to a software setpoint and to allow absolute setpoint changes.
   6. Where specified, wall module shall also have an after-hours override pushbutton and LED override indicator.
   7. Where specified, the wall module shall have a fan coil unit fan control switch for auto-off-on or auto-off-low-med-hi fan control (depending fan equipment speed options) . The wall module function is further specified in SECTION III Sequence of Operation.
   8. Where specified, wall module shall have an LCD display with 2 level user access. Level one access shall be available for typical occupant adjustments, and level two access for system configuration. Level two access shall be accessible only via password or multi-key code input. Room temperature, room temperature setpoint, VAV balancing parameters and settings, occupancy override, and other control parameters for a total of at least 35 items shall be available via the keypad/display. Wall module screens shall be configurable for typical tenant and control contractor views.

B. Duct Mount, Pipe Mount, and Outside Air Temperature Sensors:
   1. Manufacturers:
      a. Alerton
      b. ACI
      c. Honeywell
      d. Johnson Controls
      e. Novar
      f. Siemens Building Technologies
      g. Trend
   2. Outside air sensors shall include an integral sun shield.
   3. Temperature sensors shall have an accuracy of plus or minus 1.0 deg. F. over operating range.
   4. Duct sensors shall have sensor approximately in center of the duct, and shall have selectable lengths of 6, 12, and 18 inches.
   5. Multipoint averaging element sensors shall be provided where specified, and shall have a minimum of one foot of sensor length for each square foot of duct area (provide multiple sensors if necessary).
   6. Pipe mount sensors shall have copper, or stainless steel separable wells.

C. Current Switches: Solid state, split core, current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point shall be provided where specified. Current switches shall include an integral LED for indication of trip condition.
   1. Manufacturers:
      a. ACI
      b. Honeywell
      c. RIB, Inc.
      d. Veris Industries
   2. Sensing range 0.5 – 250 Amps.
   3. Output 0.3 A @ 200 VAC/VDC / 0.15 A @ 300 VAC/VDC
   4. Operating frequency 40 Hz -1 kHz.
   5. Operating Temperature 5-104 deg. F (-15 – 40 deg. C), Operating Humidity 0-95% non-condensing
   6. Approvals CE, UL.

D. Current Sensors: Solid state, split core linear current sensors shall be provided where specified.
   1. Manufacturers:
      a. ACI
      b. Honeywell
      c. RIB, Inc.
      d. Veris Industries
   2. Linear output of 0-5 VDC, 0-10 VDC, or 4-20 mA.
   3. Scale sensors so that average operating current is between 20-80% full scale.
   4. Accuracy plus or minus 1.0% (5-100% full scale)
   5. Operating frequency 50-600 Hz.
   6. Operating Temperature 5-104 deg. F (-15 – 40 deg. C), Operating Humidity 0-95% non-condensing
   7. Approvals CE, UL.

E. Air Flow Stations: Provide duct mounted airflow station type based on the following minimum design velocities. Pitot or thermal dispersion flow stations can be used for fan inlet flow stations. Outside air flow stations shall be thermal dispersion type only. Turndown of variable volume fan systems must be considered.
   1. Provide an airflow station schedule detailing the airflow range to be measured, corresponding velocity pressure, differential pressure transducer range, and the airflow station size.

Air Velocity	Duct Mounted Air Flow Station Type
0-700 FPM	Thermal Dispersion
>700 FPM	Thermal Dispersion or Multi-probe velocity pressure pitot style

   2. Duct mounted Multi-probe velocity pressure pitot air flow stations:

Multi-probe duct velocity pressure sensing station constructed of minimum 16 gauge galvanized steel casing, and multiple metallic velocity pressure sensors with automatic averaging manifold. For duct installations, provide an aluminum honeycomb cell air straightener with maximum openings of ½" and minimum of 3" depth. Each airflow measuring element shall contain multiple Total and Static pressure sensors, placed at equal distances (for rectangular Ducts) and at concentric area centers (for circular ducts) along the element length. The number of sensors on each element and the quantity of elements utilized at each installation shall comply with the ASHRAE standards for duct traversing. The airflow measuring elements shall be capable of producing steady, non-pulsating Total and Static pressure signals, with accuracy within ±2% of actual flow. Airflow resistance to be less than or equal to 0.23 inches of water at 4000 feet per minute air velocity. Probe must be cross-sectional.

3. Fan inlet probe air flow stations:
   For fan inlet probes provide two probes for each fan inlet (for DWDI fans provide four probes). Pressure drop caused by the airflow elements shall not exceed 0.03" w.c. at 2000 FPM. Airflow elements shall be provided with all necessary pivot mounting hardware and signal connection fittings for connection to tubing provided by the installing contractor. For pitot type air flow stations, the static and total pressure manifold piping by the installing contractor shall be piped symmetrically so take-off will be located where line lengths between all probes are equal in length.
4. For duct mounted and fan inlet pitot flow stations, air velocity transducers range shall be sized less than two times the design velocity pressure at maximum flow and will meet the requirements under the PRESSURE TRANSDUCERS (AIR) specification later in this specification section unless noted below.
5. Thermal dispersion air flow stations:
   a) Manufacturers: Ebtron, Air Monitor, Kurz Instruments, or equal.
6. Probe Sensor Density:

Area (sq. ft.)	Sensors
<= 1.5	2
>1.5 to <4	4
4 to <8	6
8 to <12	8
12 to <16	12
>=16	15

7. Airflow Sensor Accuracy: ±2% of reading
8. Calibrated Range: 0-2500 FPM for duct applications and 5000 FPM for fan inlet applications
9. Temperature Sensor Accuracy: ±0.15°F
10. Temperature: -20°F to +140°F
11. Relative Humidity: 0 to 95% (non-condensing)
12. Provide transmitter that will average up to sixteen sensors and provide two field selectable linear analog output signals (4-20mA and 0-10 VDC) proportional to airflow and temperature. Sensor electronic circuitry other than the temperature sensors shall not be exposed to the air stream and shall be protected from moisture to prevent failure. Provide LED displayed unit with transmitter.

F. Water Flow Meters: Water flow meters shall be axial turbine style flow meters which translate liquid motion into electronic output signals proportional to the flow sensed.
1. Manufacturers:
   a. Fluid Components International
   b. Hersey Meters
   c. Onicon Meters
2. Flow sensing turbine rotors shall be non-metallic and not impaired by magnetic drag.
3. Flow meters shall be 'insertion' type complete with 'hot-tap' isolation valves to enable sensor removal without water supply system shutdown.
4. Accuracy shall be ± 2% of actual reading from 0.4 to 20 feet per second flow velocities.

G. Low Temperature Limit Switches: Safety low limit shall be manual reset twenty foot limited fill type responsive to the coolest section of its length.
1. Manufacturers:
   a. Honeywell
   b. Johnson Controls
   c. Siemens Building Technologies
   d. TAC
2. Low Limit Setpoint shall be adjustable between 20 and 60 deg. F. (-5 and 15 deg. C.)
3. Switch enclosure shall be dustproof and moisture-proof.
4. Switch shall break control circuit on temperature fall. Contact ratings shall be 10.2 FLA at 120 VAC, and 6.5 FLA at 240 VAC.
5. Ambient Temperature range -20 to 125 deg. F. (-11 to 52 deg. C.)
6. Operating Temperature Range 20 to 60 deg. F. (-5 to 15 deg. C.)

H. High Temperature Limit Switches: Safety high limit (fire stats) shall be manual reset type.
1. Manufacturers:
   a. Honeywell
   b. Johnson Controls
   c. Siemens Building Technologies
   d. TAC
2. High Limit Setpoint shall be adjustable between 100 and 240 deg. F. (38 and 116 deg. C.)
3. Switch enclosure shall be dustproof and moisture-proof.
4. Switch shall break control circuit on temperature fall. Contact ratings shall be 10 FLA at 120 VAC, and 5 FLA at 240 VAC.
5. Ambient Temperature range -20 to 190 deg. F. (-28 to 88 deg. C.) at case, and 350 deg. F (177 deg. C.) at the sensor.
6. Operating Temperature Range 100 to 240 deg. F. (38 to 116 deg. C.)

I. CO2 Sensors:
1. Manufacturers:
   a. Honeywell
   b. TelAire

c. Vaisala

2. Carbon Dioxide sensors shall be 0-10 Vdc, 2-10 Vdc, or 4-20 mA linear analog output type, with corrosion free gold-plated non-dispersive infrared sensing, designed for duct or wall mounting.
3. Sensor shall incorporate internal diagnostics for power, sensor, analog output checking, and automatic background calibration algorithm for reduced maintenance. Sensor range shall be 0-2000 PPM with +/- 50 PPM accuracy at full scale.
4. Sensor that shall utilize non-dispersive infrared (NDIR) technology.
5. Sensor shall have an LCD display that displays the sensor reading and status.
6. Sensor shall have an automatic calibration algorithm that will compensate for sensor drift over time due to sensor element degradation. The sensor shall be user calibratible with a minimum calibration interval of five years.

J. CO/NO2 Sensors:
1. Manufacturers:
   a. Dwyer
   b. Honeywell
   c. TelAire
   d. Vaisala
2. Carbon Monoxide and Nitrogen Oxide sensors shall have an LCD display that displays the sensor reading and status and can be used for calibration
3. Accuracy: 2%
4. Temperature Range: -4° - 122°F
5. Output: selectable 4-20mA, 0-5V, 0-10V, 2-10V
6. Response time: 45 seconds for 90%
7. Drift: <5% per year
8. Sensor Lifespan: > 4 years

K. Pressure Sensors:
1. Manufacturers:
   a. ACI
   b. Honeywell
   c. RIB, Inc.
   d. Veris Industries
2. Sensor shall provide zero calibration via pushbutton or digital input.
3. Sensor shall have field selectable outputs of 0-5 VDC, 0-10 VDC, and 4-20 mA
4. Sensor shall have an LCD display that displays measured value.
5. Sensor overpressure rating shall be 3 PSID proof, and 5 PSID burst.
6. Sensor accuracy shall be plus or minus 0.5% FS selected range.
7. Operating Temperature shall be 0° - 175°F
8. Temperature Effect <0.03%/°F
9. Hysteresis <0.75% of span

L. Motion Sensors:
1. Manufacturers: WattStopper
2. Adjustable time-delay (standard set to 5 minutes)
3. Finished spaces: CI-200
4. Unfinished and large spaces: CX-100
5. Isolated relay rating 1A @ 24VDC, 0.5A @ 120V
6. Warranty 5 years

M. Differential Pressure Sensors:
1. Manufacturers:
   a. ACI
   b. Honeywell
   c. RIB, Inc.
   d. Veris Industries
2. Sensor shall have four field selectable ranges: 0.1, 0.24, 0.5, 1.0 in w.c. for low pressure models, and 1.0, 2.5, 5, 10 for high pressure models.
3. Sensor shall provide zero calibration via pushbutton or digital input.
4. Sensor shall have field selectable outputs of 0-5 VDC, 0-10 VDC, and 4-20 mA
5. Where specified, sensor shall have and LCD display that displays measured value.
6. Sensor overpressure rating shall be 3 PSID proof, and 5 PSID burst.
7. Sensor accuracy shall be plus or minus 1% FS selected range.

N. Humidity Sensors:
1. Manufacturers:
   a. ACI
2. Humidity transducer shall be accurate to +/- 2% between 20-95% RH NIST traceable calibration.
3. Sensors shall have a field selectable output of 0-10 Vdc, 0-5 Vdc, or 4-20 mA.
4. Sensors shall provide field calibration option using non-interacting zero and span potentiometers, and/or toggle switches that increment or decrement the RH value in steps of 0.5% RH.
5. Accuracy of the sensor shall not be adversely affected by condensation.

O. Dew Point Sensors:

1. Provide a Infrared Dew Point Sensor that shall utilize Non-dispersive infrared, dual-channel, non-interactive,non-saturating
2. Manufacturers:
    a. GE - Telaire model Vaporstat 9002
3. Measurement Range: -20°F – 120°F
4. Accuracy: The NIST certified calibration of the sensor can be restored or checked using a zero gas certified to have less than 0.05 grains/lb dry air moisture content.
5. Altitude correction: 500 ft increments
6. Rated Life: 15 years

P. Enthalpy Sensors:

7. Provide sensor including solid state temperature and humidity sensors with electronics which shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling .
8. Manufacturers:
    a. Honeywell
    b. Siemens Building Technologies

Q. Annular Pitot Tube Flow Meter:

1. Annular pitot tube shall be averaging type differential pressure sensors with four total head pressure ports and one static port made of austenitic stainless steel. Manufacturers:
    a. Air Monitor Corporation
    b. Ultratech
    c. Wetmaster Co., Ltd.
    d. Johnson Controls
2. Sensor shall have an accuracy of ± .25% of full flow and a repeatability of ± .05% of measured value.
3. Transmitter shall be electronic and shall produce a linear output of 0-10 Vdc, 0-5 Vdc, or 4 to 20 mA dc corresponding to the required flow span.
4. The transmitter shall include non-interacting zero and span adjustments.

R. Automatic Control Dampers:

1. Provide all automatic control dampers not specified to be integral with other equipment.
2. Manufacturers:
    a. Greenheck
    b. Honeywell
    c. Johnson Controls
    d. Ruskin
3. Frames shall be 5 inches wide and of no less than 16-gauge galvanized steel. Inter-blade linkage shall be within the frame and out of the air stream.
4. Dampers in aluminum ductwork shall be of aluminum or stainless steel. Dampers in galvanized steel ductwork shall be of galvanized steel or aluminum.
5. Blades shall not be over 8 inches wide or less than 16-gauge galvanized steel triple V type for rigidity.
6. Bearings shall be acetyl, oilite, nylon or ball-bearing with ½ inch diameter plated steel shafts.
7. Dampers shall be suitable for temperature ranges of -40 to 180F.
8. All proportional control dampers shall be opposed or parallel blade type as hereinafter specified and all two-position dampers shall be parallel blade types.
9. Dampers shall be sized to meet flow requirements of the application. The sheet metal contractor shall furnish and install baffles to fit the damper to duct size. Baffles shall not exceed 6". Dampers with dimensions of 24 inches and less shall be rated for 3,000 fpm velocity and shall withstand a maximum system pressure of 5.0 in. w.c. Dampers with dimensions of 36 inches and less shall be rated for 2,500 fpm velocity and shall withstand a maximum system pressure of 4.0 in. w.c. Dampers with dimensions of 48 inches and less shall be rated for 2,000 fpm velocity and shall withstand a maximum system pressure of 2.5 in. w.c.
10. Side seals shall be stainless steel of the tight-seal spring type.
11. Dampers shall be minimum leakage type to conserve energy and the temperature control manufacturer shall submit leakage data for all low leakage control dampers with the temperature control submittal.
12. Damper blade width shall be no greater than 8 inches, and dampers over 48 inches wide by 74 inches high shall be sectionalized. Testing and ratings to be in accordance with AMCA Standard 500.
13. Round dampers shall be provided where specified and shall be factory mounted in a section of round duct a minimum of 12 inches long, but no less than one inch longer than the duct diameter.
14. Duct shall be sleeve type spiral duct crimped on the downstream end, 24 gage galvanized minimum except duct over 12 inches in diameter shall be 22 gage.
15. Duct shall have an integral galvanized steel actuator mounting plate and a ½ inch zinc-coated steel blade shaft extending a minimum of 2 inches beyond the actuator mounting plate.
16. Shaft bearings shall be flanged bronze oilite pressed into the frame.
17. The blade shall be a minimum 16 gage galvanized steel, and damper frame shall be provided with closed-cell neoprene seals with silicone rubber bead. Damper shall be designed for a 2500 ft/min approach velocity and a 4 inch minimum static pressure.
18. Damper and actuator combination shall be designed for leakage rates less than 3 cfm per square foot at one inch w.c. differential and 6 cfm per square foot at four inches w.c. Actuator shall have an external declutch lever to allow manual blade positioning during equipment and power malfunctions. Low leakage damper blade edges shall be fitted with replaceable, snap-on, inflatable seals to limit damper leakage.
19. Testing and ratings shall be in accordance with AMCA Standard 500.
20. 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.
21. Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers shall be parallel blade type and shall be located far enough from coils to allow proper flow development over entire coil surface.
22. 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.
23. Dampers shall be sized for a characteristic ratio of 2.5 for parallel blade dampers and 10 for opposed blade dampers.

S. Control Valves (2-way):
1. Manufacturers: Honeywell VRW2 or VRN2
2. Valves shall be line size.
3. Valves shall have 50 micron (325 mesh) strainer installed upstream
4. Pressuredrop shall be 3 psi or less,or smalles pressuredrop available for flowrate
5. Provide valve position indicator and a method to operate valves manually during system start-up, or actuator power loss or failure on all valves.
6. Leakage rate shall be no more than ANSI Class III (for heating) or ANSI Class IV (for cooling).
7. Valves 1/2 inch through 3 inches shall be screwed pattern except where solder connections are specified for valves 1/2 or 3/4 inches.
8. Two-way valves shall close off against the net differential pressure resulting from the maximum head pressure of the system pumps less all loop pressure losses. Three-way valves shall close off against the difference in head pressure between the controlled load and the bypass line.
9. Valves shall have stainless-steel stems and spring loaded Teflon packing with replaceable discs.
10. Fluid temperature range shall be between -22 and +250 degrees F. water or glycol solutions up to 50%. Piping and valves shall be properly insulated to prevent formation of ice on moving parts.
11. Valves shall be tagged with flowrate and model number.

T. Control Valves (3-way): .
1. Manufacturers: Honeywell VBN3 or VBF 3
2. Valves shall be line size.
3. Proportional control valves shall be sized for a nominal pressure drop of either the device controlled or half (1/2) of the total system pressure.
4. Two-position valves shall be sized for smallest pressure drop available.
5. Three-way valves shall have equal percentage flow characteristics straight through and linear flow through the bypass.
6. Leakage rate shall be ANSI Class IV (no more than 0.01% of Cv).
7. Fluid temperature range shall be between -22 and +250 degrees F. water or glycol solutions up to 50%. Piping and valves shall be properly insulated to prevent formation of ice on moving parts.
8. Valves shall be rated for no less than 360 psig at 250 degrees F.
9. Provide a method to operate valves manually during system start-up, or actuator power loss or failure on all valves.
10. Two-way valves shall close off against 70 psi minimum, and three-way valves shall close off against 40 psi minimum.
11. Valves shall have stainless-steel or chemically nickel-plated brass stem and throttling port.
12. Valves shall be tagged with Cv rating and model number.

U. Variable Frequency Drives:
1. Manufacturers:
    a. ABB
    b. Danfoss
    c. Honeywell
    d. Siemens Building Technologies
2. Submit shop drawings Submit shop drawings for all VFD and associated system components as herein specified including all data concerning dimensions, capacities and performance, wiring diagrams and appropriate identification. Submit certified efficiency versus load and speed curves for VFD. Submit certified electrical noise generation data in accordance with IEEE 519 standard. Submit electrical noise attenuation equipment required to meet criteria specified.
3. Variable frequency drives shall be UL listed and sized for the power and loads applied.
4. Drives shall include built-in radio frequency interference (RFI) filters and be constructed to operate in equipment rooms and shall not be susceptible to electromagnetic disturbances typically encountered in such environments. Similarly, the drives must not excessively disturb the environment within which it is used.
5. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be NEMA 1, freestanding or wall mounted.
6. The VFD shall convert three-phase, 60-Hz utility power to adjustable-voltage and frequency, three-phase power for stepless motor speed control from 5% to 100% of the motor's 60-Hz speed. Input voltage shall be as specified on the Drawing schedules.
7. The VFD shall include a converter and an inverter section. The converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFDs shall include input line reactors.
8. The VFD shall employ a full wave bridge rectifier and capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.VFD shall use solid state, micro processor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).
9. The inverter section of the VFD shall invert the DC voltage into a quality output waveform, with adjustable voltage and frequency for stepless motor speed control.
10. The VFD and options shall be tested to ANSI/UL Standard 508. The Complete system, including all specified options, shall be listed by a nationally recognized testing agency such as UL or BTL.
11. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The total voltage distortion shall not exceed 5%.
12. The VFD shall not emit radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15 for Class A computing devices. The VFD shall carry a FCC compliance label. PWM type drives shall include RFI filters.
13. The VFD shall not cause objectionable acoustical motor noise. Motor noise as a result of the VFD shall be limited to three dB-over across-the-line operation, measured at three feet from the motors center line.
14. The VFD's full load AMP rating shall meet or exceed NEC Table 430-150.
15. Motors and variable frequency drives shall be provided by the drive manufacturer and selected to accommodate additional motor heating when driven by a VFD, while maintaining full nameplate horsepower at specified service factor.
16. VFD system shall modulate the speed of its respective motor in response to a 0-10 VDC or 4-20 mA control signal provided by the Temperature Control Sub-contractor.
17. VFD shall be variable torque, solid state transistorized control with diode bridge rectifier and manual transfer switch. The unit shall be U.L. listed, solid state, micro processor-based with a pulse width modulated (PWM) output wave form (none others are acceptable). The VFD shall employ a full wave bridge rectifier, to prevent

line notching, with DC output bus choke, capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device. VFD shall be factory tested at maximum HP and 40 deg. C for 100 hours.

18. Performance:
    a. Minimum Efficiency: 92% @ 50%; 99% @ 100% speed.
    b. Power Factor: 0.95 through speed range.
    c. Adjustments: Minimum and maximum speed acceleration-deceleration 30 to 50 seconds.
    d. Power Line Noise: Voltage distortion factor of 5% or less and a line notch depth of 25% or less.
    e. Ride through a momentary power outage of 15 cycles,
    f. Start into a rotating load without damage to drive components or motor,
    g. Capable of automatic restart into a rotating load after a preset, adjustable time delay following a power outage
    h. Units shall be suitable for input power of electrical system as scheduled on the drawings ±10%, 3 phase, 60 Hertz nominal.
    i. Use a current limiting control device to limit output current to 110% continuous for one minute; also refer to Protection Features in this section. Full load output current available from drive shall not be less than motor nameplate amperage. The full load amp rating of the VFD shall not be less than the values indicated in the NEC Table 430-150.
    j. Output power shall be suitable for driving standard NEMA B design, three phase alternating current induction motors at full rated speed with capability of 20:1 turndown.
19. Features:
    a. Run/stop selector switch, auto/manual selector switch, fault light, manual speed potentiometer, power on light, ready light.
    b. Speed/power/load digital display and selector switch.
    c. Automatic under voltage reset with adjustable time delay.
    d. 0-10 VDC or 4-20 mA common input signal follower.
    e. Motor overload protection.
    f. Over temperature protection.
    g. Under voltage/over voltage protection.
    h. Adjustable current limit. Input disconnect switch, not required if existing starter and disconnect reused.
    i. Local speed control at the VFD
    j. Adjustable acceleration and deceleration rate so that the time period from start to full speed and from full speed to stop can be field adjustable.
    k. Adjustable minimum and maximum speed settings for both automatic and manual modes of operation
    l. Field adjustment of minimum and maximum output frequency
    m. Two (2) sets of programmable form "C" contacts for remote indication of variable frequency drive condition. Note: default programming to be set for "Drive Run & Fault".
    n. Illuminated display keypad.
    o. External Fault indicator
    p. One (1) input for a N.O. dry contact type input for a 2-wire remote start/stop
    q. One (1) input for a N.C. dry contact type input for external faults: (freezestats, fire alarm, smokes, etc). This input shall be factory wired to prevent both the VFD and bypass starter operation when external fault is present.
    r. One (1) N.O. dry contact output for proving motor status. This output shall be programmed to detect belt or coupling break that would remove the load from the motor. The dry contact will open on loss of load or VFD being off.
    s. Diagnostics: Provide an English character display (no error codes) with indicators for the following:
        i. Phase loss
        ii. Ground fault
        iii. Overcurrent
        iv. Over-voltage
        v. Under-voltage
        vi. Over temperature
        vii. Overload
        viii. DC bus status
    t. All VFDs over 3 horsepower shall be provided with an AC choke.
    u. VFDs shall be installed in strict conformance to the manufacturer's installation instructions, and shall be rated to operate over a temperature range of 14 to 104 F.
    v. VFD automatic operation shall be suitable for an analog input signal compatible with the digital controller output.
    w. Each VFD shall be fan cooled and have an integral keypad and alphanumeric display unit for user interface. The display shall indicate VFD status (RUN motor rotation, READY, STOP, ALARM, and FAULT), and shall indicate the VFD current control source (DDC input signal, keypad, or field bus control). In addition to the alphanumeric display, the display unit shall have three pilot lights to annunciate when the power is on (green), when the drive is running (green, blinks when stopping and ramping down), and when the drive was shut down due to a detected fault (red, fault condition presented on the alphanumeric display).
20. Three types of faults shall be monitored, "FAULT" shall shut the motor down, "FAULT Auto-reset" shall shut the motor down and try to restart it for a programmable number of tries, and "FAULT Trip" shall shut the motor down after a FAULT Auto-reset fails to restart the motor. Coded faults shall be automatically displayed for the following faults:
    a. Over current
    b. Over voltage
    c. Earth ground
    d. Emergency stop
    e. System (component failure)
    f. Under voltage

g. Phase missing
h. Heat sink under temperature
i. Heat sink over temperature
j. Motor stalled
k. Motor over temperature
l. Motor under load
m. Cooling fan failure
n. Inverter bridge over temperature
o. Analog input control under current
p. Keypad failure
q. Other product unique monitored conditions

21. In addition to annunciating faults, at the time of fault occurrence the VFD shall capture and make available to the user certain system data for subsequent analysis during fault trouble shooting, including duration of operation (days, hours, minutes, seconds),output frequency, motor current, motor voltage, motor power, motor torque, DC voltage, unit temperature, run status, rotation direction, and any warnings. The last 30 fault occurrences shall be retained as well as the fault data listed in the previous sentence of each fault. New faults beyond 30 shall overwrite the oldest faults.
22. The display unit keypad shall allow setting operational parameters including minimum and maximum frequency, and acceleration and deceleration times. The display shall offer user monitoring of frequency, unit temperature, motor speed, current, torque, power, voltage, and temperature.

V. Actuators, General: All automatically controlled devices, unless specified otherwise elsewhere, shall be provided with actuators sized to operate their appropriate loads with sufficient reserve power to provide smooth modulating action or two-position action and tight close-off. Valves shall be provided with actuators suitable for floating or analog signal control as required to match the controller output. Actuators shall be power failure return type where valves or dampers are required to fail to a safe position and where specified. Actuators shall be chosen based on torque requirement of the device controlled and allow for 10% additional torque. All actuators shall include end-switches and resistor-position feedback (for modulating type) to provide actual valve/damper position to BAS.

W. Non-Spring Return Low Torque Direct Coupled 35 & 70 lb-in Actuators:

1. Actuators shall be 35 or 70 lb-in. with strokes adjustable for 45, 60, or 90 degree rotation applications and designed for operation between 20 and 125 F.
2. Manufacturers:
   a. Belimo
   b. Honeywell
   c. Johnson Controls
   d. Siemens Building Technologies
   e. TAC
3. Each actuator shall also have a minimum position adjustable rotation of 0 to 30 degrees.
4. Actuators shall be for floating or two position (ML 6161 or ML6174) control, or for 4-20 mA or 2-10Vdc (ML7161 or ML7174) input signals.
5. Analog control actuators shall have a cover mounted direct/reverse acting switch.
6. Actuator motor shall be magnetically coupled or shall have limit switch stops to disengage power at the ends of the stroke.
7. Actuators shall be direct connected (no linkages) and provided with a manual declutch for manual positioning.
8. Actuators shall have NEMA 1 environmental protection rating and be 24 volt and UL listed with UL94-5V plenum requirement compliance.
9. Minimum design life of actuators shall be for 1,500,000 repositions and 35 lb-in. models shall be designed for 50,000 open-close cycles and 70 lb-in. models shall be designed for 40,000 open-close cycles.
10. Actuator options shall include 1) Auxiliary feedback potentiometers, 2) open-closed indicator switches, 3) actuator timings of 90 seconds, 3 minutes, or 7 minutes, one or two auxiliary switches, and 4) torque of 35 or 70 lb-in.

X. Non-Spring Return High Torque 177 and 300 lb-in Actuators:

1. Actuators shall be UL listed 24 Vac in NEMA 2 enclosures designed for operation between -5 and 140 F.
2. Manufacturers:
   a. Belimo
   b. Honeywell
   c. Johnson Controls
   d. Siemens Building Technologies
   e. TAC
3. Rotation direction shall be switch selectable.
4. Minimum design life of actuators shall be for 1,500,000 repositions and for 60,000 open-close cycles.
5. Actuators shall be suitable for the controller output signals encountered, floating or analog, and shall have full cycle timing of 95 seconds.
6. Actuators shall be direct connected (no linkages) and provided with a manual declutch for manual positioning. Actuators shall be chosen based on torque requirement of the device controlled and allow for 10% additional torque:
7. Actuators shall have 300 lb-in. torque with adjustable stroke, 30 to 90 degrees, and shall auxiliary end switches to annunciate full open and full closed positions.
8. Actuators shall have 177 lb-in. torque with adjustable stroke, 30 to 90 degrees, and shall auxiliary end switches to annunciate full open and full closed positions.

Y. Spring Return Direct Coupled Actuators:

1. Actuators shall have torque ratings of 44lb-in., 88 lb-in., or 175 lb-in. Actuators shall be modulating 90 seconds nominal timing or two-position 45 seconds nominal timing types with strokes for 90 degree rotation applications and designed for operation between -40 and 140 F.
2. Manufacturers:
   a. Belimo
   b. Honeywell
   c. Johnson Controls
   d. Siemens Building Technologies
   e. TAC

3. Each torque rating group shall have optionally selected control types, floating control, 2-position 24 Vac, 2-position line voltage, or analog input which is switch selectable as 0-10Vdc, 10-0 Vdc, 2-10 Vdc, or 10-2 Vdc.
4. Actuator spring return direction (open or closed) shall be easily reversed in the field, and actuators shall spring return in no greater than 20 seconds.
5. Actuators shall be direct connected (no linkages), and shall have integral position indication.
6. Actuators shall have NEMA 2 environmental protection rating, and UL approved and plenum rated per UL873.
7. Minimum design life of modulating actuators shall be for 1,500,000 repositions and 60,000 spring returns, except 2-position actuators shall be for 50,000 spring returns.
8. Each actuator shall be provided with a manual power-off positioning lever for manual positioning during power loss or system malfunctions, including a gear-train lock to prevent spring action.
9. Upon power restoration after gear lock, normal operation shall automatically recur.

Z. Fast Acting Two Position Fire & Smoke Actuators:
1. Fire/smoke damper actuators shall be direct connected (no linkages) two-position spring return types with stroke for 90 degree nominal rotation applications and designed for 60,000 full stroke cycles and normal operation between 0 and 130 F.
2. Manufacturers:
   a. Belimo
   b. Honeywell
   c. Siemens Building Technologies
3. Actuators control shall be compatible with SPST control switch and with torque ratings of 30 lb-in.
4. Actuator timing shall be 25 seconds maximum in powered instances and shall spring-return in 15 seconds.
5. Actuators shall be UL listed with UL873 plenum rating with die-cast aluminum housing with integral junction box and conduit knockouts, and designed to operate reliably in smoke control systems requiring UL555S ratings up to 350F.
6. The actuator shall be designed to operate for 30 minutes during a one-time excursion to 350F.
7. Actuator shall require no special cycling during long-term holding, and shall "hold" with no audible noise at a power consumption of approximately half of the driving power.
8. Actuators shall be 24 volt or 120 volt with models for clockwise (add a B suffix) and counter-clockwise (add an A suffix) spring return.

AA. Temperature Control Panels: Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Control panels shall meet all requirements of Title 24, California Administrative Code. Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels. A complete set of 'as-built' control drawings (relating to the controls within that panel) shall be furnished within each control panel.

3. - EXECUTION

3.1. INSTALLATION

A. All work described in this section shall be performed by system integrators or contractors that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.
B. Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.
C. Drawings of the TCS and FMCS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.
D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by this contractor in accordance with these specifications.
E. Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by this contractor.

3.2. WIRING

A. All wiring shall be in accordance with the Project Electrical Specifications, the National Electrical Code and any applicable local codes.
B. All FMCS wiring that is exposed shall be installed in the conduit types specified in the Project Electrical Specifications.
C. Only wiring behind closed ceilings is allowed to be installed without conduit. Wire in plenums has to be plenum-rated.
D. All wiring and conduit shall be labeled to show points and device they are connected to.

3.3. ACCEPTANCE TESTING

A. Upon completion of the installation, this contractor shall load all system software and start-up the system. This contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications.
B. This contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the DDC system operation.
C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.
D. System Acceptance: Satisfactory completion is when all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.4. OPERATOR INSTRUCTION, TRAINING

A. During system commissioning and at such time acceptable performance of the TCS and FMCS hardware and software has been established this contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

B. This contractor shall provide 40 hours of instruction to the owner's designated personnel on the operation of the TCS and FMCS and describe its intended use with respect to the programmed functions specified. Operator orientation of the systems shall include, but not be limited to; the overall operation program, equipment functions (both individually and as part of the total integrated system), commands, systems generation, advisories, and appropriate operator intervention required in responding to the System's operation.

C. The training shall be in three sessions as follows:

1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test. Manual shall have been submitted at least two weeks prior to training so that the owners' personnel can start to familiarize themselves with the system before classroom instruction begins.
2. First Follow-Up Training: Two days (16 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
3. Warranty Follow Up: Two days (16 hours total) in no less than 4 hour increments, to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.

4. - SEQUENCES OF OPERATION

4.1. SUMMARY

A. Contractor shall coordinate control functions, such as scheduling and supervisory-level global control, points list, and control sequences needed for this installation as listed below. Contractor shall provide written documentation to archive the system operation as accepted by the owner.

B. Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one-hour period.

C. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.

D. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

E. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

F. Optimum Start/Stop shall enable space setpoints be met at scheduled time and shall cycle of operation before scheduled end time while maintaining acceptable space conditions. System shall monitor outside air conditions and space conditions to calculate start/stop times for each day.

G. The FMCS shall monitor space CO and NO2 levels in the space.

H. Make-Up Air Units:

i. MAU-1 shall operate at 100% fresh air with respective exhaust fans (EF-1 and 2) when the building is determined to be occupied through the space occupancy sensors. Make-up Air Unit gas burner shall modulate to maintain a minimum make-up discharge air temperature with duct mounted sensor control. The discharge air temperature shall be adjustable from FMCS.

a. The MAU-1 and respective exhaust fans shall operate for an additional 15 minutes upon the space becoming unoccupied.

b. Upon loss of communication with the BMS/ATC System, the Air Handling System Controller shall operate in the Occupied Mode.

c. Upon activation of overhead door for a period of 5 minutes (adjustable) the BMS shall cycle off the MAU and GFUH's until the door is determined closed.

ii. MAU-2 shall operate at 100% fresh air with respective exhaust fan (EF-3) continuously to maintain space ventilation requirements. Make-up Air Unit gas burner shall modulate to maintain a minimum make-up discharge air temperature with duct mounted sensor control. The discharge air temperature shall be adjustable from FMCS.

a. Upon loss of communication with the BMS/ATC System, the Air Handling System Controller shall operate in the Occupied Mode.

b. Upon activation of overhead door for a period of 5 minutes (adjustable) the BMS shall cycle off the MAU and GFUH's until the door is determined closed.

I. Exhaust Fans:

1. EF-1 and EF-2 shall be interlocked to operate with MAU-1. Motorized dampers for each fan shall prove open through end switch prior to fan operation. BAS shall monitor fan status.
2. EF-3 shall be interlocked to operate with MAU-2. Motorized dampers for each fan shall prove open prior to fan operation. BAS shall monitor fan status.
3. EF-4 shall operate when toilet room is occupied and be tied directly to light switch; not controlled through BAS.

J. Gas Fired Unit Heaters:

1. Gas Fired Unit Heaters shall be controlled by the FMCS and cycle the two stage burner and fan to maintain an adjustable space temperature set point. FMCS shall monitor discharge air temperature and fan status and alarm space temperatures.

K. Electric Unit Heaters:

2. Electric Unit Heater shall be controlled by the FMCS and cycle heating element and fan to maintain space set point temperature (adjustable) during occupied times. FMCS shall monitor operation and alarm space temperatures.

5. - GRAPHICAL REPRESENTATION POINT LISTS

5.1. SUMMARY

A. The points in the following table shall be accessible from the Graphical User Interface (GUI) and/or the Web browser interface (WBI). The supplier of the IDC and IBC devices shall ensure that the points listed in this table are accessible on their respective networks, by the Network Area Controller (NAC).

B. The graphics shall provide detailed 2-dimensional building site, 2-dimensional floor plans; and 3-dimentional equipment illustrations with fan, pump, damper, and valve animation for system operation. Each graphic shall be provided with a tabular "hot button" navigational structure enabling a "one-mouse click" access to other building systems and the return, without the use of the browser "back button".

C. The graphics shall provide a real-time continuous display of critical points; Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, and KW visible within the HTML frame on all graphic screens.

D. All values shall be logged in appropriate sampling intervals.

5.2. GRAPHIC DESCRIPTION

A. Home Page: The graphic shall provide a geographical overview of the multiple-site enterprise or campus buildings. Each building image shall be a "hot button" to access the building floor plans. The image "hot button" is indicated by a "mouse over" function highlighting the building and changing curser icon, enabling a "one-mouse click" access the building floor plans.

B. All points shall be displayed including but not limited to the actual value, set-value and alarms.

C. Log of each value shall be accessible from the read value on display. All values shall be logged. Additional values (i.e. totaled run time) shall be accessible as well.

D. Floor Plans:

1. The graphic shall provide an accurate dimensional layout of the building floor(s); including all rooms, room numbers, walls, elevators, doors, entrances, hallways, and stairwells. Room numbering and naming conventions shall be provided by the architect/engineer.
2. All space sensors shall be placed on the Floor Plan graphic accurately depicting their location. Each sensor image shall be a "hot button" to access the associated equipment. The image "hot button" is indicated by a "mouse over" function changing curser icon, enabling a "one-mouse click" access to the equipment. The sensors shall be tagged with a real-time continuous display of their value.
3. Building floor layout with large area or high density of sensors. The graphic shall provide an accurate dimensional layout of the building floor(s) divided into logical sections or areas. Each section or area shall be a "hot button" to access an expanded view. The section or area "hot button" is indicated by a "mouse over" function highlighting the section or area and changing curser icon, enabling a "one-mouse click" access to the expanded view. Expanded view; all space sensors shall be placed on the graphic accurately depicting their location. Each sensor image shall be a "hot button" to access the associated equipment. The image "hot button" is indicated by a "mouse over" function changing curser icon, enabling a "one-mouse click" access to the equipment. The sensors shall be tagged with a real-time continuous display of their value.

E. Mechanical Systems:

1. The graphic shall provide an accurate 3-dimensional representation of the system being controlled; including all sensors, heat exchangers, heating and cooling coils, dampers, CW/HW piping and pumps, humidifiers, flow directions, safety devices, actuators, and limit devices with fan, pump, damper, and valve animation for real-time system operation.
2. All data point components shall be placed on the system graphic accurately depicting their location. Each component image shall be a "hot button" to access their respective schedule, set-points, and trend logs. The image "hot button" is indicated by a "mouse over" function changing curser icon, enabling a "one-mouse click" access to the parameters. All analog and digital components shall be tagged with a real-time continuous display of their value.
3. The terminal unit graphic shall also include a reduced image of the associated AHU with animated fan status and tagged with a real-time continuous display of discharge air temperature and system static pressure.

F. Device Status:

1. For each device the and zone the set point and actual value shall be displayed
2. The desired mode (i.e. winter occupied) shall be displayed

G. Temporary Override shall have the following features:

1. Drop-down menu shall provide timed override to allow automatic fall-back of overridden value. Time intervals shall be 1-hour, 2 hours, 4-hours, 24 hours, 48 hours, and permanent. Default value shall be 1-hour.

H. Energy Management:

1. Current electric power draw of devices shall be totaled and displayed.
   a. include data of sub-meters , VFD-data and other device-data
   b. categorize in system types (i.e. chiller system)
   c. Power may be derived from past pulse-meter values unless
2. If Maximum allowable demand threshold (adjustable) is reached, certain devices will be turned off or throttled to avoid exceeding demand threshold. Type of device and throttling will be determined by building operator and commissioning agent.
3. Heating degree days and heating fuel consumption comparison will be logged and a relationship developed. Based on this, an indication in if the building performs as expected will be derived.

Space Temperature Setpoint Schedule:

SYSTEM POINT DESCRIPTION	ANALOG		DIGITAL		NOTES
	INPUT	OUTPUT	INPUT	OUTPUT	
GENERAL BAS POINTS					
MAU Override		DDC			
SPACE CO LEVEL		DDC			Monitoring Only
SPACE NO2 LEVEL		DDC			Monitoring Only
Overhead Door Status			BI		Open/Close; Shut off MAU and GFUH

SYSTEM POINT DESCRIPTION	ANALOG		DIGITAL		NOTES
	INPUT	OUTPUT	INPUT	OUTPUT	
					when doors are open for 5 minutes.
Exterior Passage Door Status			BI		Open/Close
Effective Temperature	T				Outside Air Temperature
MAKE-UP AIR UNITS					
Supply Fan			CT	S/S	Start/Stop and proof with alarm
Supply Temperature	T				Distribution Loop, supply to building
Supply Air Setpoint		SP			Setpoint Adjustment
Outside Air Shutoff Damper			BI	O/C	Open/Close end switch and Proof with Alarm
Space Differential Pressure			BI		Differential pressure with Alarm
Gas Fired Burner		DDC			OAT Heat enable/disable
Occupied	OCC				Use for operation of MAU-1
EXHAUST FANS					
Fan Status			CT	S/S	Start/Stop and monitor
Damper Position			BI	O/C	Open/Close and Proof with Alarm
Occupied	OCC				Use for operation of EF's tied to MAU Operation.
UNIT HEATERS (Electric)					
EUH			Proof		
Space Temperature	T				Set at 60 F (adjustable thru BAS)
UNIT HEATERS (Gas)					
Space Temperature	T				Set at 50 F (adjustable thru BAS)
Discharge Air Temperature Sensor		T			
Burner and Fan			CT		Monitor Only

The following abbreviations apply to the point table to indicate what level of functionality must be provided:
CT = Current Sensing Relay
S/S = Start/Stop
O/C = Open Close
DDC = Direct Digital Control
DI = Digital Input
DO = Digital Output
T = Temperature
P = Pressure
AO = Analog output
SP = Setpoint Adjustment
D = Display only
M = Modify value
A = Alarm
L = Log
S = Schedule
GC = Global supervisory control routine such as demand limiting

I.

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SECTION 26 00 00
ELECTRICAL SCOPE OF WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Contractor shall provide all labor, materials, equipment, permits, supervision and other items noted in Contract General Conditions, necessary to yield completely operable and tested systems as shown on the plans and specified herein. The work includes, but is not limited to, the following areas:

B. Lighting Systems
   1. Exterior lighting including all building mounted light fixtures.
   2. Interior lighting system including fixtures and components for their complete installation.
   3. Individual lighting control devices and low voltage lighting control system.

C. Temporary Power and Lighting
   1. Temporary lighting system for construction.
   2. Temporary electrical equipment including panelboards, circuit breakers, receptacles, etc.

D. Electric Power System
   1. Provide a new service entrance including all equipment and devices required by the local utility not limited to conductors, conduits, C.T./metering cabinet, meter socket, etc.
   2. Electrical power distribution equipment including panelboards, circuit breakers, disconnect switches, and feeders.
   3. Electrical outlets and receptacles.
   4. Motor starters, disconnects and control devices.

E. Electrical connection and/or installation of equipment provided by others including:
   1. HVAC, plumbing and associated control panels, motor starters, disconnect switches, control devices, etc.
   2. Fire protection equipment and associated devices.

F. Life Safety Systems
   1. Egress lighting and exit signage throughout facility.
   2. Fire Alarm System
      a. Basic system to interface with fire protection system.

1.02 RELATED SECTIONS

A. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

PART 2 - PRODUCTS

2.01 Not Used

PART 3 - EXECUTION

3.01 Not Used

END OF SECTION

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SECTION 26 01 00
GENERAL ELECTRICAL PROVISIONS

PART 1 - GENERAL

1.01 DESCRIPTION

A. These specifications set forth conditions, and include the work to be performed, equipment to be installed, and certain methods to be employed to implement a complete and operable electrical installation. This specification shall apply to all electrical work to be performed as listed in Section 26 00 00 Electrical Scope of Work as well as any other electrical work required of other trades or by Sections of this Project Manual.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 REFERENCES

A. National Fire Protection Agency:

1. NFPA 70 - National Electrical Code
2. NFPA 72 – National Fire Alarm Code
3. NFPA 101 - Life Safety Code

B. State of Wisconsin Department of Commerce

1. PSC 114 – Electrical Code, Volume 1
2. Chapter ILHR 16 – Electrical Code, Volume 2
3. Chapter ILHR 63 - Energy Conservation
4. Chapter ILHR 73 – Illumination Code

C. Local Code and Inspector Requirements

D. Local Utility Service Rules and Requirements

1.03 CODES AND STANDARDS

A. Comply with Section 01 42 00 – Reference Standards.

B. Specific naming of codes or standards occurs on the Drawings, and in other Sections of these Specifications.

C. These specifications are minimum requirements and shall govern except where made more stringent by other sections of this specification or local, state or federal laws or regulations. Where conflict between drawings, specifications, codes or standards occurs, the more stringent requirements shall govern. No extra compensation for such compliance will be allowed.

D. Submission of proposal is considered evidence that the Contractor is proficient and experienced, and knowledgeable of all standards, codes, ordinances, permits and regulations affecting his work.

1.04 PERMITS, INSPECTIONS, AND UTILITY CONNECTIONS

A. The Contractor shall prepare and submit all applications and working drawings, as required by the General Conditions and the Supplemental/Special Conditions, to the authorities having jurisdiction over the project. All licenses and permits shall be secured and paid for by the Contractor in accordance with the General and Supplemental/Special Conditions of the project.

1.05 EXAMINATION OF PLANS, SPECIFICATION, AND SITE

A. Before submitting a bid the contractor shall be familiar with all features of the building and site which may affect the execution of his work. No additional payment will be allowed for work resulting from the failure to obtain this information. The contractor shall clarify any omissions or errors in the plans specifications with architect or engineer before submitting his bid.

1.06 DRAWINGS

A. The drawings depicting electrical work are diagrammatic and show symbols representing electrical equipment and devices in their approximate location. The exact location of such equipment and devices shall be established in the field in accordance with instructions from the Architect/Engineer and as established by manufacturer's installation drawings and details.

1. Coordinate the location of equipment and devices with the other trades performing work in the area.
2. The location of receptacles and electrical connections for equipment to be installed by others are indicated on the plans. Verify the exact location and configuration of the connection with the party responsible for the installation of such equipment.
3. Refer to shop drawings and submittal drawings for all equipment requiring electrical connections to verify rough-in and connection details.
4. Dimensions noted on the electrical drawings are subject to measurements of adjacent and previously completed work.
5. Dimensions shall not be derived by scaling drawings.

B. The Contractor shall keep a detailed set of record drawings in accordance with Section 01 71 16. The record drawings shall include all conduit and feeder runs, pull box locations, and any other deviations from the Contract Drawings.

1.07 SUBMITTALS AND SUBSTITUTIONS

A. Comply with Section 01 33 00 – Submittal Procedures in addition to the following requirements.

B. Comply with the specific submittal requirements of each specification section in addition to the following requirements.

C. Approval of equipment, fixtures, methods, etc. proposed as alternates to those called for in the plans may be obtained by the following process. Consideration of alternate equipment shall be solely at the discretion of the Engineer. No alternates to the plans and specifications will be accepted except those given prior approval as follows.

1. Any and all proposed alternate equipment, fixtures, methods, etc. must be submitted for approval not less than ten (10) days prior to bid due date. Submittals shall be equivalent to those required for review as noted in section B below.
2. After review of the submittals the Engineer will determine acceptability of alternate proposals. All acceptable alternates will be made known to prospective contractors through the means of communication deemed best by the Engineer.

D. Submit all materials and equipment for review. Each sheet of descriptive literature submitted shall be clearly marked to identify the material or equipment as follows:

1. Submit schematics and connection diagrams for all electrical equipment. A manufacturer's standard connection diagram or schematic showing more than one scheme of connection will not be accepted unless it is clearly marked to show the intended connections. Sequence of operation shall be worded to indicate the progression of operation of all pushbuttons, limit switches, relays, solenoids and all other control devices.
2. Equipment and materials descriptive literature not readily cross-referenced with the drawings or specifications shall be identified by a suitable notation.

3. Lamp fixture descriptive sheets shall show the fixture schedule letter, number, or symbol for which the sheet applies.
4. Product sheets showing UL approved systems & materials for fire stopping. Identify the fire wall or floor where the product will be applied.
5. Sheets or drawings showing more than the particular item under consideration shall have crossed out all but the pertinent description of the item for which review is requested.
6. Equipment and materials descriptive literature and drawings shall show the specification paragraph for which the equipment applies.
7. The Contractor shall submit within thirty (30) days of the award of the contract for the Engineer's approval and prior to any purchase of the items, six (6) copies of materials, equipment, devices (including outlets and switches), conduit and wire, and fixtures proposed to be incorporated within the work. Where manufacturers are indicated for an item in the specification, only designation by catalog number of the manufacturer of the item to be used shall be required. All other items shall be listed with catalog numbers and descriptive information. The list must be complete to receive consideration. Items judged by the Engineer to be in non-conformance may be rejected. Shop Drawings of panelboards, switches over 35 amp rating, and special equipment will be required prior to their approval.
8. The Contractor shall review all shop drawings prior to submission.
    a. The Contractor shall verify that the materials and equipment depicted will properly fit into construction.
    b. The Contractor shall review all previously completed work related to the installation of the equipment depicted to insure that it has been properly installed.
9. No materials or equipment subject to prior review by the Architect/Engineer shall be fabricated or installed by the Contractor without approval. The Architect/Engineer's review of the shop drawings does not relieve the Contractor of the responsibility of deviations from the requirements of the drawings and specifications, unless prior written approval for such deviations has been granted.

1.08 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall assemble and submit to the Architect/Engineer for subsequent submission to the Owner, complete Operation and Maintenance manuals in accordance with Section 01 78 23 for each of the Lighting, Electrical, Communications, and Alarm systems.

B. The manuals shall consist of bound volumes instructing the Owner's personnel in the use, operation, and maintenance of the system or piece of equipment to which the manual pertains. The manual shall include the items specified in Section 01 78 23 and in the specific Specification Section for the equipment or system. The manuals shall cover all phases of operation and maintenance and shall be illustrated with drawings, photographs, wiring diagrams etc. as necessary.

C. Each manual shall include two sets of final shop drawings depicting the equipment or system as installed.

1.09 TEMPORARY FACILITIES

A. Comply with the requirement of Section 01 50 00 Temporary Facilities/Controls.

B. The Electrical Contractor shall provide all labor and material for temporary power and lighting required in construction for all trades until the permanent system is in operation.

C. The Electrical Contractor shall include the following facilities in the temporary power and lighting service for the entire project:
    1. For general temporary lighting in construction areas, provide an average maintained level of not less than 10fc. Provide not less than 100 watt incandescent lamps in

corridors and similar traffic ways, spaced not more than 50 feet apart, except provide one (1) lamp at each stairway or ladder landing.

2. Temporary lighting system shall be circuited and controlled so that the lighting level in each portion of the building can be reduced to provide security lighting during non-working hours and on weekends and holidays. The level of lighting for security purposes shall be in accordance with all federal, state and local regulations. The Electrical Contractor shall be responsible for the control of the temporary lighting such that the lighting is turned on at the beginning of each workday and the normal working lighting is reduced to the security lighting level at the end of each workday.
3. After installation of the permanent lighting system, it may be used for construction lighting as required.
4. Complete installation shall be in compliance with all applicable codes. Electrical Contractor's bid will allow removal and salvage for any temporary service when it is no longer required.

1.10 NEGLIGENCE

A. Should the electrical contractor fail to provide materials, templates, or other necessary information causing delay or expense to another party, he shall pay the actual amount of the damages to the party who sustained the loss.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Material and equipment shall be furnished new.

B. All material and equipment shall be listed by Underwriters' Laboratories, Inc. and shall bear UL listing labels where a UL test or standard exists.

C. Products shall be by established manufacturers regularly engaged in making type of materials to be provided and complete with all parts, accessories, trimmings, connections, etc. reasonably incidental thereto as specified in detail or as described in manufacturer's catalog. All equipment shall be properly cleaned, adjusted, and put in complete working order ready for service.

2.02 SUPPORTING DEVICES

A. Channel Support Systems
   1. U-Channels: Roll formed from 12-gauge steel. U-Channel width 1.5/8”, height shall be sized for the application of the channel and the device it supports.
      a. Channel for indoor, dry application shall have one of the following finishes.
         i. Pre-Galvanized Zinc Coating – ASTM A525 G-90
         ii. Finish equal to B-Line Dura-Green®™ or Unistrut Perma-Green®™
   2. Fittings and accessories:
      a. Fittings and accessories shall be manufactured by the U-Channel manufacturer.
      b. Indoor, dry application finish: Electro-plated Zinc – ASTM B633.

B.

C. Fastening Hardware including screw, bolts, nuts, washers, etc. shall be stainless steel in outdoor, wet or damp locations.

D. Concrete or masonry anchoring systems shall be applied per manufacturer’s recommendations for base material and load applications.

2.03 FIRESTOPPING

A. Provide Firestopping systems that comply with ASTM E-814 and UL 1479.

B. Firestopping systems shall provide a fire resistance rating equal to the hourly resistance rating of the floor, wall, or partition in which the system is installed.

C. Application and installation of firestopping products shall be in strict compliance with the manufacturer's instructions.

D. Acceptable manufacturers: Nelson Firestop Products, Tremco, RectorSeal and CSD Sealing Systems.

2.04 ACCESS PANELS

A. All access panels required by code or otherwise to electrical service equipment shall be supplied and installed by Electrical Contractor.

PART 3 - EXCECUTION

3.01 EQUIPMENT INSTALLATION REQUIREMENTS

A. Install all components, level, plumb, and parallel and perpendicular to other building system components, except where specifically noted.

B. Install all equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnection with minimum interference of installation with other systems.

C. Coordinate equipment locations with equipment and systems installed by other trades. Where a conflict arises, notify the Architect/Engineer and obtain approval for an alternate location before proceeding with installation.

D. Verify equipment dimensions to insure dimensional compatibility.

3.02 CUTTING AND PATCHING

A. Comply with the requirements of Section 01 73 29

B. Cutting and patching shall not impair the strength or function of work being cut, i.e. structural members shall not be weakened, and holes through exterior walls shall be waterproofed.

C. No structural members shall be cut without prior approval from the Architect/Engineer.

1. Repair disturbed surfaces to match adjacent undisturbed surfaces.

3.03 FIRESTOPPING

A. All penetrations through walls, floors, and partitions shall be sealed.

B. Sealants and sealing systems shall restore the fire resistive rating of the wall, floor, or partition that is penetrated.

3.04 TESTS

A. The Electrical Contractor shall conduct all tests required to ensure proper installation and operation off all components of the electrical system. The Electrical Contractor shall provide all instrumentation and labor necessary to conduct these tests. The engineer may require that he or his authorized representative be present for any required test.

B. During the course of construction, conduct the following tests, tabulate data, date, sign and submit to the Engineer. Further tests may be required to ensure proper operation of the electrical system.

1. Standard megger insulation test on each feeder.
2. Ground resistance test.
3. Check motors for proper rotation.
4. Ensure that all phase conductors are entirely free from grounds and short circuits.

3.05 PLACING OF SYSTEMS IN OPERATION

A. The Electrical Contractor shall be responsible for all start-up procedures and system checks.

B. All equipment shall be installed, tested and operated in accordance with the respective manufacturer's recommendations.

3.06 GUARANTEES

A. All labor, materials and equipment shall be guaranteed in writing by installing contractor for one year after final acceptance date and/or normal continuous complete season's operation applicable to equipment or system.

B. Acceptance date shall be determined by Architect/Engineer and stated in writing. Contractor shall secure equal guarantees from suppliers.

C. Contractor shall make all necessary alterations, repairs, adjustments and replacements during guarantee period as directed by Architect/Engineer to comply with Contract Documents, at no cost to the Owner.

D. Repair or replacements made under the guarantee provision shall bear further one-year guarantee from date of acceptance of repair or replacement.

3.07 INSPECTION

A. Upon completion of the work described under these specifications and drawings, the Electrical Contractor shall obtain and pay for inspection and approval by the local electrical inspecting authority or the State of Wisconsin. One (1) certified copy of the inspection report shall be delivered to the Architect/Engineer.

3.08 HOUSEKEEPING AND CLEANUP

A. Daily remove from the site all debris and rubbish accumulating as a result of the electrical installation. Upon completion of the project, dispose of all debris and rubbish and leave manholes and electrical equipment rooms broom clean. Clean the interiors of all cabinets, pull-boxes and equipment enclosures.

3.09 PRODUCT HANDLING

A. Protection: Equipment shall be constructed and packaged to withstand all stress induced in transit and during installation.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

3.10 DISCREPANCIES

A. In the event of discrepancy, immediately notify the Architect/ Engineer.

B. Do not proceed with the installation in areas of discrepancies until all such discrepancies have been fully resolved.

3.11 START-UP ASSISTANCE

A. The Electrical Contractor shall provide electricians to assist with the equipment start-up, including but not limited to, the following:

1. Vacuum and blow out all electrical panels.
2. Change motor rotation as required.
3. Increase overload element sizes when required by the engineer.
4. Correct all wiring errors.

END OF SECTION

SECTION 26 05 19
CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section encompasses the selection and installation of wire and cable for all types of applications.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions.
3. Section 26 05 33 – Raceways and Boxes.
4. Section 26 05 53 - Electrical Identification.

1.02 REFERENCES

A. Federal Specifications (Fed. Spec.):

1. J-C-30A(1) Cable and Wire Electrical (Power, Fixed Installation).

B. Underwriters Laboratories, Inc. (UL) Publications:

1. No. 44 Rubber-Insulated Wire and Cables.
2. No. 83 Thermoplastic-Insulated Wires.
3. No. 493 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures in addition to the following requirements.

B. Comply with Section 26 01 00 - General Electrical Provisions.

C. Provide product data from the cable manufacturer.

1.04 DELIVERY AND STORAGE

A. Provide cable on original reels or in boxes, new and unused.

B. Store cables in dry protected area and protect cable ends in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Low Voltage, Lighting and Power Cables:

1. Conductors provided on 600 volt power and lighting systems to be stranded per ASTM B 8 soft drawn copper for wires sizes 8 AWG through 14 AWG and stranded soft drawn copper per ASTM B 8 for 6 AWG wire sizes and larger.
2. Insulation system shall be type THHN, THWN or XHHW, 75ºC min., rated 600V as defined and listed in Article 310 of NEC.
3. Minimum size conductor utilized shall be #14 AWG for lighting circuits and #12 AWG for power circuits.
4. Acceptable manufacturers are Anaconda, Essex, ITT Royal, Southwire, Triangle, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Lighting and Power Cables:

1. Install only after completion of work which might cause damage to wires or conduit.
2. Clean out or replace conduit in which dirt, water, concrete, or other foreign matter has been allowed to accumulate, before installing wiring.
3. Identification of Insulated Conductors: Mark on outer cover giving voltage, type, and size. In addition, identify each end of each conductor wire with marking tape or sleeve as described in Section 26 05 53 - Identification.
4. Splices:
   a. No wire splices allowed in entire length of conduit or raceway.
   b. Make splices in electrical enclosures.
   c. Splice Insulation: Equal to original factory insulation.
   d. Splicing Copper to Aluminum: Use aluminum-copper connections, approved as suitable for the purpose.
5. Termination of Conductors:
   a. Insulated type compression lugs, "Sta-Kon" type by Thomas & Betts.
   b. At distribution equipment containing aluminum bus bars use aluminum-copper lugs rated and approved for the application.
   c. For lighting and receptacle circuits use "Scotchlox Spring" connectors manufactured by 3M.

B. Lace or clip groups of feeder conductors at distribution centers, pullboxes, and wireways.

C. Use wire pulling lubricant listed by UL for pulling No. 4 AWG and larger wire. Do not pull cables through conduit with more than allowable bends specified in NEC 345-11.

D. Limit the number of conductors in boxes so that the maximum number does not exceed the number permitted by Tables 370-6 of the National Electrical Code.

E. Support conductors in vertical raceways in accordance with the National Electrical Code. Cable supports shall be O-Z/Gedney Type "R".

F. A common neutral may be used for a maximum of three circuits provided each circuit is on a separate phase. Wherever possible, four (4) wire home runs shall be installed. Shared neutral circuits shall not be used when circuits are supplying non-linear loads or have an isolated ground. These circuits shall have dedicated neutrals, except where the circuit is part of a connection to an office furniture modular wiring system.

G. Wiring for emergency systems shall be installed in separate conduit runs.

END OF SECTION

SECTION 26 05 26
GROUNDING SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section covers the selection and installation of the equipment for an effective grounding system.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.

1.02 REFERENCES

A. Institute of Electrical and Electronics Engineers:

1. IEEE Standard 142-1972 - Grounding.

B. National Fire Protection Association (NFPA) Publications:

1. NEC Article 250.

C. Underwriters Laboratories Inc. (UL) Publications:

1. UL-No. 467.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures in addition to the following requirements.

B. Certified test reports on cable and ground rods.

C. Ground resistance tests.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ground rods shall be 3/4" x 10'-0" long, copper-weld, sectional type, steel core with thick copper covering inseparably welded together.

B. Ground Bus shall be predrilled copper (aluminum not permitted) with standard NEMA bolt hole sizing. Bus bar to be electro-tin plated for reduced contact resistance. Size: 1/4" X 2" minimum.

C. Ground Connections:

1. Shall be exothermic weld when concealed.
2. Shall be mechanical where exposed to view.
3. Where the grounding conductor penetrates a concrete surface use a 5/8 inch solid copper-weld rod or a thermo-weld anti-siphon water stop.

D. Grounding electrode shall be soft drawn stranded copper sized in accordance with Section 250 of the NEC. Solid may be used where penetration of a concrete surface is required.

E. Acceptable manufacturers are Cadweld, 0-Z Gedney, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Ground all metallic conduits, supports, cabinets and equipment in accordance with the National Electrical Code. Ground wire shall be of the same kind and quality as other

conductors in the building, shall be placed in steel conduit runs as specified for branch circuits, and shall be sized to meet the requirements of the National Electrical Code.

B. Test ground resistance with a ground meter of bridge type and report results to Architect/Engineer. Drive additional rods as directed by Architect/Engineer. Additional rods will be paid for as an extra. The system resistance should not exceed 5 OHMS.

C. Ground Rod Installation: Drive each rod vertically for not less than ten feet. Multiple rods: Where required to obtain the specified ground resistance, install multiple rods. Where rock prevents the driving of vertical ground rods, install grounding electrodes in horizontal trenches to achieve the specified resistance.

D. Grounding conductors shall be attached to equipment by means of approved copper alloy solder-less grounding lugs or clamps which shall be attached to the equipment and the grounding point by means of hexhead cap screws or machine bolts after the contact surfaces have been cleaned to bright metal.

E. Ground conductors run in conduit with circuit conductors shall be securely connected inside the junction boxes or enclosures.

F. Flexible or nonmetallic conduit will not be approved for continuity in a grounding system. A separate ground wire shall be installed and bonded to conduit system on both sides of flexible conduit. A separate ground wire shall be installed in all non-metallic conduit. Ground motor bases and frames pulling a separate conductor in with the motor feeder.

G. Install a bonding jumper around expansion fittings to maintain continuous ground continuity.

H. Service entrance ground conductor shall be connected to the building water service. Where ground connection is made to the water service on the building side on the water meter, a jumper or shunt shall be installed around the water meter, the current carrying capacity and mechanical protection shall not be less than required for the grounding conductor. Ends of the grounding electrode conductor shall be tinned.

I. All power feeds to panels, motors, etc. shall contain a ground conductor sized according to the NEC. The conduit system shall not be considered an acceptable ground.

J. All branch feeds to lights, receptacles, equipment, and general distribution shall contain a ground conductor sized according to the NEC. The conduit system shall not be considered an acceptable ground.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Raceways include the following:
   1. Rigid metal conduit.
   2. Intermediate metal conduit.
   3. Electrical metallic tubing (EMT).
   4. Flexible metal conduit.
   5. Liquidtight flexible conduit.
   6. Rigid nonmetallic conduit.
   7. Wireway.

C. Boxes, enclosures, and cabinets include the following:
   1. Device boxes.
   2. Outlet boxes.
   3. Pull and junction boxes.
   4. Cabinets and hinged cover enclosures.

D. Related Documents
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Section 26 01 00 - General Electrical Provisions.
   3. Section 26 27 26 - Wiring Devices.
   4. Section 26 05 53 - Electrical Identification.

1.02 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures in addition to the following requirements.

B. Comply with Section 26 01 00 - General Electrical Provisions.

C. Product data for wireway and fittings, floor boxes, hinged cover enclosures, and cabinets.

D. Shop drawings for nonstandard boxes, enclosures, and cabinets. Include layout drawings showing components and wiring.

1.03 QUALITY ASSURANCE

A. Comply with NFPA 70 "National Electrical Code" for components and installation.

B. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
   1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.

C. Comply with NECA "Standard of Installation."

D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering Products that may be incorporated in the Work include, but are not limited to, the following:

1. Metal Conduit and Tubing:
   a. Allied Tube and Conduit, Grinnell Co.
   b. Anamet, Inc., Anaconda Metal Hose.
   c. Anixter Brothers, Inc.
   d. Carol Cable Co., Inc.
   e. Cole-Flex Corp.
   f. Flexcon, Inc., Coleman Cable Systems, Inc.
   g. Spiraduct, Inc.
   h. Triangle PWC, Inc.
   i. Wheatland Tube Co.
2. Nonmetallic Tubing and Conduit:
   a. Anamet, Inc., Anaconda Metal Hose.
   b. Breeze-Illinois, Inc.
   c. Carlon.
   d. Certainteed Corp, Pipe & Plastics Group.
   e. Hubbell, Inc., Raco, Inc.
   f. Spiraduct, Inc.
   g. Thomas & Betts Corp.
3. Conduit Bodies and Fittings:
   a. Scott Fetzer Company, Adalet-PLM.
   b. American Electric, Construction Materials Group.
   c. Emerson Electric Co., Appleton Electric Co.
   d. Carlon.
   e. Hubbell, Inc., Killark Electric Manufacturing Co.
   f. General Signal, O-Z/Gedney Unit.
   g. Thomas and Betts Electrical Components Group.
4. Wireway:
   a. Hoffman Engineering Co.
   b. Keystone/Rees, Inc.
   c. Square D Co.
5. Boxes, Enclosures, and Cabinets:
   a. Scott Fetzer Company, Adalet-PLM.
   b. Butler Manufacturing Co., Walker Division.
   c. Cooper Industries, Midwest Electric.
   d. Erickson Electrical Equipment Co.
   e. Hoffman Engineering Co., Federal-Hoffman, Inc.
   f. Hubbell Inc., Killark Electric Manufacturing Co.
   g. General Signal, O-Z/Gedney.
   h. Raco, Inc., Hubbell Inc.
   i. Robroy Industries, Inc., Electrical Division.
   j. Square D Co.
   k. Thomas & Betts Corp.

B. Metal Conduit and Tubing

1. Rigid Steel Conduit (GRC, RSC): ANSI C80.1.
2. Intermediate Metal Conduit (IMC): ANSI C80.6.
3. Electrical Metallic Tubing (EMT) and Fittings: ANSI C80.3 with set-screw or compression-type fittings.
4. Flexible Metal Conduit: Zinc-coated steel.
5. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.
6. Fittings: NEMA FB 1, compatible with conduit/tubing materials.

C. Non-metallic Conduit and Tubing
   1. Electrical Nonmetallic Tubing (ENT): Not an acceptable raceway, shall not be used.
   2. Rigid Nonmetallic Conduit (RNC): NEMA TC 2, Schedule 40 or 80 PVC.
   3. PVC Conduit and Tubing Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

D. Wireways
   1. Material: Sheet metal sized and shaped as indicated.
   2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.
   3. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.
   4. Finish: Manufacturer's standard enamel finish.

E. Outlet and Device Boxes
   1. Sheet Metal Boxes: NEMA OS 1.
   2. Cast Metal Boxes: NEMA FB 1, type FD, cast feralloy box with gasketed cover.
   3. Nonmetallic Boxes: NEMA OS 2.

F. Pull and Junction Boxes
   1. Small Sheet Metal Boxes: NEMA OS 1.
   2. Cast Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

G. Cabinets and Enclosures
   1. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch. Finish inside and out with manufacturer's standard enamel.
   2. Cabinets: NEMA 250, type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of the raceway system. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

A. Outdoors: Use the following wiring methods:
   1. Minimum conduit size to be 1".
   2. Exposed: Rigid or intermediate metal conduit.
   3. Concealed: Rigid or intermediate metal conduit.
   4. Underground, Single Run: Rigid nonmetallic conduit.
   5. Underground, Grouped: Rigid nonmetallic conduit.
   6. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.
   7. Boxes and Enclosures: NEMA Type 3R.

B. Indoors: Use the following wiring methods:
   1. Minimum conduit size to be 1/2".

2. Conduits for feeder conductors shall be GRC or IMC regardless of size.
3. Conduits 1 1/4" diameter and smaller may be EMT where allowed by other paragraphs in this section.
4. Conduits 1 1/2" and greater shall be IMC or GRC except where flexible conduit is allowed by other paragraphs in this section.
5. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Flexible metal conduit, except in wet or damp locations use liquidtight flexible metal conduit.
6. Damp or Wet Locations: Rigid steel conduit.
7. Exposed:
   a. Below 8'-0" above finished floor: Rigid or intermediate metal conduit.
   b. Above 8'-0" above finished floor: Electrical metallic tubing.
8. Concealed in walls and above ceilings: Electrical metallic tubing.
9. Conduit fittings:
   a. RMC and IMC shall have threaded fittings.
   b. EMT shall have steel compression fittings except set screw fittings will be accepted for ½" and ¾" raceways.
10. Boxes and Enclosures: NEMA Type 1.

3.03 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Use of plastic anchors must be pre-approved by project engineer.

C. Conceal conduit and EMT within walls, ceilings, and floors except where specifically noted in the plans and specifications.

D. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Use temporary closures to prevent foreign matter from entering raceway.

H. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

I. Make bends and offsets so the inside diameter is not reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

J. Use raceway fittings compatible with raceway and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings.

K. Run concealed raceways with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions, except as otherwise indicated.

L. Do not embed raceways slabs.

M. Install raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
   1. Run parallel or banked raceways together, on common supports where practical.
   2. Make bends in parallel or banked runs from same center line to make bends parallel. Use factory elbows only where they can be installed parallel; otherwise, provide field bends for parallel raceways.

N. Join raceways with fittings designed and approved for the purpose and make joints tight.

1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
2. Use insulating bushings to protect conductors.

O. Tighten set screws of threadless fittings with suitable tool.

P. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely, and install the locknuts with dished part against the box. Where terminations cannot be made secure with one locknut, use two locknuts, one inside and one outside the box.

Q. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.

R. Install pull wires in empty raceways. Use No. 14 AWG (1.6 mm) zinc-coated steel or monofilament plastic line having not less than 200-lb (90 kg) tensile strength. Leave not less than 12 inches (300 mm) of slack at each end of the pull wire.

S. Telephone and Signal System Raceways 2-Inch Trade Size (Size 53) and Smaller: In addition to the above requirements, install in maximum lengths of 150 feet (45 m) and with a maximum of two 90-deg bends or equivalent. Install pull or junction boxes where necessary to comply with these requirements.

T. Install raceway sealing fittings according to the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:
1. Where conduits pass from warm locations to cold locations, such as the boundaries of refrigerated spaces and air-conditioned spaces.
2. Where otherwise required by the NEC.

U. Stub-Up Connections: Extend conduits through concrete floor for connection to freestanding equipment with an adjustable top or coupling threaded inside for plugs, and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible metal conduit may be used 6 inches (150 mm) above the floor. Where equipment connections are not made under this Contract, install screwdriver-operated threaded flush plugs flush with floor.

V. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semi-recessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

W. Install hinged cover enclosures and cabinets plumb. Support at each corner.

X. Provide grounding connections for raceway, boxes, and components as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torque requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that coatings, finishes, and cabinets are without damage or deterioration at Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC or paint finishes with matching touch-up coating recommended by the manufacturer.

3.05 CLEANING

A. Upon completion of installation of system, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 05 53
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section provides the minimum requirements for the identification of the components of the electrical system.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions.

1.02 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Nameplates shall be 1/8" 5-ply laminated with 1" high white letters on a black background.

B. Wire and cable markers shall be permanently attached cloth, split sleeve, or tubing type.

1. The identification shall be printed on the marker; write-on markers are not acceptable.
2. Include the branch circuit number, control circuit or any other appropriate identification that will expedite future tracing and trouble shooting.

C. Tape for wire color coding shall be thermo-plastic adhesive tape.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Identify switchboards, panelboards, individual circuit breakers, enclosed switches, motor starters and other electrical enclosures using engraved laminated plastic nameplates, specified above, as follows:

1. Switchboards and panelboards with panel number.
2. Motor starters, individual circuit breakers in switchboards and MCCs, and enclosed switches with equipment served (0.75" high letters).
3. Other enclosures with equipment and location being served.

B. Equip each distribution, lighting, and lighting control panel with a clear plastic covered typewritten directory accurately indicating rooms and/or equipment being serviced.

C. All electrical systems shall be color coded per National Electrical Code.

1. 208Y/120 Volt Systems:

Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green (or bare copper)
Isolated Ground	Green with one yellow stripe

2. Wire sizes #10 and smaller shall have color coded insulation the full length of the wire.

3. Wire size #8 and larger shall be identified with the appropriate color tape at all switchboards, panelboards, junction boxes, motor terminals, and any other enclosure where phase identification is necessary.

D. Wires in each junction box, panelboard, disconnect, enclosure or outlet shall be labeled with wrap-on numbers according to the circuit number to which they are connected.

E. When wire of different systems junction in a common box, each cable shall be grouped with its own system and identified using tags or identification strips.

F. When a piece of equipment is fed from more than one electrical source or more than one disconnect switch must be off to completely disconnect the equipment provide signs at each disconnect warning of this hazard.

G. Identify all mechanical and electrical items with item, panel and circuit number.

H. An underground warning marker shall be placed above buried cables and conduits the full length of the trench at a depth of 6" below grade.

I. Identify all non standard receptacles and multi-switch lighting controls as follows:

1. Provide non-standard receptacles with engraved stainless steel plates identifying the equipment being served and the Nema configuration of the device.
2. Line voltage multi-switch lighting controls shall be labeled using engraved or stamped plates.
3. Low voltage multi-switch lighting controls shall be labeled using factory provided label holders, or using stamped or engraved plates.

END OF SECTION

SECTION 26 09 00
LIGHTING CONTROLS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following types of lighting controls:
   1. Occupancy Sensors for control of lighting fixtures.
   2. Photoelectric relays for control of lighting fixtures.
   3. Time Clocks.

B. Related Documents
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Section 26 01 00 - General Electrical Provisions.
   3. Section 26 05 33 - Raceway and Boxes.
   4. Section 26 05 53 - Electrical Identification.

1.02 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Product Data for lighting control equipment and systems components, including dimensions and data on features and components. Include wiring diagrams and elevation views of front panels of control and indicating devices. Include data on ratings. For flush control panels, submit color and finish options for selection.

C. Typical wiring diagrams for all components including, but not limited to relay panels, relays, low voltages switches, occupancy sensors and daylighting controls.

D. Field test reports indicating and interpreting test results specified in Part 3 of this Section.

E. Maintenance data for lighting control equipment and systems components to include in the operation and maintenance manual specified in Division 1.

1.03 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Comply with FCC Regulations of Part 15, Subpart J for Class A.

C. Comply with NEC as applicable to electrical components and wiring.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the site dry and in their original unopened containers with all labels intact and legible at the time of use.

B. Store in strict accordance with manufacturer's recommendations and as approved by the Architect/Engineer.

C. Store materials in a dry location, off the floor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:
   1. Occupancy Sensors

a. Sensorswitch

2. Relays

a. Sensorswitch

2.02 OCCUPANCY SENSORS

A. Wall Switch Passive Infrared Type

1. UL listed, with 5-year warranty.
2. Sensor shall be self-contained control system that replaces a standard wall switch and turns lights on automatically when motion is detected and off after no motion is detected for an adjustable period of time.
3. Sensor shall detect 6” motions in a 300 square foot area with 180 degree field of view.
4. Sensor shall be insensitive to sunlight.
5. Time delay shall be adjustable from 15 sec. to 15 min.
6. Sensor shall have an LED indicating when motion is detected.
7. Sensor shall be compatible with all ballasts.

B. Passive Infrared with separate Photoelectric Relay Controlled Output

1. Sensor shall detect motion in a 1200 square foot area.
2. Sensor shall be insensitive to sunlight.
3. Time delay shall be adjustable from 15 sec. to 15 min.
4. Sensor shall have an LED indicating when motion is detected.
5. Sensor shall be compatible with all ballasts.
6. Sensor shall have two outputs, one based on occupancy only, and the other based on occupancy and an adjustable light level.
7. Provide adjustable motion sensitivity.
8. Provide light level sensitivity from 10 to 200 foot-candles.

C. Color of occupancy sensors shall match color of other devices, refer to Section 26 27 26.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all lighting controls according to manufacturers written instructions.

B. Mount control equipment according to manufacturers' instructions and Division 26 Section "Basic Electrical Materials and Methods."

C. Install all control wiring in conduit and according to manufacturer’s written instructions.

D. Bundle, train, and support wiring in enclosures.

E. Identify all switches, relays, wiring and other devices in accordance with Division 26 Section 26 05 53 “Electrical Identification.”

3.02 FIELD QUALITY CONTROL

A. If necessary to achieve proper operation provide services of a factory-authorized service representative to test, adjust, and program lighting control systems.

B. Reports: Prepare written reports of tests and observations. Report defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

C. Visual and Operational Inspections: Include the following inspections:

1. Inspect control components for defects and physical damage, NRTL labeling, and nameplate compliance with current Project Drawings.
2. Verify settings of photoelectric devices with photometer.

3. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions for routine functional operation.

D. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following tests according to manufacturer's instructions:

1. Continuity tests of circuits.

2. Operational Tests: Set and operate controls to demonstrate controls in a methodical sequence that cues and reproduces actual operating functions. Include testing of dimming equipment and ambient-light, programmable, and occupancy controls under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

E. Correct deficiencies disclosed by inspections and tests, make necessary adjustments, and retest deficient items. Verify that specified requirements are met.

3.03 ADJUSTING AND CLEANING

A. Occupancy Adjustments: Upon request within 1 year of date of Substantial Completion, make up to 2 on-site visits to Project site to assist in adjusting light levels, making program changes, and adjusting sensors and controls.

B. Repair scratches and mars of finish to match original finish. Clean equipment and devices internally and externally using methods and materials recommended by manufacturers.

3.04 DEMONSTRATION

A. Train Owner's personnel to operate, service, maintain, adjust, and program equipment and system components. Allow at least 8 hours to conduct training. Schedule training with at least 7 days' advance notice. Use final approved operation and maintenance manual as a training aid throughout training. Use both classroom training and hands-on exercises.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section encompasses the selection and installation of circuit breaker panelboards, and their circuit breakers.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions
3. Section 26 05 53 - Electrical Identification
4. Section 26 28 16 - Circuit Breakers

1.02 REFERENCES

A. Underwriters' Laboratories, Inc. (UL) Publications:

1. No. 50 - Cabinet and Boxes, Electrical.
2. No. 67 - Panelboards.
3. No. 489 - Molded Case Circuit Breakers and Circuit Breaker Enclosures.

B. National Electrical Manufacturers Association (NEMA) Publications:

1. No. PB-1 - Panelboards.
2. No. AB-1 - Molded Case Circuit Breakers.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Shop drawings for panel.

C. Product data on circuit breakers.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Circuit Breaker Panelboard:

1. Furnish and install power panelboards as shown on the plans. Panelboards shall be dead-front, safety type equipped with thermal magnetic, molded case bolt-on circuit breakers of frame and trip ratings as shown on the schedule. Provide Type 1, Class I, UL listed.
2. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the drawings. Bussing and neutral shall be fully rated throughout. Panelboard assembly, including main breaker, shall be 100% rated for the capacity indicated on the drawings. All sections and branch units shall be bussed directly to bus structure. Main bus shall be copper. Neutral and ground busses shall be copper. Buses to be rated for the available short circuit current, but not less than 22,000 amperes symmetrical.
3. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel is to be specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67. Recessed cabinets to be equipped with spring latch and tumbler lock on door of trim. Doors over 48" long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. End walls shall be

removable. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.

4. All panelboards shall be completely factory assembled with molded case circuit breakers. Provide mounting brackets, busbar drillings, filler pieces for unused spaces and ground bus.
5. Lighting panels shall have circuits numbered vertically in two rows, (1, 3, 5 and 2, 4, 6, etc.) Branch runs shall be connected by circuit numbers indicated in home runs on drawings for maximum load balance.
6. Provide locking devices for 20% of the circuit breakers. Minimum circuit trip rating shall be 20 amps for power and lighting.
7. Panelboards shall bear the UL label and conform to latest NEC requirements. Panelboards shall be Square D.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with NEC, as shown on the drawings, and as herein specified.

B. All panels shall be so mounted that the top is no more than 72" above the finished floor line.

C. Each panel shall be provided with a neatly typewritten directory identifying its circuit connections. Panel identification and directories shall comply with Section 26 05 53 of this specification. Panelboards shall be identified with one (1") inch letters as per designations on drawings, stenciled in white paint on the inside of the cover.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This Section encompasses the selection and installation of wiring devices to include:
   1. Line Voltage Wall Switches
   2. Receptacles
   3. Cover Plates

B. Related Documents
   1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
   2. Section 26 01 00 - General Electrical Provisions.
   3. Section 26 05 53 - Electrical Identification.

1.02 REFERENCES

A. Underwriters Laboratories Inc. (UL) Publications:
   1. UL-20 Underwriter's Laboratories General Use Snap Switches.

B. National Electrical Manufacturers Association (NEMA) Publications:
   1. WD 1 General Purpose Wiring Devices: National Electrical Manufacturers Association Standards (NEMA).

C. American National Standard Institute (ANSI):
   1. C 73 Series American National Standard Institute (ANSI) American Standards on Plugs and Receptacles.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures in addition to the following requirements.

B. Product data of all types of items supplied.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wall Switches
   1. Lighting and other flush switches shall be specification grade, quiet operating, toggle type in totally enclosed base of the following make and catalog number or approved equal:
      a. Single Pole 20 amp 120/277V Hubbell No. 1221
      b. Two Pole 20 amp 120/277V Hubbell No. 1222
      c. Three Way 20 amp 120/277V Hubbell No. 1223
      d. Four Way 20 amp 120/277V Hubbell No. 1224
   2. Color shall be ivory.
   3. Reference to Hubbell devices has been used as a means of establishing the grades and types of devices for use on the project. Comparable devices of Bryant, Leviton, or Pass & Seymour, Inc. will be acceptable.

B. Receptacles:

1. Standard Duplex Receptacle: Full gang size, specification grade, polarized, duplex, parallel blade, grounding slot, rated at 20 amperes, 120 volts, to conform to NEMA WD-1. Receptacles shall be similar to those as manufactured by Hubbell (No. 5362) or equivalent devices by Bryant, Challenger, or Pass and Seymour.
2. Ground fault receptacle: UL listed Class A with 5 milli-ampere sensitivity 20 ampere 120 VAC rating grounded NEMA 5-20R. Manufactured by Leviton, Hubbell, Square-D, or equal.
3. TVSS receptacle UL listed to standards 1449 and 498. Hubbell 5262S or equal.
4. Color of devices shall be ivory.

C. Cover Plates: Provide for standard switches and receptacles.
1. Material:
   a. Plastic, non-combustible, mar-proof thermosetting material, minimum 0.100" thick.
   b. Steel: Hot dip galvanized, 1.25 oz/sq.ft. minimum.
   c. Cast Metal: Die cast profile, ribbed for strength, flash removed, primed with gray enamel, furnished complete with four mounting screws.
   d. Gaskets: Resilient rubber or closed cell foam urethane.
2. Type Application:
   a. Flush Mounting Plates: Plastic in all living and office areas, stainless steel in all others.
   b. Surface Box Plates: Beveled, steel, pressure formed for smooth edge to fit box.
   c. Weatherproof Plates: Cast metal, gasketed for receptacles.
3. Acceptable manufacturers are Hubbell, Crouse-Hinds, Bryant, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All wiring devices shall be of one manufacturer and shall be delivered to project in original cartons. Devices shall be in accordance with Electrical Symbol Legend.

B. Mounting heights shall be as specified on the drawings.

C. Coordinate switch mounting location with architectural detail.

D. Standard duplex receptacles shall be oriented with the ground opening on top.

E. The outdoor units to be enclosed in cast aluminum boxes with weatherproof cover plates that can be closed with plug in the receptacle.

F. Provide engraved nameplate for receptacle other than standard duplex receptacle.

G. Device plates of the one-piece type shall be provided for all outlets to suit the devices installed; do not use sectional type device plates. Screws shall be of metal with countersunk heads, in color to match the finish of the plates. Screws shall be vertically aligned. Install plates with all four edges in continuous contact with finished wall surfaces without the use of mats or similar devices; plaster filling will not be permitted.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section encompasses the selection and installation of fuses and current limiters.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions
3. Section 26 28 16 - Motor & Circuit Disconnects

1.02 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Product data.

C. Test reports on conditions.

D. Time current curves and current limitation curves.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Time delay, dual element fuses.

1. Ferrule, blade, type.
2. Fiber, laminated, casing.
3. Ampere rating as shown.
4. 600 volt rating.
5. 200,000 ampere interrupting rating.
6. Class RK5, UL listed.
7. Can withstand 110% of rated load current at 25 degrees C indefinitely.
8. Provide a time delay of at least 10 seconds at 500% of rated load current.

B. Acceptable manufacturers of fuses are Bussman, Reliance fuse or equal.

C. Fuseholders:

1. Bakelite, porcelain, phenolic base.
2. Spring clips with side barriers and screw terminals.
3. Screw, waterproof, in-the-line universal mounting.
4. Panel-mounted type.
    a. Standard.
    b. Snap-lock.
    c. RFI shielded.
    d. Waterproof.
    e. Bayonet knob.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fuses to be properly mounted or bolted into their fuseholder or circuit breaker so as to maintain proper continuity.

B. Fuses and fuseholders sized according to the NEC.

C. Coordination with other protective devices shall be accomplished by using proper time-current curves.

D. Where ampere rating or protective device is 600 amperes or less, protection shall be FUSETRON dual element fuses having an interrupting rating of 100,000 amperes RMS.

E. Where the ampere rating of the protective device is 30 amperes or less and where the voltage is not over 150 volts to ground, protection shall be Fustat fuses or Type SC fuses, having an interrupting rating of 10,000 amperes.

F. Single phase motors of 150 volts or less to ground shall be protected with Fustat fuses in motor running protection sizes.

G. Single or three phase motors operated on line voltages over 150 volts shall be installed with individual motor running protection by using Fusetron fuses.

END OF SECTION

SECTION 26 28 16
DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section encompasses all motor and general circuit disconnects including separately mounted disconnects and those mounted in motor control centers, panelboards and switchboards.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions
3. Section 26 28 13 - Fuses

1.02 REFERENCES

A. Underwriters Laboratories Inc. (UL):
No. 98 - Enclosed Switches.

B. National Fire Protection Association (NFPA):
No. 70 - National Electrical Code (NEC).

C. National Electrical Manufacturers Association (NEMA):
No. KS 1 - Enclosed Switches.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Provide shop drawings for approval for all disconnects not an integral part of equipment, including outline and mounting dimensions, wiring schematic diagrams and withstandability ratings.

C. Provide product data for approval for all disconnects not an integral part of equipment.

D. Provide typical test report data for all disconnects outlined above.

E. Provide manuals for operation and maintenance data including renewal parts for all disconnects.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Disconnect Switches:

1. The disconnect switches shall be safety type, NEMA type HD, UL listed, with quick-make, quick-break operating handle, and mechanism forming an integral part of the box, not in the cover. The switches to have dual cover interlock to prevent unauthorized opening of door in the "ON" position or closing mechanism with door open. Handle position shall indicate if switch is ON or OFF. Switches shall have removable arc suppressors, where necessary to permit easy access to line-side lugs. Lugs shall be UL listed for aluminum and/or copper cables and front removable. All current carrying parts shall be plated.
2. Provide fusible disconnect switches with clips for fuses which have adequate interrupting capacity for the application and have an adequate short circuit current withstand rating to meet or exceed the available short circuit current.
3. Disconnect switches shall be provided with lugs suitable for the conductors used.

4. Acceptable manufacturers are Square-D, General Electric, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install motor and circuit disconnects in accordance with manufacturers recommendations and applicable codes.

B. Disconnect switches for single phase motors rated 1/4 HP and less may be a general use switch if it is provided with a means for locking the switch in the open position.

C. Disconnect switches for motors 1/3 HP and larger shall be heavy duty switches similar to Square "D" Type H heavy duty line.

END OF SECTION

SECTION 26 28 18
CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section encompasses the selection and installation of circuit breakers in their related enclosures.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00: General Electrical Provisions.
3. Section 26 24 19: Motor Starters.
4. Section 25 24 16: Panelboards.

1.02 REFERENCES

A. National Fire Protection Association (NFPA) Publications:
No. 70 National Electrical Code (NEC).

B. National Electrical Manufacturers Association (NEMA) Publications:
No. AB-1 Molded Case Circuit Breakers.

C. Underwriters Laboratories, Inc. (UL) Publications:
No. 489 Molded Case Circuit Breakers and Circuit Breakers Enclosures.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Product data including applicable shop drawings.

C. Coordination and characteristic curves for circuit breakers.

D. Test reports.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Molded Case Circuit Breakers:

1. Molded case circuit breakers shall have over-center, trip-free, toggle-type operating mechanism with quick-make/quick-break action and positive handle indication. Two- and three-pole breakers shall be common trip.
2. Construction shall be of a rugged, integral housing type molded insulating material, with silver alloy contacts, arc quenchers and phase barriers for each pole.
3. Each circuit breaker shall have a permanent trip unit containing individual non-adjustable thermal and magnetic trip elements in each pole with a common trip bar for all poles and a single operator. Circuit breaker operating handles shall assume a center position when tripped. All breakers shall be calibrated for operation in an ambient temperature of 40°C. Magnetic trip shall be adjustable from 3X to 10X for breakers with 400 ampere frames and higher. Factory setting shall be HI, unless otherwise noted.
4. Breakers shall have removable lugs. Lugs shall be UL Listed for copper conductors. Breakers shall be UL Listed for installation of mechanical screw type lugs or crimp lugs.

5. Circuit breakers in panelboards shall be bolt-on type on phase bus bar and shall have minimum interrupting rating indicated on the drawings or as follows (whichever is higher):
   a. 120 volt breakers: 10,000 amperes symmetrical.
   b. 208 and 240 volt breakers: 22,000 amperes symmetrical.

B. Acceptable manufacturer: Square-D

2.02 INSTALLATION

A. Circuit breakers to be mounted in enclosures, or panels.

B. Enclosure for circuit breaker shall be properly grounded.

C. Attach handles so as not to interfere with cover plate or door.

D. Properly mount circuit breaker so that acceptable electrical connection is made to bus work.

E. Termination of breaker terminals shall be to industry standards.

F. Installation shall be in accordance with NEC, as shown on the Drawings, and as herein specified.

G. Balance the load on all phases and rearrange branch circuiting if required, for balancing.

END OF SECTION

SECTION 26 29 13
MOTOR STARTERS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes all motor starters for all applications, including separately mounted starters, motor control centers, panel board or switch board starters and starters integrally mounted with equipment.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions.

1.02 REFERENCES

A. National Electrical Manufacturers Association (NEMA) Publications:

1. No. ICS-1 General Standards for Industrial Control and Systems.
2. No. ICS-2 Industrial Control Devices, Controllers and Assemblies.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittal Procedures in addition to the following requirements.

B. Provide shop drawings for approval for all motor starters not an integral part of equipment, including outline, mounting dimensions and wiring diagrams.

C. Provide Product Data for approval including:

1. Outline mounting dimensions and wiring diagrams.
2. Component layout.
3. Component product data, including significant electrical design ratings, coil current data.
4. NEMA starter size.
5. Overload relay and overload relay heater data, including significant electrical design ratings and characteristics.
6. Over-current disconnect device data, including significant design ratings.

D. Provide typical test report data for all starters not an integral part of equipment.

E. Provide operation and maintenance data, including renewal parts for all starters.

1.04 PRODUCT HANDLING

A. Protection:

1. Motor starters shall be constructed and packaged to withstand all stresses induced in transit and during installation.

B. Replacement:

1. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Single Phase Manual Starters (use only where specifically noted and remote control interlock is not required):

1. Enclosures shall be surface or flush mounted as specified. The starter shall be so assembled that the ON position of the operating toggle switch or pushbutton is to the top of the enclosure. All starters shall include pilot lights. Enclosures shall be general purpose NEMA 1 unless otherwise specified.
2. Operating mechanism shall be of the toggle switch or pushbutton type and shall be mechanically trip-free requiring a reset operation before the starter can be reset. Contacts shall be silver plated. Non-current carrying parts shall be mounted on a molded porcelain, Bakelite or composition base. Starter operating handle shall be capable of being padlocked in the OFF position.
3. Provide accessories as listed in the equipment schedule on the drawings or as specified elsewhere in these documents.
4. Overload protection shall be provided with one solid state overload relay. Provide 3:1 current range adjustability, phase loss protection, and visible trip indication. Trip Class: 10.
5. Wiring - Terminals for connections shall be easily accessible from the front and shall have large heads, capable of accommodating a wire size of current carrying equal to the current rating of the starter.
6. Each starter shall bear a nameplate stating the voltage, current and horsepower rating, manufacturer's name or symbol, catalog number and Underwriters' Label.
7. Starters shall be by same manufacturer: Square D, Allen Bradley, Cutler-Hammer/Westinghouse or approved equal.

B. Full Voltage Combination Magnetic Starters:
1. Motor starters shall be across-the-line magnetic-type rated in accordance with NEMA Standards, sizes and horsepower ratings. Enclosures shall be NEMA Type I, unless otherwise specified, and shall be of sufficient size to contain circuit breaker, contactors, overload relays and control transformer. The enclosure cover shall be hinged and shall contain the reset button for the overload relays.
2. As a disconnecting means, combination starters shall be provided with a thermal-magnetic circuit breaker in a molded plastic case, mechanically interlocked to prevent the enclosure door from being opened with the circuit breaker in the ON position.
3. Circuit breaker operator mechanism shall be mechanically interlocked so that the enclosure door cannot be opened with the circuit breaker in the CLOSED position. Provision shall be made to lock switch operation mechanism in the OFF position and shall accommodate three padlocks having a minimum of 5/16" diameter hasps.
4. Contactors shall be 600 volt, 3 phase, 60 cycle, NEMA sized and provided with 120 volt operating coils, shall be line voltage type, energized by a relay with 120 volt operating coil.
5. Main line contacts shall be silver-coated, double break type with arc barriers of heat resistant insulation compound between breaker contacts. Single break contact shall be supplied on sizes seven and eight. One auxiliary contact, unless otherwise specified or required, shall be provided and wired into the control circuit to provide under-voltage protection. All parts shall be readily accessible from the front for ease of maintenance or repair.
6. Overload protection shall be provided with one solid state overload relay. Provide 3:1 current range adjustability, phase loss protection, and visible trip indication. Trip class: 10.
7. Coils shall be of molded construction through NEMA size six. Coils on sizes seven and eight starters shall be form wound, taped, varnished and baked. All coils shall be replaceable from the front without removing the starter from the panel.
8. NEMA Size 0 through 6 starters shall be suitable for the addition of at least four external electrical interlocks of any arrangement shall be field convertible. Size 7 and 8 starters shall be suitable for the addition of up to three external electrical interlocks of any arrangement normally open or normally closed.

9. Starters shall have control transformers with line voltage primary and 120 volts fused secondary. The primary leads shall be wired to the load side of starter disconnect switch.
10. Selector switches and pushbuttons shall be flush mounted in starter covers where specified.
11. All starters shall have one N.0. and N.C. auxiliary contact.
12. Starters shall be front wired and conductors no smaller than No. 12 A.W.G. All terminals shall be legibly marked and connections to terminals made with solderless connectors. A wiring diagram of starter with all terminals identified shall be provided and attached to the inside of starter door.
13. Mechanical interlocks shall be provided to prevent access to live electrical parts by unauthorized personnel without the use of a suitable screwdriver when switch is in ON position.
14. The acceptable manufacturers are; Square D, Allen Bradley, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer recommendations and applicable codes.

B. Select overload relay heaters to provide proper motor overload protection in accordance with NEC considering motor service factor, temperature rise, ambient temperatures and other applicable factors.

C. Wire equipment as shown on the Plans. Prior to starting motor and equipment wiring, the Electrical Contractor shall verify the sizes and control schemes of the motors and equipment with the various contractors supplying equipment.

D. All materials shall be new and of the best of their kinds and all labor shall be performed by skilled mechanics under the direction of a competent superintendent approved by the Architect/Engineer.

E. All line voltage control wiring to be performed by the Electrical Contractor. Low voltage control wiring unless otherwise specified shall be the responsibility of the Mechanical or Temperature Control Contractor. Low voltage control wiring shall be performed in accordance with these specifications and shall be installed in an independent raceway and box system.

F. In the event of discrepancy, immediately notify the Architect/Engineer. Do not proceed with the installation in areas of discrepancies until all such discrepancies have been fully resolved.

END OF SECTION

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SECTION 26 33 23
CENTRALIZED EMERGENCY LIGHTING INVERTER

PART 1 - GENERAL

1.01 DESCRIPTION

A. This specification defines the electrical and mechanical characteristics and requirements for a stored electrical energy, uninterruptible, emergency power supply system. The system as specified herein includes all the components required to deliver reliable, high quality uninterruptible power for emergency illumination and related life safety equipment.

B. The system shall incorporate an online, dual conversion, advanced DSP controlled, high frequency, IGBT PWM rectifier/charger and inverter, high speed automatic bypass transfer device, battery charging system, energy storage battery platform, a diagnostic monitoring display panel, and all the related hardware components and software to facilitate a functional centralized system.

C. The emergency power supply system shall provide immunity from all line disturbances and power interruptions.

D. The system includes an uninterrupted, normally on output power section thus enabling compatibility with emergency lighting fixtures operating in normally on mode.

E. A self-diagnostic monitoring alarm system continuously advises of system status and battery condition.

1.02 QUALITY ASSURANCE

A. Final installation/inspection and start-up shall be completed by a factory authorized representative of the Centralized Emergency Lighting Inverter manufacturer.

B. 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 location and application.

1. American National Standards Institute (ANSI C57.110)
2. Institute of Electrical and Electronic Engineers (IEEE 519-1992) (C62.41-1991)
3. National Electrical Manufacturers Association (NEMA PE-1)
4. National Electric Code (NEC 2005, Article 700)
5. National Fire Protection Association (NFPA 70) (NFPA 101) (NFPA 111)
6. Underwriters Laboratories (UL 924)
7. Federal Communications Commission (FCC Part 15, Sec. J, Class A)
8. Federal Aviation Administration (FAA-G-201e)
9. Listed UL Standards UL 924 Emergency Lighting Equipment with 90 minutes, or UL 924 Auxiliary Lighting and Power Equipment (UL 924A) for other than 90 minutes battery backup.

1.03 SUBMITTALS

A. Manufacturer Requirements:

1. The manufacturer shall be ISO 9001:2008 “Quality Assurance Certified” and shall upon request furnish certification documents.
2. The manufacturer shall be a United States based manufacturer with 5 years experience or greater in design and fabrication of centralized stored electrical energy emergency and standby power systems.

B. Product Data:

1. The manufacturer shall supply documentation for the installation of the system,

including wiring diagrams and cabinet outlines showing dimensions, weights, BTUs, input/output current, input/output connection locations and required clearances.

2. Factory test results shall be provided to show compliance with the requirements. The manufacturer shall include battery test documentation which demonstrates compliance with the specified minimum emergency reserve with full rated KW load.
3. Submittals shall be specific for the equipment furnished and shall include as-built information.

C. Factory Test Reports: Comply with specified requirements.

D. Field Test Reports: Indicate test results compared with specified performance requirements, and provide justification and resolution of differences if values do not agree.

E. Maintenance Data: For Centralized Emergency Lighting Inverter units to include in maintenance manuals specified in Division 1. Include the following:
1. Lists of spare parts and replacement components recommended being stored at Project site for ready access.
2. Detailed operating instructions covering operation under both normal and abnormal conditions.

F. Warranties.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.

B. Store equipment in spaces with environments controlled within manufacturers' ambient temperature and humidity tolerances for non-operating equipment.

PART 2 - PRODUCTS

2.01 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. Controlled Power Company.
2. Cooper Lighting – Sure-Lites.
3. Bodine
4. Myers Power
5. Others as approved prior to bid.

2.02 FUNCTIONAL DESCRIPTION

A. Input Specifications
1. Input Voltage: 120 VAC.
2. Input Voltage Operating Range: +12% to -15% at full load without battery usage.
3. Extended Range: The unit shall incorporate the use of variable range logic in conjunction with the load percentage to extend the input range up to +12% to -30%, without battery usage, while maintaining a regulated output voltage.
4. Frequency Range: 57.5 hertz to 62.5 hertz.
5. Power Factor: Self correcting to >0.97 (approaching unity).
6. Input Current Harmonics: <5% THD (total harmonic distortion).

B. Output Specifications
1. Output Voltage: 120 VAC.

2. Sine Wave Voltage: Maximum 3% THD under linear load.
3. Frequency: 60 hertz + 0.5% under full load while in the battery operation mode.
4. Harmonic Attenuation: Reflected load generated harmonics shall be attenuated at the input.
5. Voltage Regulation: +/-2%.
6. Output Power Rating: KVA at 1.0 power factor (unity). KVA = KW

C. Battery Specifications
1. Battery time: 90 Minutes at full rated kilowatt output, UL 924 listed.
2. Battery Type: Integral, valve regulated, sealed lead calcium, maintenance free.
3. Charger: 4 stage, 400 watts, temperature compensated, smart charge.
4. Recharge Time: UL 924, NFPA 101 compliant, 24 hour recharge.
5. Bus Voltage: 72 VDC.

D. Manufactured Units:
1. The system shall be designed and manufactured to assure maximum reliability, serviceability and performance. All control devices and system electronics shall be accessible via the front inverter cabinet for rapid service or replacement. The diagnostic monitor panel display shall be mounted on the front of the system for easy observation of system status and battery condition. The system is to be furnished with an internally located AC input circuit breaker and up to 12 output circuit breakers as specified. The battery and DC conductors shall be DC circuit breaker protected. All conductors and transformer windings shall be copper constructed. The installed system shall be floor mounted and wall secured, constructed of steel, with the inverter controls, bypass, and breakers being front accessible through a hinged door, requiring a hand tool for access. The installed inverter cabinet shall be designed to meet NEMA 2 standards, rated for indoor use.
2. The system shall operate in accordance with requirements as specified herein to support any combination of fluorescent ballast fixtures, incandescent lamps, electronic and high power factor fluorescent ballasts, LED or HID fixtures or other approved loads up to the rating of the system. “Normally on” AC output bus shall be 100% rated and limited only by the system’s maximum KW output rating.
3. Normal Operation: The load is supplied with regulated power derived from the normal AC power input terminals through the rectifier charger and inverter. The rectifier charger shall be fully rated to charge the batteries and supply sufficient DC energy for the inverter when under full load. The battery shall be connected in parallel with the rectifier charger output.
4. Uninterrupted Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, energy will be supplied by the battery through the inverter and continue to supply power to the load without switching loss or disturbance. When power is restored at the AC input terminals of the system, the rectifier charger shall continue to supply power to the load through the inverter and simultaneously recharge the batteries. There shall be no break or interruption of power to the load upon failure or restoration of the commercial AC power.
5. Automatic Bypass Operation: The system shall include a high speed automatic bypass for fault clearing, for instantaneous overload conditions and/or to connect the load to the normal utility source in the event of a system rectifier charger or inverter failure.
6. Manual Bypass Switch: The system shall include an integral inverter bypass switch for use in case of an inverter failure. The switch shall be accessible via the front of the inverter enclosure, through a hinged door, requiring a hand tool for access. When in the bypass position, the switch shall bypass the inverter power control electronics and divert utility power to the inverter’s normally on output bus.

7. System Power Output Capability: The stored emergency power supply system output power rating shall be 1500 watts.
8. Battery Time Reserve Capacity: Battery shall be capable of producing emergency power for 90 minutes at full rated watts.
9. Reliability: MTBF 100,000 hours. MTTR, 1 hour typical.
10. System Input Breaker Rating: Input breaker shall be sized to accommodate full rated load, low line input, and maximum recharge current simultaneously. 1500 watt unit – 25A @ 120 VAC.

E. Performance Specifications
1. Overload Rating: 1000% for 1 cycle, 500% for 1 second and 150% for 1 minute when fed from AC power source.
2. On Battery Overload Rating: Normally On Bus Output shall be 200% surge rating for 5 cycles, 105% continuous.
3. Voltage Regulation: The output voltage shall be regulated to within +2% during input voltage changes from +12% to -15% with reference to nominal, and when the output is loaded from no load to full rated load.
4. Reactive Power Correction: Load at .6 pF corrected to > 0.97 at input (automatically correcting).
5. Efficiency: 88% typical under full rated load.
6. Reliability: 100,000 hours MTBF.
7. Audible Noise Level: Not greater than 50 dba at 3 feet.
8. Enclosure: NEMA 2, powder-coat painted steel construction, drip-proof, and sealed prohibiting rodent entry.

2.03 OPERATING ENVIRONMENT

A. Environmental Conditions: The Centralized Emergency Lighting Inverter shall be capable of operating continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability, except battery performance.
1. Operating Temperature: 20°C to 35°C for UL 924 Listed models. Optimum battery performance and life shall be achieved at 25°C. Inverter electronics shall be designed for use at 0°C to 40°C.
2. Inverter Storage Temperature: -20°C to 50°C.
3. Battery Storage Temperature: 25°C for 6 months. For each 9°C rise, reduce storage time by half.
4. Relative Humidity: 95% non-condensing.
5. Elevation: 5,000 feet, 1,500 meters.

2.04 Display Monitor and Diagnostics

A. Display Panel – System shall include a local, front mounted, sealed, LED display panel to indicate system status and battery condition. Display shall include provisions to automatically monitor inverter input voltage normal, inverter input voltage high, inverter input voltage low, inverter on automatic bypass, % load, battery in use, battery full charge, battery low and check battery.

B. Audible Alarm – The display panel includes an audible alarm with alarm silence for system on battery, low battery, check battery, over temperature warning, system fault and inverter overload.

C. Control Functions – Push button for inverter on, fail safe dual push buttons for inverter off, alarm silence push button and push button for manually initiating a system battery test.

D. Communications Port (RS232) – Include a DB9 and USB communications port for remote monitoring access to electrical measurements, system set point programming and system logs.

E. Electrical Measurements (RS232) – Electrical measurements shall include: input voltage L1-neutral, output voltage L1-neutral, output current (amps), output watts, output volt amperes, % load, battery voltage and DC charging current, and output frequency.

F. System Set Points (RS232) – Include provision to program the following: low battery alarm, battery usage, automatic battery tests programmable for 30 day intervals, or 90 day intervals and an annual discharge test. The start date and time of the 30, or 90 day test selected and of the annual test (365 day interval) shall be programmable via the RS232 connection (DB9 or USB port). The time duration of the automatic battery test shall be programmable (30 seconds or 5 minutes).

G. System Log (RS232) – System shall include provisions to log power outages, system overloads and battery test pass/fail results, all with a date and time stamp.

H. Automatic Self-Testing – Systems shall provide a programmable 30 second (UL 924A) or 5 minute automatic battery test that can be programmed to occur every 30, or 90 days.

2.05 Relay Communications Interface

A. Status / Alarm relay interface normally open contacts shall be provided for optional remote annunciator panel or automatic message dialer. Include potential free, 120 VAC @ .5amps, contacts for inverter on battery, low battery warning, and general alarm.

2.06 Accessories (Optional Equipment)

A. Include automatic message dialer for telephone messaging to inform maintenance personnel of system alarm conditions for system on emergency battery power, low battery warning or general alarm.

B. Include network device SNMP / Ethernet TCP/IP adapter for network communication of inverter system status, electrical measurement data, and automatic battery pass / fail test results with time and date stamp.

C. Include one pre-installed, 20 amp, single pole, output circuit breakers for use with normally on AC output bus.

2.07 Warranty

A. The manufacturer shall guarantee the inverter to be free from defects in material and workmanship for a period of 2 years following shipment from the factory.

B. Battery warranty shall be 1 year full replacement, 14 year prorated.

2.08 Serviceability

The inverter's power section, including all control cards and system electronics, shall be front-accessible and located behind a secure hinged access door for ease of service or component replacement. An integral inverter bypass switch must be provided. A DC circuit breaker and DC Anderson connector shall be incorporated into the design to facilitate rapid replacement of the batteries via the front of the system enclosure. No side access shall be required. To facilitate inverter diagnostics and programming, a DB9 and USB communications port shall be provided for access to electrical measurements, system set points, and system logs.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install according to manufacturer's written installation instructions and recommendations.

B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

C. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

3.02 GROUNDING

A. Comply with Division 26 Section 26 05 26 "Grounding System" for materials and installation requirements.

B. Separately Derived Systems: Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near isolation transformer.

3.03 BATTERY EQUALIZATION

A. Equalize charging of battery cells according to manufacturer's written instructions. Record individual-cell voltages.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage the services of a factory-authorized service representative to supervise installation, startup, and preliminary testing and adjustment and to participate in final tests, inspections, and adjustments.

B. Electrical Tests and Inspections: Perform tests and inspections according to manufacturer's written instructions and as listed below to demonstrate condition and performance of each component:

1. Inspect interiors of enclosures, including the following:
    a. Integrity of mechanical and electrical connections.
    b. Component type and labeling verification.
    c. Ratings of installed components.
2. Test manual and automatic operational features and system protective and alarm functions.
3. Test communication of status and alarms to remote monitoring equipment.

C. Retest: Correct deficiencies and retest until specified requirements are met.

D. Record of Tests and Inspections: Maintain and submit documentation of tests and inspections, including references to manufacturers' written instructions and other test and inspection criteria. Include results of tests, inspections, and retests.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the UPS.

1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment.
2. Review data in maintenance manuals. Refer to Division 1 Section 01 78 23 "Operation and Maintenance Data."
3. Schedule training with Owner, through Architect/Engineer, with at least seven days' advance notice.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions

1.02 DEFINITIONS

A. Fixture: A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery-powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.

B. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Product Data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

1. Outline drawings indicating dimensions and principal features of fixtures.
2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.
3. Battery and charger data for emergency lighting units.

C. Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, method of field assembly, components, features, and accessories.

D. Wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for specific system of this Project, and differentiating between factory-installed and field-installed wiring.

1.04 QUALITY ASSURANCE

A. Electrical Component Standard: Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling: Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project.

1. Special Listing and Labeling: Provide fixtures for use in damp or wet locations, and recessed in combustible construction that are specifically listed and labeled for such use.
2. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

3. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.

1.05 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries: Submit a written warranty executed by the manufacturer agreeing to replace rechargeable system batteries that fail in materials or workmanship within the specified warranty period.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, fixtures that may be incorporated into the Work include, but are not limited to, the products specified in the Light Fixture Schedule.

B. Electronic ballasts for fluorescent light fixtures shall be manufactured by GE except where other manufacturers have been specifically approved by the Architect/Engineer.

2.02 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, except as 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.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.
   1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Lens Thickness: 0.125 inch (3 mm) minimum; except where greater thickness is indicated.

F. Fluorescent Fixtures: Conform to UL 1570.

G. Fluorescent Ballasts: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
   1. Certification by Electrical Testing Laboratory (ETL).
   2. Labeling by Certified Ballast Manufacturers Association (CBM).
   3. Type: Class P, high power factor, except as otherwise indicated.
   4. Sound Rating: "A" rating, except as otherwise indicated.

5. Voltage: Match connected circuits.
6. Lamp Flicker: Less than 5 percent.
7. Minimum Power Factor: 90 percent.
8. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
9. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
10. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
11. Multi-lamp Ballasts: Use 2, 3, or 4 lamp ballasts for multi-lamp fixtures where possible.
12. Lamp-ballast connection method does not reduce normal rated life of lamps.
13. Dimming Ballasts: Electronic type providing smooth dimming over a minimum range from 100 to 5 percent light output. Listed for use with specific fluorescent dimming system provided. Provide Lutron slide-to-off wall-box dimmers designed for use with the dimming ballasts they will be controlling.

H. Electronic ballasts shall be UL listed to operate at high ambient temperatures without decreasing lamp or ballast life.

I. Exit Signs: Conform to UL 924 and the following:
1. Sign Colors: Refer to Luminaire Schedule on drawings.
2. Arrows: Include as indicated.
3. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum rated life.

J. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with the following features:
1. Battery: Sealed, maintenance-free with minimum 10-year nominal life and special warranty.
2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

2.03 LAMPS

A. Comply with ANSI C78 series that is applicable to each type of lamp.

B. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 3500 K and 85 CRI, except as otherwise indicated.

C. Non-compact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.

D. Metal Halide as specified in Luminaire Schedule on drawings.

2.04 FINISHES

A. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 26 Section "Basic Electrical Materials and Methods."

B. Lamping:

1. Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.02 CONNECTIONS

A. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Give advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

1. Duration of supply.
2. Low battery voltage shutdown.
3. Normal transfer to battery source and retransfer to normal.
4. Low supply voltage transfer.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

F. Report results of tests.

G. Replace fixtures that show evidence of corrosion during Project warranty period.

3.04 ADJUSTING AND CLEANING

A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.

B. Allow for three separate sessions with architect, engineer and owner's representative to adjust exterior floodlight fixtures.

END OF SECTION

SECTION 28 31 00
FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes a conventional fire alarm control system to provide monitoring and notification for the fire protection system. The system includes five Class B Initiating Device Circuits (IDCs), which may be wired as Class A circuits with the addition of an optional Class A module. The system also includes two Notification Appliance Circuits (NACs), which may be wired Class A or Class B. A built-in Dialer (DACT) provides a means of remote station or central station monitoring.

B. Related Documents

1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
2. Section 26 01 00 - General Electrical Provisions
3. Section 26 05 33 - Raceway and Boxes.
4. Section 26 05 53 - Electrical Identification

1.02 DEFINITIONS

A. FACP: Fire Alarm Control Panel.

1.03 SYSTEM DESCRIPTION

A. Signal Transmission: Hard wired, using separate individual circuits of alarm initiation and alarm device operation.

B. Audible Alarm Indication: By sounding of bells and strobe device.

C. Visual Alarm Indication: By xenon-strobe-type units.

1.04 SEQUENCE OF OPERATION

A. Alarm Operation:

1. Upon alarm activation of any manual pull station, automatic detection or sprinkler waterflow switch, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel. In addition the red "Fire Alarm" led will begin to flash. Pressing the "Alarm Ack" button will silence the internal audible device and cause the red "Fire Alarm" led to glow steady.
3. The LCD display shall indicate all applicable information associated with the alarm condition including; zone, device type, device location and time/date.
4. Record the occurrence of the event, the time of occurrence and the device initiating the event in the system's historical log. .
5. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
6. Transmit signal to the central station with point identification.
7. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

B. Supervisory Operation:

1. Upon supervisory activation of any sprinkler valve supervisory switch, the following functions shall automatically occur:

2. The internal audible device shall sound at the control panel.
3. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time/date.
4. Record, the occurrence of the event, the time of occurrence and the device initiating the event in the system's historical log. .
5. Any remote or local annunciator LCD/LED's associated with the supervisory zone shall be illuminated.
6. Transmit signal to the central station with point identification.

C. Trouble Operation:
1. Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:
2. The internal audible device shall sound at the control panel. Along with trouble audible and visual signals as indicated on the drawings.
3. The LCD display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time/date.
4. Record, the occurrence of the event, the time of occurrence and the device initiating the event in the system's historical log. .
5. Any remote or local annunciator LCD/LED's associated with the trouble zone shall be illuminated.
6. Audible signals shall be silenced from the fire alarm control panel by a trouble acknowledge switch.
7. Transmit signal to the central station with point identification.
8. Trouble reports for primary system power failure to the master control shall be automatically delayed for a period of time equal to 25% of the system standby battery capacity to eliminate spurious reports as a result of power fluctuations.

1.05 SUBMITTALS

A. Comply with Section 01 33 00 - Submittals and Substitutions in addition to the following requirements.

B. Product Data for each type of system component specified including dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and Nationally Recognized Testing Laboratory (NRTL)-listing data.

C. Wiring diagrams from manufacturer differentiating clearly between factory- and field-installed wiring. Include diagrams for equipment and for system with all terminals and interconnections identified. Make all diagrams specific to this Project and distinguish between field and factory wiring.

D. System operation description covering this specific Project, including method of operation and supervision of each type of circuit and sequence of operations for all manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are unacceptable.

E. Operating instructions for mounting at the FACP.

F. Maintenance data for fire alarm systems to include in the operation and maintenance manual specified in Division 1. Include data for each type of product, including all features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at the site. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.

G. Record of field tests of system.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced factory-authorized Installer to perform work of this Section.

B. Single-Source Responsibility: Obtain fire alarm components from a single source who assumes responsibility for compatibility of system components.

C. Compliance with Local Requirements: Comply with the applicable building code, local ordinances, and regulations, and the requirements of the authorities having jurisdiction.

D. Comply with NFPA 70 and NFPA 72.

E. Listing and Labeling: Provide systems and equipment specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Simplex Time Recorder Co.
2. EST
3. Siemens

2.02 ALARM-INDICATING DEVICES

A. General: Equip alarm-indicating devices for mounting as indicated. Provide terminal blocks for system connections.

B. Horns/Strobe: Exterior rated, operating on 24-V dc, with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the source.

2.03 ALARM-INTIATING DEVICES

A. Manual Stations

1. Manual Station - Double Action Single Stage
    a. Provide analog/addressable double action, single stage fire alarm stations at the locations shown on the drawings. The fire alarm station shall be of polycarbonate construction and incorporate an internal toggle switch. A locked test feature shall be provided. The station shall be finished in red with silver "PULL IN CASE OF FIRE" lettering. The manual station shall be suitable for mounting on North American 2 ½ (64mm) deep 1-gang boxes and 1 ½ (38mm) deep 4 square boxes with 1-gang covers.
2. Smoke Detectors & Accessories
    a. Smoke Detector – Photoelectric
        i. Provide analog/addressable photoelectric smoke detectors at the locations shown on the drawings. The detector shall have the ability to set the sensitivity and alarm verification of each of the individual detectors on the circuit. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings. Each

detector microprocessor shall contain an environmental compensation algorithm that identifies and sets ambient environmental thresholds approximately six times an hour. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 75% and 100% of the allowable environmental compensation value.

2.04 FACP CONTROL PANEL

A. The system includes the Main System Board (MSB) mounted in a steel enclosure with locking door. The MSB contains everything needed for a UL-listed fire alarm system on one board:

1. System power supply (3A); 24V filtered
2. 120 VAC, 60 Hz, 4A; 240V, 50 Hz, 3A
3. 24 VDC (filtered) 3A alarm power
4. 24 VDC, ½ A auxiliary power
5. Battery charger for up to 26 Ah batteries per UL864; temperature compensated. Recharge 12.7Ah batteries per ULC-S527.
6. Five IDCs (Class B)
7. Two, 2A Notification Appliance Circuits (Class A or B)
8. Internal System Dialer (DACT)
9. Two auxiliary relay circuits (2 Amps @ 30 VDC)
10. One auxiliary power tap (1/2 Amp)
11. 2x20 backlit LCD, LEDs and keypad
12. Service Port (Programming Access and Service Terminal)
13. Expansion power supply connection
14. Expansion IDC connection
15. Expansion port for Class A IDC adapter connection
16. Connection for interface to optional city card
17. Communication channel for remote annunciators
18. Battery-backed, non-volatile memory preserves logs, time/date information, and disabled points on AC loss.

2.05 WIRE

A. Wire: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.

1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install system according to NFPA standards referenced in Parts 1 and 2 of this Section.

B. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.

3.02 EQUIPMENT INSTALLATION

A. Audible Alarm-Indicating Devices: Install not less than 90 inches (2280 mm) above the finished floor or finished grade. Install bells and horns on surface-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated.

B. Mount manual pull station adjacent to the FACP.

3.03 WIRING INSTALLATION

A. Wiring Method: Install wiring in metal raceway according to Division 26 Section 26 05 33 "Raceways, Boxes, and Cabinets." Conceal raceway except in unfinished spaces and as indicated.

B. Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

C. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

D. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

3.04 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals to match the existing system identification.

B. Fire alarm system junction box covers shall be painted red.

3.05 GROUNDING

A. Provide grounding as required by FACP/power supply manufacturer.

3.06 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.

B. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.

C. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72.

D. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.

3.07 CLEANING AND ADJUSTING

A. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.

3.08 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, adjusting, and preventive maintenance.
2. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
3. Schedule training with Owner with at least 7 days' advance notice.

3.09 ON-SITE ASSISTANCE

A. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions.

END OF SECTION

SECTION 31 00 00
EARTHWORK

PART 1 - GENERAL

1.01 SUMMARY

A. Special Conditions: See Summary of Work Section 01 11 00 for information on construction services to be provided by the City outside of Contract.

B. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the earthwork as shown on the drawings and herein specified.
2. Clearing and grubbing.
3. Stripping and stockpiling topsoil.
    a. Note: Contractor shall haul all excess material to north stockpile location as shown on plans, or other location on site as directed by Owner. The north stockpile shall be filled from south to north.
4. Rough grading.
5. Proof-rolling of stripped sub-grades.
6. Excavating, filling, compacting, and grading sub-grade, sub-base, and base course for building foundation and footing, floor slab, sidewalks, yard slabs, and pavement.
7. Disposal of excavated materials not required for fills.
8. Dewatering of excavations for building foundation and footing, floor slab, sidewalks, yard slabs, and pavement.
9. Drainage of all areas of the Work to prevent standing water and erosion of excavations for building foundation and footing, floor slab, sidewalks, yard slabs, and pavement.
10. Protection of excavations for building foundation and footing, floor slab, sidewalks, yard slabs, and pavement.
11. Furnishing and placing select fill and backfill materials.
12. Topsoil placement and finish grading for landscaping.
13. Providing temporary haul roads and erosion controls.
14. Restoration.

C. Related Sections:

1. Division 02 Section 02 30 00 Subsurface Investigations
2. Division 31 Section 31 25 00 Erosion and Sedimentation Control
3. Division 31 Section 31 23 16 Trenching

1.02 REFERENCES

A. ASTM International, ASTM C 136-2001 “Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.”

B. ASTM International, ASTM D1557-2002 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.”

C. ASTM International, ASTM D2487-2000 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).”

D. ASTM International, ASTM D2922-2001 “Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).”

E. ASTM International, ASTM D3017-2001 “Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).”

1.03 DEFINITIONS

A. Influence Zone Under Footings: Foundations, Pavements, Floor Slabs, Yard Slabs, or Sidewalks: Area below sub-base bounded by a horizontal to two vertical slope extending outward from one foot beyond outer edges.

B. Influence Zone Around Piping, Electrical, and Ducts: Area below limits bounded by horizontal line 12 inches above pipe, conduit, or duct and by one horizontal to two vertical slope extending downward from that line one foot beyond outer edge of pipe, conduit, or duct.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures. Minimum of five (5) copies shall be submitted.

B. Quality Control Submittals:

1. Test Reports: Submit three copies of compaction test reports for existing in-place soils and controlled fill, laboratory test reports (including sieve analysis), and field footing sub-grade evaluation reports.

C. Written approval by Geotechnical Engineer of structural fill and usage.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
2. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent provisions shall govern.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Storage and Protection

1. Use all means necessary to protect all materials of this section before, during, and after installation and to protect all objects designated to remain.
2. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Design Professional at no additional cost to the Owner.
3. Use all means necessary to protect all existing utilities, roads, and all other site improvements that are to remain.

1.07 PROJECT CONDITIONS

A. Project Environmental Requirements

1. All erosion and sediment control shall comply with the Wisconsin Department of Natural Resources Conservation Practice Standards:
   a. 1052 “Non-Channel Erosion Mat”
   b. 1053 “Channel Erosion Mat”
   c. 1056 “Silt Fence”
   d. 1057 “Stone Tracking Pad and Tire Washing”
   e. 1060 “Storm Drain Inlet Protection for Construction Sites”
   f. 1061 “Dewatering”
   g. 1064 “Sediment Basin”
   h. 1067 “Temporary Grading Practices for Erosion Control”
   i. 1068 “Dust Control on Construction Sites”
   j. All other applicable standards not listed above.
2. Dust Control:

a. Use all means necessary to control dust on and near the Work and on and near all site borrow areas if such dust is caused by the Contractor's operations during performance of the Work or if resulting from the condition in which the Contractor leaves the site.

b. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other Work on the site.

B. Existing Conditions

1. Where existing sewers, water, electric or other services are encountered, Contractor shall take adequate steps to protect such services.

2. If such existing services require relocation, make written request for ruling from the Design Professional. Do not proceed on such portions of Work until written instructions are received. Costs involved shall be negotiated.

3. Information Based on Preliminary Investigations:

a. Information pertaining to preliminary investigations, such as test borings, location of utilities, and existing grades has been collected for the Project and will be available for review by bidders. There is no expressed or implied guarantee that conditions so indicated are entirely representative or those actually existing or that unforeseen developments may not occur. The interpretation of results of such investigation shall not be the responsibility of the Design Professional. The Contractor shall visit the Site and make his/her own interpretation of conditions, based on his/her investigation of existing conditions and on soil reports. Where underground services, utilities, etc., are located on the Drawings or given at the Site, they are based on available records, but are not guaranteed to be complete or correct. They are merely available for assistance.

1.08 SEQUENCING AND SCHEDULING

A. Sequence and schedule activities so that work will progress in a timely manner. Contractor shall schedule and sequence work with all Contractors on the Project.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Fill and Usage:

1. Approval is required by geotechnical engineer in writing to the Design Professional.

2. Composition: Pit Run conforming to Wisconsin Department of Transportation 2009 Standard Specification Section 313.

3. Classification

a. Floor Slabs, Footings, and Aprons at Building:

i. 100 percent passing screen having nominal square opening size of 3”.

ii. Not more than 30% retained on 3/4" sieve.

iii. Not more than 46% passing No. 100 sieve.

iv. Raising Site Grades: Not more than 12% passing No. 200 sieve.

v. Final Eight Inches of Fill Material: Not more than 5% passing No. 200 sieve.

vi. Sieve analysis report shall be completed and submitted prior to placement. Separate sieve analyses shall be performed if fill is supplied by multiple suppliers.

b. Exterior Concrete Yard Slabs and Walks:

i. Raising Site Grades: Silty Clay with moisture content of 2 to 3 percent of optimum moisture content. Lifts not to exceed 6" in loose thickness and compacted with sheepsfoot type roller. Minimum compaction 95%.

ii. Final Eight Inches of Fill Material:

(a.) Not more than 5% passing No. 200 sieve.

(b.) 100 percent passing screen having nominal square opening size of 3".

c. Paved Areas and Concrete Aprons at Roads:

i. Raising Site Grades: Silty Clay with moisture content of 2 to 3 percent of optimum moisture content. Lifts not to exceed 6" in loose thickness and compacted with sheepsfoot type roller. Minimum compaction 95%.

ii. Final Eight Inches of Fill Material:

(a.) Not more than 5% passing No. 200 sieve.

(b.) 100 percent passing screen having nominal square opening size of 3".

B. Earth Fill:

1. On-site subsoil or borrow free from organic material and other deleterious substance and rocks or lumps over six inches in greatest dimension, and not more than 15% of the rocks or lumps shall be larger than 2 1/2 inches in greatest dimension. Satisfactory materials are defined as those meeting ASTM D2487 Soil Classification Groups GW, GP, GM, GC, SW, SP, SM, SC, and CL.

a. Unsuitable Material: Soil Classification Groups ML, OL, MH, CH, OH and Pt.

2. Final Eight Inches of Fill Material:

a. 100 percent passing screen having nominal square opening size of 3".

C. Topsoil Fill: On-site topsoil. Use excess topsoil for landscaping and filling in turf areas.

1. Final Eight Inches of Fill Material:

a. 100 percent passing screen having nominal square opening size of 3".

PART 3 - EXECUTION

3.01 EXAMINATION

A. Notify corporations, companies, individuals, or authorities owning above or below ground conduits, wires, pipes, or other utilities running to property or encountered during excavation operations. Cap or remove and relocate services as required.

3.02 PREPARATION

A. Protection: Protect, support, maintain conduits, wires, pipes, or other utilities that are to remain in accordance with the requirements of owners of said services.

B. Surface Preparation:

1. Layout of Work:

a. Layout site earthwork.

b. Establish sitework elevations.

3.03 CLEARING AND GRUBBING

A. Accept the site as found and remove all trash, rubbish, and other debris.

B. Remove all trees, saplings, bushes, vines, and undergrowth within the Contract Limits as required for execution of construction except for planning to remain or removed by others as indicated on the Drawings.

C. Remove all stumps, roots, and matted roots within the limits of grubbing depths below:

1.	Walks	12 inches below bottom of base course
2.	Drives	18 inches below bottom of base course
3.	Parking Areas	12 inches below bottom of base course

4. Lawn Areas 8 inches below bottom of new topsoil
5. Fills 12 inches below bottom of fill zone
6. Where drives, walks, and other construction or fills overlap, the greater depth shall apply.

D. Remove the material from the site. Burning of materials on-site is not permitted.

3.04 STRIPPING AND STOCKPILING TOPSOIL

A. Remove topsoil and unsuitable material to its entire depth from areas to be occupied by buildings and paving, and from areas to have change in grade, plus additional area as needed to prevent intermixing of topsoil with subgrade.

B. Stockpile topsoil in a designated or approved location. Remove excess topsoil from the site.

3.05 PROOF ROLLING OF STRIPPED SUB-GRADES

A. Proof roll subgrades under building areas, walk areas, and areas to be paved in the presence of the geotechnical engineer. Proof roll after stripping to sub-grade and immediately prior to placing fill material.

B. Proof roll with at least two passes performed in a criss-cross pattern with a fully loaded tri-axle dump truck with a minimum gross weight of 30 tons, or equivalent acceptable to the Design Professional.

C. Remove soft, loose, weak, and unstable or unsuitable soils and replace with approved compacted fill materials and re-compact.

3.06 EXCAVATING

A. Excavate to elevations and dimensions necessary to complete construction.

B. Remove unsuitable material as determined by Geotechnical Engineer.

C. Remove excess material from the Site.

3.07 PLACING FILL

A. Notify Owner and Soils Testing Agency before placing fill material.

B. Do not use wet or frozen material or place fill on wet, unstable or frozen sub-grade.

C. Fill excavations below bottom of foundation or footing elevations within influence zone with concrete or structural fill.

D. Do not backfill until new concrete has been properly cured, and required tests have been accepted.

E. Place fill simultaneously on both sides of free-standing structures.

F. Fill adjacent to structure, footings, and foundation walls shall be structural fill.

G. Place fill against foundation walls enclosing interior spaces only after construction is in place to brace the top of the wall.

H. To minimize lateral forces against structure due to wedging action of soil, begin compaction of each layer at structure wall.

I. Provide mechanical compaction for cohesive materials and vibratory compaction for granular materials. Compaction by travel of grading equipment shall not be considered adequate for uniform compaction.

J. Provide hand guided vibratory or tamping compactors whenever fill is to be placed in confined areas.

K. Lift Thickness: Place materials uniformly in layers not to exceed 6 inches in depth, measured loose, for cohesive soils; and in layers not to exceed 8 inches in depth, measured

loose for granular materials.

L. Compact to the percent of maximum dry density listed in the following schedule in accordance with ASTM D 1557.

Compaction Schedule Location	Minimum Percent Compaction
Footing or Foundation Slab Influence Zone & Adjacent to Foundations	95
Floor Slab, Pavements, Subgrade Pipe Influence Zones; Walks, aprons, and stoops	95
Lawns and Landscape Areas	85

M. Compact sub-grade to degree required for subsequent fill.

N. Moisture Content of Fill: Within 3% of optimum when placed and compacted. For silty clay see paragraph 2.01.A.3. b. & c in this Section.

O. Testing Requirements:
   1. Contractor shall provide testing.
   2. Geotechnical Engineer shall check all foundation subgrades to verify bearing capacities and settlement characteristics of foundation soils prior to the construction of foundations.

P. Test Frequency:
   1. Test sub-grade and fill to check bearing capacity or densities as follows:
      a. At each layer of compacted fill, one test for every 5,000 sq. ft., for areas other than backfill at foundation wall.
      b. At sub-grade of each individual pad footing.
      c. At sub-grade for continuous footings at 50 ft. center to center.
      d. At each layer of compacted fill for foundations, floor slabs, pavements, utility trenches, walks, aprons, and step sub-grade.
      e. At each layer of compacted backfill for foundation walls, and adjacent to foundations, test locations not to exceed 50 ft. center to center.
   2. Test performed on successive layers of fill shall be made at alternating and remote locations from each other to provide a representative profile of the section or area being constructed.

Q. Rough Grading Tolerances:
   1. Granular cushion: Plus or minus 0.1 ft.
   2. All backfill: Plus or minus 0.1 ft.

R. Structural Design Data:
   1. Soil Bearing Capacity: Net Allowable Bearing Capacity for Footings: 4000 PSF

3.08 DRAINAGE

A. All building material waste shall be properly managed and disposed to prevent pollutants and debris from being carried off the site.

B. Grade around the building so that ground is pitched to prevent water from running into excavated areas and damaging structures.

C. Maintain all excavations and trenches where footings are to be placed, free of water at all times.

D. Provide all pumping required to keep excavated areas clear of water during construction.
   1. Use geotextile bag and discharge to appropriate location on site to prevent erosion
      a. Maximum apparent opening size: ASTM D 4751, 0.212 mm
      b. Grab Tensile Strength: ASTM D 4632, 300 lbs.
      c. Mullen Burst: ASTM D 3786, 580 psi

d. Permeability: ASTM D 4491, 0.2 cm/sec

e. Fabric: Nominal Representative Weight, 12 oz.

2. Geotextile bags shall be securely attached to discharge pipe

3. Discharge shall be directed to either a sediment trap or sediment basin

3.09 SHEETING AND SHORING

A. All excavation of every description and of whatever substances encountered shall be performed to the depths indicated or otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner in a sufficient distance from the banks of the trench or pit to avoid overloading and to prevent slides or cave-ins. Sheeting and shoring shall be placed as may be necessary for the protection of the Work and for the safety of personnel.

3.10 PLACEMENT OF TOPSOIL

A. Prior to spreading topsoil, scarifying the sub-grade to a depth of two inches to promote the bonding of the topsoil to the subsoil.

B. Spread and compact topsoil to a uniform depth of eight inches in all landscaped areas and other areas stripped, but no paved or otherwise constructed upon.

3.11 RESTORATION

A. Restore all lawn and surface areas, whether within the Contract limits or not, disturbed as a result of earthwork operations of this job.

B. Conduct earthwork operations in a manner that prevents spillage on streets and adjacent areas. Clean-up spillage, on-site and off-site, caused by earthwork operations.

3.12 TEMPORARY HAUL ROAD

A. Temporary haul road shall be constructed to the thicknesses, lengths, and widths necessary to assure trades access to and from the Site, and to and from construction zones to places of equipment storage. The road shall be constructed to prevent sediment from being tracked onto public or private roadways. The temporary haul road shall be constructed adjacent to the job trailer and the road shall be wide enough at the job trailer to permit proper ingress and egress of construction trades and authorized personnel parking during peak hours.

3.13 PROTECTION OF EXCAVATIONS

A. Protect newly graded areas from traffic and erosion. Repair settlement and washing that occurs prior to acceptance of Work. Reestablish grades to required elevations and slopes.

3.14 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of all excess excavation on the Site as directed by the Design Professional.

END OF SECTION

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SECTION 31 11 00
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Clearing and grubbing as shown on the Drawings and described herein.

B. Clearing and grubbing shall consist of cutting and disposing of trees and removing and disposing of stumps, where designated on the Drawings or directed by the Architect/Engineer.

C. Trees under six inches (6") in diameter, shrubs, brush, windfalls, logs and other vegetation within the right-of-way, where designated on the Drawings or directed by the Architect/Engineer, shall be removed, such work being incidental to other items of the Work.

D. Trees over 4 inches in diameter shall only be removed if marked in the field by the Architect/Engineer.

1.02 QUALITY ASSURANCE

A. Permits and Regulations

1. All demolition and site clearance is subject to all provisions of applicable local ordinances and regulations.
2. All local codes, rules and regulations governing the respective utilities shall be observed in executing all Work under this Section.

1.03 JOB CONDITIONS

A. Protection

1. Protect from damage existing items indicated to remain by the erection of barriers or by other means approved by the Architect/Engineer.
2. All open depressions, excavations, pits, and the like, shall be barricaded. Adequate barricades shall be provided at all times. Barricades shall be constructed of materials which must conform to local safety regulations and must be acceptable to the Architect/Engineer. Remove barricades and fences when no longer required.
3. Keep all public highways and roads clean of spillage at all times. All potholes, ruts, or pavement damage shall be repaired by the Contractor immediately
4. It is the intent that barricades placed by the Contractor for safety or protection purposes be constructed of materials of the Contractor's choice, in accordance with applicable codes and regulations.

B. Utility Protection

1. The Contractor shall protect all existing utilities from damage resulting from his operations

C. Tree Protection

1. Protect all trees to remain within the Contract Limit Lines from damage or injury by any construction operation or equipment, from abuse by workmen, or any other danger that might arise as a result of this work.
2. Where existing trees are vulnerable to damage by construction operations, the Contractor shall erect suitable barriers around trees to be protected.
3. Any damage to trees resulting from insufficient protection shall be repaired by a competent tree surgeon to the satisfaction of the Architect/Engineer without cost to the Owner.
4. Remove barriers when protection is no longer required.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

A. Where trees cannot be felled without danger to traffic or injury to other trees, structures or property, they shall be cut in sections from the top down.

B. All desirable and structurally sound trees, saplings or shrubs suitable for shade or street beautification purposes shall be saved unless otherwise ordered by the Architect/Engineer. Trees, saplings and shrubs designated to be left in place shall not be damaged or injured by the Contractor. The absence of specific orders to remove trees, saplings or shrubs shall be considered as orders to save such trees, saplings or shrubs. Trimming of limbs of trees or saplings or trimming of shrubs shall not be done without the permission of the Architect/Engineer.

C. Under proposed concrete sidewalk, concrete curb and gutter, all types of pavement, permanent structures and at such other places as directed by the Architect/Engineer, all tree stumps shall be completely removed by excavation. Tree stumps under other areas in the right-of-way may be removed with stump cutting machinery to a depth of at least twelve inches (12") below the original ground area in fill areas, and at least twelve inches (12") below the sub-grade in cut areas.

D. The Contractor shall provide a disposal area for all trees, stumps, limbs, brush and vegetation from the project at no additional cost to the Owner.

END OF SECTION

SECTION 31 23 16
TRENCHING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Excavation of trenches, pipe bedding, backfilling and compaction for sanitary sewer, storm sewer, and watermain.

1.02 RELATED SECTIONS

A. Section 31 00 00 - Earthwork

B. Section 33 10 00 - Water Supply

C. Section 33 40 00 - Sanitary and Storm Sewerage

1.03 REFERENCES

A. ASTM C 33: Standard Specification for Concrete Aggregates.

B. ASTM C 136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D 698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

D. ASTM D 2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

E. ASTM D 2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

F. ASTM D 3017: Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

PART 2 - PRODUCTS

2.01 BEDDING MATERIALS

A. Crushed Stone: Hard, durable particles of crushed stone or gravel free from shale and lumps of clay or loam with 85% to 100% of the particles having at least one machine fractured surface.

1. For pipe 18 inches in diameter or less crushed stone meeting the gradation requirements of Table 1.

3/8 Inch Crushed Stone	
Percent Passing	
Sieve Size	By Weight
1/2 Inch	100
3/8 Inch	90-100
No. 8	0-15
No. 30	0-3

2. For pipe larger than 18 inches in diameter crushed stone meeting gradation requirements of Table 1 above or Table 2.

3/4 Inch Crushed Stone	
Percent Passing	
Sieve Size	By Weight
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20-55
No. 4	0-10
No. 8	0-5

B. Crushed Stone Screening: Hard, durable particles of crushed stone without excessive amounts of loam, dust or other undesirable substances conforming to the following gradation:

Crushed Stone Screening	
Percent Passing	
Sieve Size	By Weight
1/2 Inch	100
No. 4	75-100
No. 100	10-25

C. Sand: Durable particles ranging in size from fine to coarse in a substantially uniform combination. Unwashed bank-run sand, rejected concrete sand and crushed bank-run gravel are generally acceptable. Clay or loam lumps are not permitted, but approximately six percent of fine clay or loam particles are desirable. The maximum moisture content shall be ten percent. Conform to the following gradation:

Sand	
Percent Passing	
Sieve Size	By Weight
1 Inch	100
No. 16	45-85
Finer than No. 200	2-10

2.02 COVER MATERIAL

A. Cover Material: Unwashed bank-run sand or crushed bank-run gravel consisting of durable particles ranging in size from fine to coarse in a substantially uniform combination. Conform to the following gradation:

Cover Material	
Percent Passing	
Sieve Size	By Weight
1 Inch	100
3/4 Inch	85-100
No. 4	35-65
No. 40	15-35
No. 200	5-15

Bedding material may be substituted for cover material.

2.03 BASE MATERIAL

A. Crushed Stone: Hard, durable particles of crushed stone or gravel substantially free from shale or lumps of clay or loam. When crushed stone base is required under sewer, watermain or structures, gradation shall meet the requirements of Type 1. When crushed stone base is required to affect soil stability or drainage it shall meet the gradation requirements of Type 2.

1 1/2 Inch Crushed Stone	
Percent Passing	
Sieve Size	By Weight
2 Inch	100
1 1/2 Inch	90-100
1 Inch	20-55
3/4 Inch	0-15
1/2 Inch	0-5

2 Inch Crushed Stone	
Percent Passing	
Sieve Size	Bt Weight
2 1/2 Inch	100
2 Inch	90-100
1 1/2 Inch	35-70
1 Inch	0-15
1/2 Inch	0-5

B. Excavated Material: Natural soils classified in ASTM D 2487 as Gravels (GW, GP GM and GC), Sands (SW, SP, SM and SC) and Silts and Clays (ML and CL). Silts and Clays classified as OL, MH, CH, OH, and PT are not acceptable unless specifically allowed by

Architect/Engineer. Soil material shall be free from vegetable or other organic matter, trash, debris, stones larger than three inches and frozen material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify fill materials to be used are acceptable.

3.02 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Maintain and protect existing utilities remaining, which pass through Work area.

C. Protect plant life, lawns, rock outcroppings and other features remaining as a portion of the final landscaping.

D. Protect benchmarks, existing structures, fences, paving and curbs from excavation equipment and vehicular traffic.

E. Protect above- and below-grade utilities which are to remain.

F. Strip topsoil and stockpile on Project site for reuse.

G. When excavating across or within existing pavement, saw cut in neat straight lines.

3.03 DEWATERING

A. Do not allow water to accumulate in the trench.

B. Provide all dewatering equipment needed to accomplish this work. Unless indicated otherwise, no additional compensation will be made for dewatering.

C. No additional compensation will be made for crushed stone used for trench drainage.

D. Dispose of water in a suitable manner without damage to property.

E. Install, operate and abandon dewatering equipment in accordance with applicable state and local codes.

F. Contact the DNR for a permit if the quantity of water to be pumped from dewatering equipment is in excess of 70 GPM:

Wisconsin Department of Natural Resources

Private Water Supply Section

P.O. Box 7921

Madison, WI 53707-7921

3.04 EXCAVATION

A. Excavate subsoil to required depth and grade.

B. Cut trenches sufficiently wide to enable installation of the utilities and allow inspection. Normal trench width below the top of the pipe shall be the nominal pipe diameter plus 24 inches. Do not undercut trench walls.

C. Trench walls above the top of the pipe shall be as dictated by soil type and safety requirements. Provide shoring and bracing as required to maintain safe working conditions.

D. Remove excess excavated material from the Project site.

3.05 BEDDING

A. Support pipe during placement and compaction of bedding.

B. Provide bedding as indicated in the individual Sections.

3.06 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen materials.

B. Do not backfill over wet, frozen or spongy sub-grade surfaces.

C. Provide backfill type and compaction as indicated in Section 31 00 00.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by Contractor under provisions of Section 01 45 00 Quality Control.

B. Density/moisture relationship will be determined in accordance with ASTM D 698.

C. Compaction testing will be performed in accordance with ASTM D 2922 and ASTM D 3017.

D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.

E. Frequency of Tests: One for every 150 feet of trench.

END OF SECTION

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SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnishing and installing or construction of erosion control facilities in accordance with the Drawings and Specifications.

1.02 RELATED SECTIONS

A. Section 31 00 00 - Earthwork

1.03 REFERENCES

A. Wisconsin Department of Natural Resources, Conservation Practice Standards
   1. 1056 “Silt Fence”
   2. 1052 “Non-Channel Erosion Mat”
   3. 1053 “Channel Erosion Mat”
   4. 1061 “Dewatering”
   5. 1064 “Sediment Basin”
   6. 1060 “Storm Drain Inlet Protection for Construction Sites”
   7. 1057 “Stone Tracking Pad and Tire Washing”
   8. 1067 “Temporary Grading Practices for Erosion Control”

B. Wisconsin Department of Transportation “Erosion Control Product Acceptability Lists.”

1.04 GENERAL

A. Erosion control measures shall be utilized throughout the construction to prevent erosion during construction and after construction until vegetation is established. Eroded material shall not be allowed to be deposited off the Project Site.

B. Install perimeter silt fence prior to the commencement of any grading work.

C. Eroded material, refuse, rubbish or other debris shall not be deposited in any waterway.

1.05 SUBMITTALS

A. Provide submittal of silt fence information from manufacturer, showing the requirements listed below are met.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Silt Fence: Fabric shall be a woven or non-woven geotextile meeting the following requirements:
   1. Consists of either polyester, polypropylene, stabilized nylon, polyethylene, or polyvinylidene chloride
   2. All non-woven fabric may be needle punched, heat bonded, resin bonded, or combination thereof.
   3. Minimum grab tensile strength in the direction of the machine direction: 120 lbs. (550 N), per ASTM D 4632
   4. Minimum grab strength in the cross machine direction: 100 lbs (450 N), per ASTM D 4632
   5. Maximum apparent opening size equivalent standard sieve: No. 30 (600 μm), per ASTM D 4751

6. Minimum permittivity: 0.05 scc^{-1}, per ASTM D 4491
7. Minimum ultraviolet stability percent of strength retained after 500 hours of exposure: 70%, per ASTM D 4355

PART 3 - EXECUTION

3.01 GENERAL

A. Provide erosion control measures as indicated on the Drawings. Additional erosion control measures may be necessary in addition to those indicated. Verify any additional requirements with the local agencies. If other measures are needed, provide installation in accordance with Wisconsin Department of Natural Resources Conservation Practice Standards.

B. Erosion Control products shall be listed on the Product Acceptability List by the Wisconsin Department of Transportation, unless otherwise noted on drawings.

3.02 CONSTRUCTION METHODS

A. Install silt fence in accordance with drawing details.

3.03 INSPECTION AND MAINTENANCE

A. Silt Fence: Inspect after each rainfall and at least once per day during prolonged rainfall. Repair or replace as necessary. Remove trapped sediment when bulges develop in the silt fence.

3.04 REMOVAL

A. Remove all erosion control facilities when permanent seeding has been established. Seed areas disturbed by erosion control facilities.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the aggregate base course work as shown on the drawings and herein specified.
2. Work includes aggregate base course work for under bituminous paving, concrete paving, curb and gutter and shoulders.

B. Related Sections

1. Division 32 Section 32 12 16 Bituminous Paving
2. Division 32 Section 32 13 13 Concrete Paving
3. Division 32 Section 32 16 00 Curbs and Gutters

1.02 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures. Minimum of five (5) copies shall be submitted.

B. Submit material certificate of compliance from material supplier or test results from testing agency for sieve analysis.

C. Submit inspection reports from Licensed Geotechnical Engineer.

D. Submit test results from testing agency for maximum density and in-place density.

E. Copy of testing agency DOT certifications for sampling.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
   a. Wisconsin Department of Transportation 2009 Standard Specifications.
3. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent provisions shall govern.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Crushed Aggregate

1. Materials shall meet the requirements of Wisconsin Department of Transportation 2009 Standard Specifications, Section 301 “General Requirements for Base Aggregates” for Dense 1.1/4” (31.5 mm) base and Section 305 “Dense Graded Base” for 1.1/4” (31.5 mm) or 3” (75 mm) gradation for all base layers.
2. Geotechnical Engineer shall approve aggregate gradation for base layers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check subgrade for conformity with grade and cross section.

3.02 PREPARATION

A. Prepare the foundation/subgrade or previously placed base layer as specified in Wisconsin Department of Transportation 2009 Standard Specifications Section 211, before placing aggregate base course.

B. Proof roll existing subgrade immediately prior to placement of aggregate base course.

1. Proof roll with at least two passes performed in a criss-cross pattern with a fully loaded tri-axle dump truck with a minimum gross weight of 30 tons, or equivalent acceptable to the Design Professional.
2. Remove soft, loose, weak, and unstable or unsuitable soils and replace with approved compacted fill materials and re-compact.

3.03 CONSTRUCTION

A. Placement

1. See Wisconsin Department of Transportation 2009 Standard Specifications Section 301.3.4.

B. Compaction

1. See Wisconsin Department of Transportation 2009 Standard Specifications Section 301.3.4.2, 301.3.4.3. and 305.3.2.
2. Compact the aggregate base course to 95 percent (+/- 2%) of maximum density in accordance with Wisconsin Department of Transportation 2009 Standard Specifications.

C. Site Tolerances

1. See Wisconsin Department of Transportation 2009 Standard Specifications Section 301.3.4.
2. Smoothness: Not more than ¼" above design grade or ½" below design grade.

3.04 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Inspections
   a. Inspections shall be performed by a licensed Geotechnical Engineer or technician under his/her direction.
   b. Geotechnical Engineer shall approve subgrade prior to aggregate base course placement.
   c. Geotechnical Engineer shall approve the aggregate base course installation.
   d. Inspection shall occur during subgrade compaction and after compaction of base course.
2. Testing
   a. Engage a testing agency with a licensed Geotechnical Engineer on staff acceptable to the Design Professional to perform sampling and testing responsibilities of the Contractor as specified.
   b. If tests indicate Work does not meet specified requirements, remove Work and replace. Contractor shall pay for retests as required until installation meets the specifications.
   c. See Wisconsin Department of Transportation 2009 Standard Specifications Section 301.2.3 for Sampling and Testing standards.

d. If material certificates of compliance are not submitted, contractor shall deliver a 50-75 lb. sample (5 gallon bucket) to the testing agency for sieve analysis and submit test results to Design Professional prior to placement. Sampler shall be certified by the Wisconsin DOT for aggregate sampling.

3. Contractor shall coordinate and pay all costs of inspections, tests and transportation of test material.

END OF SECTION

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SECTION 32 12 16
BITUMINOUS CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the bituminous concrete paving work as shown on the drawings and herein specified.

B. Related Sections

1. Division 32 Section 32 11 23 Aggregate Base Course
2. Division 32 Section 32 16 00 Curbs and Gutters

1.02 REFERENCES

A. Wisconsin Department of Transportation Standard Specifications, latest version

1. Section 450 “General Requirements for Asphaltic Pavements”
2. Section 455 “Asphaltic Materials”
3. Section 460 “Hot Mix Asphalt (HMA) Pavement”
4. Section 465 “Asphaltic Surfaces”
5. Section 475 “Seal Coat”

B. Wisconsin Department of Transportation “Construction and Materials Manual”

1. Chapter 4 Section 25 Subject 60 “Asphaltic Mixtures”

1.03 DEFINITIONS

A. HMA: Hot Mix Asphalt

B. PG: Performance Graded

C. Asphaltic Binder: The principal asphaltic binding agent in HMA. including asphalt cement and material added to modify the original asphalt cement properties.

D. Filler: A finely divided mineral aggregate added to asphaltic mixtures to improve mixture properties.

E. Leveling Layer: Initial layer placed thinner than the minimum required under Wisconsin Department of Transportation, Standard Specifications Section 460.3.2.

F. Lower Layer: Any asphaltic pavement layer that will not be exposed to traffic when the pavement structure is complete. A pavement structure may have multiple lower layers.

G. Upper Layer: The asphaltic pavement layer exposed to traffic when the pavement structure is complete. A pavement structure has only one upper layer.

1.04 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures. Minimum of five (5) copies shall be submitted.

B. Asphaltic Mixture Design: Submit asphaltic mixture design for each course for Design Professional’s review. Obtain Design Professional’s approval of aggregates before producing Hot Mix Asphalt mixture.

1.05 QUALITY ASSURANCE

A. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.

2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:
    a. Wisconsin Department of Transportation, Standard Specifications.
3. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent provisions shall govern.

B. Certifications
1. Performance Graded Asphalt Binders:
    a. Sampling and testing shall be in accordance with the most current version of the Combined State Binder Group Certification Method of Acceptance for Asphalt Binders.
2. Other asphaltic materials:
    a. Sampling other asphaltic material shall be in accordance with the Wisconsin of Transportation, Standard Specifications Section 455.2.2.2.
    b. Testing shall be in accordance with the Wisconsin of Transportation, Standard Specifications Section 455.2.3.2.
3. Hot Mix Asphalt Pavement:
    a. Provide coarse aggregates from a Wisconsin Department of Transportation approved source.

1.06 PROJECT CONDITIONS

A. Project Environmental Requirements
1. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
    a. Tack Coat: Minimum surface temperature of 60° F
    b. Asphalt Base Course: Minimum surface temperature of 40° F and rising at time of placement
    c. Asphalt Surface Course: Minimum surface temperature of 60° F at time of placement
2. Pavement Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40° F for oil-based materials, and not exceeding 95° F.

PART 2 - PRODUCTS

2.01 EXISTING PRODUCTS

A. The requirements of Wisconsin Department of Transportation Standard Specifications Section 460.2.5 regarding use of reclaimed asphaltic pavement materials shall apply.

2.02 ACCESSORIES

A. Exterior pavement markings
1. Sherwin Williams SetFast® Acrylic Traffic Marking Paint, White, TM5632, or approved equal, applied per manufacturer's instructions.

2.03 MIXES

A. The asphalt pavement shall be WisDOT Type E-1 or E-3 with thickness according to Wisconsin Department of Transportation, Standard Specification Section 460.2.7.
1. The lower layer shall have a nominal aggregate size of 19 mm.
2. The upper layer shall have a nominal aggregate size of 12.5 mm.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Site Verification of Conditions

1. Verify that elevations and gradients of base are correct.

B. Proof roll existing subgrade immediately prior to placement of aggregate base course.

1. Proof roll with at least two passes performed in a criss-cross pattern with a fully loaded tri-axle dump truck with a minimum gross weight of 30 tons, or equivalent acceptable to the Design Professional.
2. Remove soft, loose, weak, and unstable or unsuitable soils and replace with approved compacted fill materials and re-compact.

3.02 PREPARATION

A. Protection

1. All exposed surfaces not to be covered with asphaltic concrete shall be protected during priming so that asphalt cement will not adhere to or discolor the surface. No pockets shall remain in the finished surface to prevent lateral drainage of water. The Contractor shall replace any low spots at no additional cost to Owner.
2. Contact surfaces of curbs, gutters, underground appurtenances, and other structures shall be painted with a thin, uniform coating of hot asphalt cement, or asphalt cement dissolved in naphtha before the surface mixture is placed against them. The surface material shall be placed uniformly high so that after compaction, it will be approximately ¼" higher than adjacent gutter flanges and all other structures.

B. Surface Preparation

1. Apply tack coat to contact surfaces of curbs and concrete paving.
2. Coat surfaces of manhole frames with oil to prevent bond with asphalt paving. Do not tack coat these surfaces.
3. Cut edge of existing bituminous surfaces against which new pavement abuts in a straight and perpendicular cut.

3.03 INSTALLATION

A. All water valve boxes and manhole frames shall be set to ¼" below the finished pavement grade by Contractor.

B. Contractor shall remove loose material during the construction of all middle and upper lifts.

C. Contractor shall sweep or clean dust, dirt, debris and other foreign matter from the road prior to application of the tack coat.

D. Heavy Duty pavement at 4" thickness is to be constructed in three lifts as follows:

1. 2.5" lower lift of E-1 (19.0 mm)
2. 1.5" upper lift of E-1 (12.5 mm)

3.04 APPLICATION

A. Tack coat shall be applied at a rate of 0.025 gallons per square yard after dilution in conformance with Wisconsin Department of Transportation Standard Specifications Section 455.3.2.

1. Apply to surfaces on the longitudinal joints between successive paver passes and on contact surfaces of previously construed asphalt or Portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement.
   a. Tack coat may be eliminated if previous course is freshly placed and thoroughly clean.
   b. Allow tack coat to dry until at proper condition to receive paving.

3.05 CONSTRUCTION

A. Site Tolerances

1. Density: Minimum required density shall conform with Wisconsin Department of Transportation Standard Specifications Table 460-3 for traffic lanes.
2. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 will not be acceptable if exceeding the following tolerances:
   a. Lower (Base) Course: Plus or minus ½ inch
   b. Upper (Surface) Course: Plus ¼ inch, no minus
3. Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10 foot straightedge applied parallel to and at right angles to centerline of paved areas:
   a. Lower (Base) Course: Plus or minus ½ inch.
   b. Upper (Surface) Course: Plus ¼ inch, no minus.
   c. Crowned Surface: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is ¼ inch.

B. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

C. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

D. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

E. Pavement Marking:

1. Allow paving to age for 30 days prior to starting pavement marking.
2. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.06 REPAIR/RESTORATION

A. Existing surfaces to be seal coated

1. Adhere to Wisconsin Department of Transportation Standard Specifications Section 475 "Seal Coat."
2. Immediately prior to application of asphalt material, existing surfaces shall be thoroughly cleaned with a power broom or other suitable equipment to remove dirt and other objectionable matter.
3. The asphalt material shall be applied in a single application at a rate of approximately 1/3-gallon per square yard. When the desired stage of tackiness of the asphalt coat is attained, aggregate for seal coat cover shall be spread uniformly over the treated surface by mechanical spreaders. The amount of aggregate shall be sufficient to completely cover the treated surface but shall be limited to the approximate amount that can be embedded in and bonded by the asphalt material.
4. Roll surface immediately after spreading the aggregate to ensure aggregate is thoroughly embedded in the asphalt material and the surface is smooth and uniform in texture.

3.07 FIELD QUALITY CONTROL

A. The Contractor shall be required to furnish a nuclear density machine with a qualified operator to verify field compaction. Testing shall be performed the day of placement. There shall be a minimum of five density tests for every 200 ton placed. The five tests shall be taken across the width of the mat at a location determined by the Engineer. The average of those five tests shall meet minimum required density conforming to Table 460-3 of the State Specifications.

B. The Owner shall administer paving density disincentives in conformance with Section 460.5.2.2 of the State Specifications.

C. Contractor shall pay all costs of tests and transportation of test material.

END OF SECTION

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SECTION 32 12 73
PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:

1. Expansion, contraction, and construction joints within portland cement concrete pavement at building interior. Refer to structural slab plan for joint locations and details.

B. Related Sections include the following:

1. Section 03 30 00 – Cast in Place Concrete.

1.3 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use test methods standard with manufacturer to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 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.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, 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. Colors of Exposed Joint Sealants: Color to best match concrete pavement.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multi-Component Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.

    a. Products:

        1) Pecora Corporation; Urexpan NR-300.
        2) Approved equal.

2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.

    a. Products:

        1) Meadows, W. R., Inc.; Sealtight Gardox.
        2) Approved equal.

3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

    a. Products:

        1) Tremco Sealant/Waterproofing Division; Vulkem 202.
        2) Approved equal.

B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

1. Products:

    a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.
        1) Approved equal.

C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Products:

    a. Crafco Inc.; RoadSaver Silicone.
    b. Dow Corning Corporation; 888
    c. Approved equal.

D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Products:

    a. Crafco Inc.; RoadSaver Silicone SL.
    b. Dow Corning Corporation; 890-SL.

E. Multi-Component Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Products:

a. Meadows, W. R., Inc.; Sof-Seal.

b. Approved equal.

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.5 PRIMERS

A. Primers: Product 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.

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.

1. 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.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on 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.

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. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type 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 backer materials.
2. Do not stretch, twist, puncture, or tear backer materials.
3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. 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 provided for each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified 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 sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 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 and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the reinforced cement concrete paving work as shown on the drawings and herein specified.

B. Related Work: Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions and Sections in Division 1 of these specifications.

C. Related Sections

1. Division 03 Section 03 10 00 Concrete Forms and Accessories
2. Division 03 Section 03 20 00 Concrete Reinforcement
3. Division 03 Section 03 33 00 Cast-in-Place Concrete
4. Division 32 Section 32 11 23 Aggregate Base Course

1.02 REFERENCES

A. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and herein:

1. American Concrete Institute, ACI 301-99 "Specifications for Structural Concrete."
2. American Concrete Institute, ACI 304R-00 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete."
3. American Concrete Institute, ACI 304.2R - 96 "Placing Concrete by Pumping Methods."
4. American Concrete Institute, ACI 330R-08 "Guide for the Design and Construction of Concrete Parking Lots."
5. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
6. Wisconsin Department of Transportation, 2008 Standard Specifications
   a. Section 415 “Concrete Pavement”
7. ASTM International, ASTM A 615/ 615M – 01b “Standard Specification for Deformed and Pain Billet-Steel Bars for Concrete Reinforcement.”
8. ASTM International, ASTM C 114 – 03 “Standard Test Methods for Chemical Analysis of Hydraulic Cement.”

1.03 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures. Minimum of five (5) copies shall be submitted.

B. Concrete Mixture Design: Submit concrete mixture design for each mixture for Design Professional’s review. Obtain Design Professional’s approval of mix before mixing concrete.

1. For aggregates: Provide types, pit or quarry locations, producers’ names, gradings, specific gravities, and field test data used to establish the required average strength
2. For Admixtures: Provide types, brand names, producers, manufacturer’s technical data sheets, and certification data
3. Include alternate design mixtures when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.04 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Do not commence placement of concrete until mix designs have been reviewed and approved by the Architect/Engineer and all governmental agencies having jurisdiction and until copies of the approved mix designs are at the job site and the batch plant.

C. Provide access for, and cooperate with, the inspector and testing laboratory representative.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms and Accessories:

1. See Section 03 10 00.

B. Reinforcement:

1. See Section 03 20 00.

C. Concrete:

1. See Section 03 30 00.

D. Isolation Joint Filler

1. Provide closed-cell polyethylene foam expansion joint filler, complying with ASTM D 3575.
2. Comply with ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork in preformed strips.

E. Curing Materials

1. Spray membrane curing compound

F. Other Materials

1. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect/Engineer.

2.02 EQUIPMENT

A. Meets the requirements of the Wisconsin Department of Transportation, Standard Specifications (latest version) Section 415.3.1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Surface Conditions

1. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PREPARATION

A. Protection

1. Protect any adjacent surfaces from any spilling from the concrete work.

B. Final preparation of subgrades

1. After preparation of subgrade as specified in another Section of these Specifications, thoroughly scarify and sprinkle the entire area to be paved and then compact to a smooth, hard, even surface of 95% compaction to receive the concrete.

2. Contractor shall grade subgrade to provide positive drainage away from existing and new building. Refer to Geotechnical Report for subgrade and groundwater elevation information.

C. Placement of Subbase Course

1. Subbase:
   a. Spread the specified coarse aggregate to a thickness providing the compacted thickness shown on the Drawings.
   b. Compact to 95% modified proctor.
2. Thickness tolerance: Provide the compacted thickness shown on the Drawings within a tolerance of minus 0.0" to plus 0.5".
3. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 0.05 feet vertically and 1" in alignment at any point.
4. Correct deviations by removing materials, replacing with new materials and reworking or recompacting as required.
5. Use only the amount of moisture needed to achieve the specified compaction.

3.03 INSTALLATION

A. Upon completion of base course and formwork, install reinforcement (if required) as shown on the Drawings.

1. Clean reinforcement to remove loose rust and mill scale, earth and other materials which reduce bond or destroy bond with concrete.
2. Position, support and secure reinforcement against displacement by formwork, construction and concrete placement operations.
3. Place reinforcement to obtain the required coverage for concrete protection.

B. Transit mix the concrete in accordance with provisions of ASTM C 94.

1. With each load, provide ticket certifying to the materials and quantities and to compliance with the approved mix design.
2. On the transit-mix ticket, state the time water was first added to the mix.
3. At the batch plant, withhold 2 ½ gal of water per cu yd of concrete.
4. Upon arrival at the job site, and as directed by the testing laboratory inspector, add all or part of the withheld water before the concrete is discharged from the mixer.
5. Mix not less than five minutes after the withheld water has been added and not less than one minute of that time immediately prior to discharge of the batch.
6. Unless otherwise directed provide 15 minutes total mixing time per batch after first addition of water.

C. Do not use concrete that has stood over 30 minutes after leaving the mixer or concrete that is not placed within 60 minutes after water is introduced into the mix.

D. Conveying:

1. Place concrete in accordance with the following and pertinent recommendations contained in ACI 304.
2. Deposit concrete continuously in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section.
3. If a section cannot be placed continuously, provide construction joints as specified herein.
4. Perform concrete placing at such a rate that concrete which is being integrated with fresh concrete is still plastic.
5. Deposit concrete as nearly as practicable in its final location so as to avoid segregation due to rehandling and flowing.

6. Do not subject concrete to any procedure which will cause segregation.
7. Do not use concrete which becomes non-plastic and unworkable or does not meet required quality control limits or has been contaminated by foreign materials.
8. Remove rejected concrete from the Site.

E. Deposit and consolidate concrete in a continuous operation within the limits of construction joints until the placing of a panel or section is completed.
1. Bring surfaces to the correct level with a straightedge and then strike off.
2. Use bullfloats or darbies to smooth the surface, leaving it free from bumps and hollows.
3. Do not sprinkle water on the plastic surface. Do not disturb the surfaces prior to start of finishing operations.

F. Isolation joints:
1. Do not permit reinforcement to extend continuously through any expansion joint.
2. Locate expansion joints along the edges of all structures and where indicated, filled to full depth with expansion joint material.

G. Finishing:
1. Begin floating when the water sheen has disappeared and when the surface has stiffened sufficiently to permit the operation.
2. During or after the first floating, check the planeness or surface with a ten foot straightedge applied at not less than two different angles.
3. Cut down high spots and fill low spots and produce a surface level within ¼" in two feet as determined by a two foot straightedge placed anywhere on the surface in any direction.
4. Refloat the surface immediately to a uniform sandy texture.
5. While the surface is still plastic provide a textured finish by drawing a fiber bristle broom uniformly over the surface.
a. Unless otherwise directed by the Architect/Engineer provide the texturing in one direction only.
b. Provide light, medium or course texturing as directed by the Architect/Engineer.

3.04 CURING AND PROTECTION

A. Beginning immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures and mechanical injury.

B. If curing compounds are utilized, install per manufacturer's recommendations.

3.05 WARRANTY

A. Any uncontrolled cracking that occurs within 30 days after installation shall be replaced at no cost to the Owner.

B. Any uncontrolled cracking that occurs after 30 days from installation and because of heavy contractor equipment driving over a light-duty surface shall be replaced at no cost to the Owner.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the new fencing and relocation of fencing, gates and associated materials as shown on the drawings and herein specified.
2. The intent is to match existing fencing with barbed wire and post spacing. Existing fencing shall be relocated where possible and when material is still in acceptable condition.

B. Related Sections:

1. Division 31 Section 31 00 00: Earthwork
2. Division 03 Section 03 30 00: Cast-In-Place Concrete
3. Division 26: Electrical

1.02 ACCEPTABLE MANUFACTURERS

A. Cyclone Fence, U.S. Diversified Group, USX Corporation

B. The Anchor Group

C. Boundary Fence & Railing System, Inc.

D. Petrovend Petroleum Equipment Service

E. Hy-Security Gate Operators

1.03 QUALITY ASSURANCE

A. ASTM A 121: Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.

B. ASTM A 123/A 123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A 153/A 153M: Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A 392: Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.

E. ASTM A 491: Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.

F. ASTM A 1011/A 1011M: Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability.

G. ASTM F 1043: Standard Specification for Strength and Protective Coatings on Metal Industrial Chain-Link Fence Framework.

H. ASTM F 567: Standard Practice for Installation of Chain-Link Fence.

1.04 SUBMITTALS

A. Submit shop drawings showing details of fabrication and installation.

B. Submit manufacturer's literature showing descriptive data of installation methods and procedures, and standard drawings of fence and gate installation.

C. Submit manufacturer's literature showing descriptive data of installation methods and procedures, and standard drawings of gate controls and operators.

D. Submit manufacturer's certification that materials meet Specification requirements.

1.05 PRODUCT DELIVERY: STORAGE AND HANDLING

A. Deliver materials with manufacturer's tags and labels intact.

B. Handle and store so as to avoid damage.

PART 2 - PRODUCTS

2.01 GENERAL

A. All fittings shall be conforming to ASTM A 153/A 153M. Tie wires shall be a minimum 6 gauge aluminized steel.

2.02 FABRIC

A. Chain link fabric shall be aluminized conforming to ASTM A 491, Type I (0.40 ounce per square foot of surface area). Fabric shall be woven from nine gauge (coated size) wire 2" mesh. Fabric shall be knuckled at one selvage, and twisted.

B. Height of Fabric: 8 ft.

C. Color: Aluminum

2.03 BARBED WIRE

A. Provide 18” high 3-strand barbed wire with angled brackets to match existing on site.

2.04 LINE POSTS

A. Line posts shall be C-Section roll formed from steel conforming to ASTM A 1011/ A 1011M, Grade 45, 1.875" x 1.625" with minimum bending strength of 247 pounds under a 6' cantilever load, continuously coated with 2.0 ounces of GALFAN Alloy in accordance with ASTM A 875/A 875M.

2.05 TOP AND BRACE RAIL

A. Top and brace rails shall be roll formed section of 1.5/8" O.D., 5.7#/ft. channel shaped rail with a minimum vertical bending strength of 237 pounds on a 10' span continuous coated with 2.0 ounces of GALFAN Alloy in accordance with ASTM A 875/A 875M. Top rail couplings 6" minimum in length will be spaced a maximum 21' centers. Fabric tie wire shall be spaced at 24" maximum centers.

2.06 TERMINAL POSTS

A. All end, corner, and pull posts shall be 3” O.D., 5.7#/ft. with a minimum bending strength of 486 pounds under a 6' cantilever load coated with 2.0 ounces of hot dipped zinc in accordance with ASTM A 123/A 123M.

2.07 RELOCATED MANUAL SWING GATES

A. There are two 12’-0” wide manual swing gates with 3-strand vertical barbed wire, padlock and knox box to be relocated. See plan for existing and new location. Contractor shall relocate all associated accessories with these gates and shall notify Design Professional of any concerns prior to relocation.

2.08 CONCRETE

A. Conforming to requirements of ASTM C 94/ C 94M.

B. Minimum 28 day compressive strength 2500 psi.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that final grading in fence location is completed without irregularities which would

interfere with fence installation.

B. Do not commence work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Measure and lay out complete fence line.

B. Measure parallel to surface of ground.

C. Locate and mark position of posts.

D. Locate line posts at equal distance spacing, not exceeding 10' centers.

E. Locate corner posts at positions where fence changes direction more than 10 degrees.

3.03 INSTALLATION

A. Posts:

1. Minimum post hole diameter three times outside post diameter.
2. Minimum post hole depth 3 in. below post bottom
3. Place concrete in hole to depth of post bottom.
4. Set post plumb to 1/4 in. in 10 feet.
5. Fill hole with concrete to 2 in. above grade.
6. Crown surface of concrete to slope away from post.

B. Fence Fabrics:

1. Stretch fabric tight between terminal posts.
2. Position bottom of fabric approximately 1 inch above ground level at each post.
3. Cut fabric to form one continuous piece between terminal posts.
4. Attach fabric directly to posts.
5. Attach fabric to terminal post using tension bars and tension band.
6. Attach top edge of fabric to top rail using wire ties or clips, spacing not to exceed 24 in. on-center.
7. Attach bottom edge of fabric to bottom tension wire using wire ties or clips, spacing not to exceed 24 in. on-center.
8. Install barbed wire brackets and barbed wire.

C. Gates:

1. Install gates plumb and level 1/4 in. in ten feet.
2. Install ground-set items in concrete.
3. Adjust hardware to provide smooth operation.

3.04 ADJUST AND CLEAN

A. Adjust brace rails, gate, and tension rods for rigid installation.

B. Tighten hardware, fasteners, and accessories.

C. Remove excess and waste materials from Project Site.

3.05 WARRANTY

A. Warranty shall include all material and workmanship as furnished and installed are in accordance with these Specifications. Repair and replacement of defective materials or workmanship shall be for one year unless otherwise noted above.

END OF SECTION

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SECTION 32 91 16
NATIVE SEEDING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the native seeding work as shown on the drawings and herein specified.

B. Related Sections

1. Division 31 – Section 31 00 00 Earthwork
2. Division 32 – Section 32 93 00 Plants

1.02 DEFINITIONS

A. PLS: Pure Live Seed, defined as (purity) x (total germination)

B. Total Germination: Germination + hard seeds + dormant seeds

C. Finish Grade: Elevation of finished surface of planting soil.

D. Planting Soil: Native or imported topsoil or surface soil modified to become topsoil; mixed with soil amendments.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill immediately beneath planting soil.

1.01 SUBMITTALS

A. Submittals shall be in accordance with Division 01 – Section 01 33 00 Submittal Procedures. Minimum of five (5) copies shall be submitted.

B. Product Data for herbicide.

C. Quality Assurance/Control Submittals

1. Certification of Seed: From seed vendor for each native-seed mixture stating the botanical and common names, PLS value, PLS weight, bulk weight, percentage of species seed and weight to total mix. Include the year of seed product and date of seed tests. All seed tests must be dated within one year of proposed seed installation.
2. Certification by WCIA for Origin and Seed Quality of each seed mixture, identifying source, including name and telephone number of supplier.
3. Certification of weed-free straw mulch.
4. Installer Qualifications: Native planting installer shall provide proof of experience in at least three (3) native planting installation, establishment and maintenance projects. Installer shall provide proof of a minimum of five (5) years of experience in native planting projects.
    a. Provide evidence of compliance from applicable agencies having jurisdicition over herbicide application and copies of applicator's current license and copies of applicator's current license.

D. Closeout Submittals

1. Maintenance Instructions: Following maintenance period by installer and final acceptance by Owner, provide recommended maintenance procedures for native plantings. Submit prior to required maintenance period.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Native planting installer shall have a minimum of five (5) years of experience in installation, establishment and maintenance of native plantings.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.
2. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent provisions shall govern.

C. Certifications

1. Comply with applicable regulations for herbicide composition and application.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver seed in original unopened containers, showing weights, analysis, and name of manufacturer. Store in a manner to protect against leakage, damage and to maintain dormancy while in transit.

B. If plugs are delivered to site before planting can take place, protect against direct sunlight by covering with a shade structure or cloth. Water as necessary to prevent plant deterioration.

1.05 PROJECT CONDITIONS

A. Project Environmental Requirements

1. Herbicide shall be applied at start of construction and every one to 1.5 months to prepare for final installation. A minimum of two applications shall be performed on the site prior to seeding.
2. Final Seeding: Install all seed mix between May 1 and June 15, or October 15 to December 15. Install per seed supplier’s recommendations.
3. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit.

1.06 SCHEDULING

A. Coordinate herbicide treatment of site for weed removal and final seeding with General Contractor.

B. Cover crop: A cover or nurse crop shall be planted to control erosion and help shade the native seeds to promote germination.

C. Coordinate time of planting with the need for seed stratification.

D. Final seeding shall not occur between July and September unless water is available to aid in germination and establishment. If site is ready for seeding during this time, protect site from erosion by applying weed-free straw mulch and/or cover crop.

1.08 WARRANTY

A. Warrant the seed materials for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor’s control.

1.09 MAINTENANCE

A. Maintenance Service

1. **Installer shall include a one-year maintenance service of native plantings.** Maintenance shall include establishment of the native plantings, weed control

(including spot herbicide treatment and mowing) and watering as necessary. Erosion problems in native seeding areas shall also be included in maintenance service.

a. Maintenance shall be performed by skilled employees of installer with a minimum of 6 months of native landscape maintenance experience.

b. Maintenance period shall begin at the substantial completion of the seeding.

c. Mowing

i. During the growing season after planting, mow vegetation back to 6 inches high when it has reached a height of at least 12 inches.

d. Invasive Species Eradication

i. During the growing season after planting, eradicate the following species from the seeded areas as soon as they become evident by spot herbicide treatment or hand pulling:

(a.) Musk thistle (*Carduus nutans)*

(b.) Spotted knapweed (*Centaurea maculosa)*

(c.) Canada thistle (*Cirsium arvense)*

(d.) Bull thistle (*Cirsium vulgare)*

(e.) Field bindweed (*Convolvulus arvensis*)

(f.) Leafy spurge (*Euphorbia esula)*

(g.) Sweetclover (*Melilotus species*)

(h.) Wild parsnip (*Pastinaca sativa*)

2. Installer shall provide a three-year extended maintenance proposal to Owner as an extended service option.

PART 2 - PRODUCTS

2.01 SEED

A. Seed: Fresh, clean, dry, new-crop, pure live seed.

1. Certified by the Wisconsin Crop Improvement Association (WCIA) for Origin and Seed Quality for Native Species.
2. Pure Live Seed with a minimum 80% germination rate as determined by third-party testing.
3. Seeds shall be derived from same eco-region of site, as determined by *The Nature Conservancy*.
4. All seeds shall be guaranteed by the supplier to be true to species name and variety.
5. All species with dispersal appendages shall be de-fluffed and de-hulled.
6. All legume species shall have the appropriate inoculants supplied with them.
   a. Inoculate legume seed unless it has been pre-inoculated by the vendor. Follow the inoculation instructions that come with the culture purchases.
7. Cover crop
   a. Wheat and Common Oats allowed
   b. Round-Up resistant Soybeans are allowed

B. Seed Mixes as designated on plans:

1. Modified Rainwater Renewal Mix
2. Modified Shortgrass Prairie for Medium Soils
3. Approved Equal by Design Professional
4. Cover Crop as recommended by seed supplier

C. Seed Sources: Seed available from:

1. Agrecol Corporation, (608) 223-3571
2. Approved Equal

2.02 TOPSOIL

A. Areas of site to be graded:
   1. Provide a minimum of 8” depth of topsoil.

B. Areas of site to have existing vegetation killed:
   1. Use existing soil; do not grade area.

2.03 PLANTING ACCESSORIES

A. Herbicides:
   1. Selective Herbicides: As needed to remove weeds. Follow seed supplier recommendations.

2.04 EROSION-CONTROL MATERIALS

A. Erosion Control Blanket: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a degradable natural or synthetic fiber netting.
   1. Comply with the Erosion Control Technology Council (ECTC) Standard Specification for Temporary Rolled Erosion Control Products, for type of erosion mat called out on plan.
      a. Include manufacturer's recommended steel wire or biodegradable staples, 6 inches (150 mm) long.
   2. Comply with the Wisconsin Department of Transportation Erosion Control Product Acceptability Lists (PAL).
      a. WisDOT Class I Urban Type B
      b. WisDOT Class III Type A
   3. Contractor shall verify that erosion mat will not inhibit native seed germination.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive seeding for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected. Remove any weeds prior to seeding.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.03 HERBICIDE TREATMENT ON EXISTING VEGETATION

A. Apply herbicide treatment on existing vegetation per the Wisconsin Department of Transportation Standard Specifications Section 630.3.3.3 “Method C.”

B. Apply application of a non-selective herbicide to vegetation to be removed. Acceptable herbicides include ‘RoundUp’ and ‘Journey.’

C. Herbicide treatment shall result in a 95% kill rate of targeted weed species.

3.04 NEWLY GRADED SUBGRADE

A. Loosen subgrade to a minimum depth of 4 inches.

B. Remove stones larger than 1 inch (25 mm) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Spread topsoil a minimum of 6 inches to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

3.05 FINISH GRADING

A. Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture.

B. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation.

C. Roll and rake, remove ridges, and fill depressions to meet finish grades.

D. Limit fine grading to areas that can be planted in the immediate future.

E. Firm up soft soil prior to seeding with a roller or cultipacker.

F. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

G. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.06 SEEDING

A. Obtain Design Professional’s approval of the seed bed before seeding.

B. Sow seed by drill seeding or broadcast seeding. Do not spread when wind velocity exceeds 5 mph (8 km/h).

C. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

D. Apply seed at the following rates: *minimum 60 seeds per square foot.*

E. Cover Crop seeding rates:

1. Spring Seeding
    a. Common Oats at 20-30 pounds per acre on low-sloped sites
    b. Common Oats at 40 pounds per acre on slopes greater than 20%.
2. Fall Seeding
    a. Winter Wheat at 15-20 pounds per acre on low-sloped sites
    b. Winter Wheat at 30 pounds per acre on slopes greater than 20%.
    c. Please note that excessive seeding rates of winter wheat can slow germination rates of native seed due to chemical given off by winter wheat.

F. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray. It is critical that there is a good seed to soil contact to ensure germination.

3.07 EROSION MAT

A. Double netted light duty (WisDOT Class I Urban Type B) erosion mat should be used on the entire site except where noted on plans.

B. In designated locations on the plans, WisDOT Class III Type A shall be used.

C. Install per manufacturer’s recommendations.

3.08 FINAL ACCEPTANCE

A. Inspection to determine acceptance of native plantings will be made by the Design Profesional, upon Contractor's request. Provide notification at least ten (10) working days before requested inspection date.

1. Planted areas will be accepted provided all requirements, including maintenance, have been complied with and plant materials are alive and in a healthy vigorous conditions.

B. Upon acceptance, the Owner will assume plant maintenance.

3.09 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

END OF SECTION

SECTION 32 91 19
TOPSOIL AND FINISH GRADING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnishing and placing topsoil.

B. Finish grading.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 32 92 00: Lawns and Grasses

1.03 PROJECT CONDITIONS

A. Consult the Owner's site construction plans for known underground and surface utility lines.

B. Protect existing trees, plants, lawns and other features designated to remain as part of the landscaping work.

C. Promptly repair damage to adjacent facilities caused by earthwork operations. Cost of repair at Contractor's expense.

D. Promptly notify the Architect/Engineer of unexpected subsurface conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All soil material is subject to testing and inspection.

B. Topsoil: Utilize existing topsoil available on site.

PART 3 - EXECUTION

3.01 FINISH GRADING

A. Finish grading within Contract limits, including adjacent transition areas, to new elevations, levels, profiles and contours indicated.

B. Grade surfaces to assure areas drain away from structures and to prevent ponding and pockets of surface drainage.

C. Lawn: 8" minimum depth of topsoil at lawn areas.

D. Perform grading, within branch spread of existing trees to remain, by hand methods to elevations indicated.

E. Fine grade topsoil eliminating rough and low areas to ensure positive drainage.

F. Remove stones, roots, weeds and debris while spreading topsoil materials. Rake surface clean of stone 1" or larger in any dimension and all debris. Provide surfaces suitable for soil preparation provided under lawn and planting work.

G. Maintenance:

1. Protect finish graded areas from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settled, eroded and damaged areas.
2. Where completed areas are disturbed by construction operations or adverse weather, scarify, reshape and compact to required density.

3.02 DISPOSAL OF WASTE MATERIALS

A. Remove from site and legally dispose of trash and debris.

3.03 CLEANING

A. Upon completion of earthwork operations, clean areas within contract limits, remove tools and equipment. Provide site clear, clean, free of debris and soot.

END OF SECTION

SECTION 32 93 00
PLANTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Soil preparation.
   2. Trees, shrubs and groundcovers.
   3. Topsoil and soil amendments.
   4. Mulch and planting accessories.
   5. Tree stabilization.
   6. Landscape edgings.
   7. Initial maintenance of landscape materials.

B. Related Sections:
   1. Section 31 00 00 "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
   2. Section 32 92 00 "Lawns and Grasses" for lawn and planting.

1.02 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they are grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree or shrub required; wrapped, tied, rigidly supported, and drum laced as recommended by ANSI Z60.1.

C. Clump: Where three or more young trees were planted in a group and have grown together as a single tree having three or more main stems or trunks.

D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Finish Grade: Elevation of finished surface of planting soil.

F. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

G. Multi-Stem: Where three or more main stems arise from the ground from a single root crown or at a point right above the root crown.

H. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

J. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.03 SUBMITTALS

A. Submit topsoil source, and soils analysis, and recommendations for soil amendments and fertilizers.
   1. Furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay and sand), deleterious

material, pH, and mineral and plant-nutrient content of soil.

2. Report suitability of topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce satisfactory topsoil.

B. Submit maintenance instructions that include recommended procedures to be established by Owner for maintenance of plantings during a calendar year. Submit before expiration of required maintenance periods.

1. Procedures shall include removal of trunk-wrap and future fertilization recommendations.

2. Furnish one copy of written maintenance instructions to Architect.

C. Submit warranty information for plantings.

D. Submit plant material record drawings.

1. Identify field changes of dimension and detail and changes made by Change Order.

2. Provide any additional installation notes that impact the installation process.

1.04 QUALITY ASSURANCE

A. Contractor Qualifications: A qualified landscape Contractor whose work has completed landscaping work similar in material, design, and extent to that indicated for this project and with a record of successful landscape establishment.

1. Contractor's Field Supervision: Require Contractor to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock." Provide healthy, vigorous stock grown in accordance with good horticultural practice and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

1. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the larger plants will not be cut back to size indicated.

2. Stock listed in quantity on plant list shall be matched in size and characteristics.

3. Label at least one tree, one shrub and one groundcover of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

C. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of 2 years.

D. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above the ground for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.

E. Do not make substitutions. If specified landscape material is not obtainable, submit proof of non-availability with proposed alternative materials to Architect at least 2 weeks prior to installation.

1. Adjustments will be made at no additional cost to the Owner, except if downsized, credits will be based on comparable industry costs.

2. Container plants may be substituted for those designated as “BB” only if approved by Architect.

F. Observation and Inspection: Architect may observe plantings either at place of growth or at site before planting for compliance with requirements for genus, species, variety, size, and

quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, insects, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

G. Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Take necessary precautions in good trade practice in preparing plants for moving. Spray deciduous plants in foliage with an approved 'Anti-Desiccant" immediately after digging to prevent plant from wilting. Dig, pack, transport, and handle plants with care to ensure protection against injury. Cover plants transported on open vehicles

B. Inspection certificates required by law shall accompany each shipment invoice or order to stock and on arrival, the certificate shall be filed with the Architect.

C. Do not prune trees and shrubs before delivery except as approved by Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape.

D. Handle planting stock by root ball or container to prevent damage to stock. Do not drop stock during delivery and handling.

E. Deliver stock after preparations for planting have been completed and plant immediately. Do not let plants dry out. If planting is delayed more than six hours after delivery, set plants in shade, protect from weather and mechanical damage, and keep roots moist.

1. Heel-in bare-root stock with soil, wet peat moss, or in a manner acceptable to Architect. Soak roots that are in dry condition in water for two hours. Water heeled-in plants daily.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.
4. Water root systems of plants stored on-site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

F. Do not deliver more plant materials than can be planted in one day. Label stock as noted in quality assurance.

1.06 PROJECT CONDITIONS

A. Work Notification: Notify Architect at least 7 working days prior to installation of plant material.

B. Protect Existing Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerns.

C. A complete list of plants, including a schedule of sizes, quantities and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern.

D. Planting Restrictions:

1. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions (i.e. compacted or heavy soils), or obstructions, notify Architect before planting.
2. Planting Time: Proceed with, and complete landscape work as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed and according to manufacturer's written instructions and warranty requirements.

F. Coordination with Lawns: Plant trees and shrubs after finish grades are established and before planting lawns unless otherwise acceptable to Architect.

1. If planting of trees and shrubs occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.07 WARRANTY

A. Special Warranty: Contractor's standard form in which Contractor agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control (fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of plantings areas).

b. Structural failures including plantings falling or blowing over.

c. Faulty operation of tree stabilization.

d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Periods from Date of Substantial Completion:

1. Trees and Shrubs: One year.

2. Perennials and Grasses: One year.

C. Include the following remedial actions as a minimum:

1. Remove dead plant material immediately. Replace immediately unless required to plant in the succeeding planting season.

2. Replace plant material that is more than 25 percent dead or in an unhealthy condition at end of warranty period.

3. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.

4. Provide extended warranty for replaced plant materials; warranty period equal to original warranty period.

5. Repair damage to other plants or lawn during plant replacements at no cost to the Owner.

1.08 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide full maintenance by skilled employees of landscape Contractor. Maintain as required in Part 3.10. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period: Three months from date of substantial planting completion.

B. Initial Maintenance Service for Ground Cover and Plants: Provide full maintenance by skilled employees of landscape Contractor. Maintain as required in Part 3.10. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period: Three months from date of substantial planting completion.

PART 2 - PRODUCTS

2.01 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Provide trees and shrubs of sizes, grades, and ball or container sizes as indicated complying with ANSI Z60.1 for types and form of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls. Cracked or mushroomed balls are not acceptable.

C. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the plant list.

D. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.

E. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

F. If formal arrangements or consecutive order of trees or shrubs is shown, select stock for uniform height and spread, and number label to assure symmetry in planting.

2.02 SHADE AND FLOWERING TREES

A. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, complying with ANSI Z60.1 for type of trees required.

1. Provide balled and burlapped trees.
2. Branching Height: One-third to one-half of tree height.

B. Small Upright Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:

1. Stem Form: Single trunk, unless noted on drawings as multistem.
2. Provide balled and burlapped trees.

C. Small Spreading Trees: Branched or pruned naturally according to species and type, with relationship of caliper, height, and branching according to ANSI Z60.1; stem form as follows:

1. Stem Form: Single trunk, unless noted on drawings as multistem.
2. Provide balled and burlapped trees.

2.03 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, complying with ANSI Z60.1.

1. Provide balled and burlapped trees.
2. Provide balled and burlapped or container shrubs. Refer to drawing for specifications. Potted plants shall not be loose in container or pot bound.
3. Coniferous trees shall be branched to the ground.

2.04 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch (25 mm) or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil thru soils analysis. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

2.05 ORGANIC SOIL AMENDMENTS

A. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range suitable for intended purpose. Weed and seed free raw or baled peat, containing not more than 9% mineral on a dry basis.

B. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste of uniform texture; free of chips, stones, sticks, soil, or toxic materials. Add 7.5 lbs. ammonium sulfate (34-0-0 or 21-0-0) per cubic yard of sawdust.

C. Manure: Well-rotted, un-leached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth. Wood derivatives mixed with the manure shall be mixed with 7.5 lbs. of ammonium sulfate per cubic yard to prevent induced nitrogen deficiency.

D. Lime: Natural dolomitic limestone containing not less than 85 percent of total carbonates with a minimum of 30 percent magnesium carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

2.06 FERTILIZER

A. Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing following percentages of available plant nutrients.

1. For trees and shrubs use specified 2 ounce or greater microporous slow release fertilizer packets with not less than 16 percent total nitrogen, 8 percent available phosphoric acid and 16 percent soluble potash.

2.07 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs:

1. Shredded hardwood, Ground or shredded bark, or wood and bark chips. If wood-based organic mulch is used, a commercial fertilizer with higher nitrogen content (12-6-4) should be applied with mulch to off-set potential for nitrogen deficiency.

B. Mineral Mulch: Free from deleterious materials and suitable as a stone mulch strip along building in combination with weed barrier fabric and edging:

1. Type: 1.1/2 inch local washed stone without fines

2.08 WEED-CONTROL BARRIERS

A. Composite Fabric: Rot resistant, woven, needle-punched polypropylene substrate bonded to a non-woven polypropylene fabric, minimum 4.0 oz. per square yard. Water and air permeable. Color gray or black.

2.09 EDGING

A. Stone mulch strip shall be contained with eding, as noted on plans:

1. Heavy-Duty Aluminum Edging: PermaLoc CleanLine or approved equivalent extruded aluminum landscape edging for straight-line and curvilinear applications in corrugated straight profile. Section shall have loops on side of section to receive stakes spaced approximately 2 to 3 feet (610 mm to 915 mm) apart along its length. ASTM B 221 (ASTM B 221M), Aluminum 6063 alloy, T6 hardness.

a. Size: 3/16” thick by 4” high (4.8 mm x 102 mm)

b. Thickness: 3/16 inch (4.8 mm) gage section at 0.116 inch (2.95 mm) minimum thick with 0.187 inch (4.75 mm) exposed top lip.

c. Connection Method: Section ends shall splice together with an interlocking stakeless snap-down design.

d. Finish: Organic Black Anodized, Class II, 0.4 mils thick minimum, AA-M10C21A33.

e. Stakes: Heavy-duty Structural Stake, extruded aluminum, 0.125 inch (3.2 mm) thick with 0.25 inch (6.4 mm) round mid section, 1.25 inches (32 mm) wide, 16 inches (406 mm) high, ASTM B 221 (ASTM B 221M), Aluminum 6063 alloy, T6 hardness.

B. Individual trees shall incorporate spade-cut edging, unless otherwise noted on drawings.

1. Spade-cut Edging: Edging to be created either manually or mechanically with a landscape edger to create a 3-4" deep trench.

2.10 TREE STABILIZATION MATERIALS

A. Tree stabilization shall be incorporated if site is typically exposed to high winds or if soil has not completely settled after development. Landscape Contractor's judgment shall be used to determine whether stabilization shall be needed.

1. Staking: Tree stakes shall be hardwood stakes, not less than two inches by two inches (2"x2"), or steel fence posts. Stakes shall be wired to the trees using rubber hose of sufficient length to keep the wires from coming into contact with the bark.

a. Guy wire shall be 12 gauge minimum with white surveyor's flagging tape or approved equal attached to wire midway between each stake and tree.

2. Tree Staple: Use the below-ground tree stabilization method to secure root ball to soil, rather than the traditional staking and guying. Refer to manufacturer's specifications for installation instructions.

a. Manufacturer: Tree Staple, 139 South Street, New Providence, NJ 07974, USA, telephone: (877) 873-3749, fax (908) 464-8878, email: sales@treestaple.com, website: www.treestaple.com

2.11 MISCELLANEOUS PRODUCTS

A. Trunk-Wrap Tape: Crinkled paper, 4-inch- (100-mm-) wide minimum, with stretch factor of 33 percent. Secure with biodegradable twine. Before applying to trunk, inspect to ensure that there is no mechanical or insect damage to trunk. Wrapping a trunk that has either of these problems can worsen these conditions. Remove within one year, typically in early to mid spring. Use at landscape Contractor's discretion.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Before planting, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth and 1" in diameter or larger.

D. Mix specified soil amendments and fertilizers with topsoil at rates recommended based on soil test results.

E. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of modified layout before planting.

F. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to

protect from wind and other damage during digging, handling, and transportation.

3.03 PLANTING BED ESTABLISHMENT AND INSTALLATION

A. Loosen subgrade of planting beds to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread topsoil and soil amendments on surface and thoroughly blend planting soil mix.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

C. Before planting, restore planting beds if eroded or otherwise disturbed after finish grading.

3.04 EXCAVATION FOR TREES

A. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
2. Excavate at least 12 inches (300 mm) wider than root spread and 6” deeper than container.
3. If drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.

B. Obstructions: If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected.

C. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

3.05 TREE PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

B. Set balled and burlapped stock plumb and in center of pit or trench with top of root ball flush with adjacent finish grades. Place plants to give the best appearance or relationship to adjacent elements.

1. Pull away burlap and ropes from the tops of the root balls and partially from the sides, but do not remove from under root balls. Completely remove wire baskets to prevent future root girdling. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
2. Install the slow release fertilizer packets at the bottom of the pits of the trees and shrubs per the manufacturer’s directions and in the quantity recommended for the plant size.
3. If tree stabilization is needed, install tree stake per manufacturer’s instructions.
4. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.
5. Create a temporary topsoil berm 3” above finish grade at a diameter 2’ greater than the root ball. This shall be used as a watering basin. Contractor shall remove at the end of the maintenance period.

3.06 MULCHING

A. For individually-placed trees, apply 3-inch (75 mm) average thickness of specified mulch

extending out per plans. Pull mulch away from trunk to prevent rotting.

B. Mulch planting beds according to edging lines as indicated on drawings. Apply 3-inch (75 mm) average thickness of specified mulch and edging. Pull mulch away from plant bases to prevent rotting.

1. Planting beds to be mulched with stone mulch shall be installed over weed-barrier fabric.

3.07 TREE STABILIZATION

A. Refer to section 2.13.

3.08 TREE AND SHRUB PRUNING

A. Only prune to remove dead or broken branches off of plant.

3.09 ACCEPTANCE

A. Inspection to determine acceptance of planting areas will be made by the Architect, upon contractor's request. Provide notification at least ten (10) working days prior to requested inspection date.

1. Planted areas will be accepted provided all requirements, including maintenance, have been complied with and plant materials are alive and in a healthy vigorous condition.

2. Upon acceptance, the Owner will assume plant maintenance.

3.10 CLEANUP AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

3.11 DISPOSAL

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION

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SECTION 33 00 00
UTILITY SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: This Section describes necessary labor, materials, tools and equipment for the excavation, installation, construction, and backfilling of the following, including pipes, pipe trenches, and associated appurtenances, as shown on the Drawings and specified herein:

1. All necessary State and local permits.
2. Coordination and control of installation of natural gas service by local Gas Company to meter location. Cost of gas service will be billed to and paid by the Owner.
3. Conduits for electrical service. Coordination and control of installation of electrical service by local Utility Company.
4. Coordination with other trades.
5. Contractor shall provide plug removal connection, to be inspected by the City of Madison. Owner shall reimburse Contractor for cost of City's water connection and street repairs.
6. Sanitary connection and lateral and associated excavation shall be performed by the Contractor and shall be included in their cost. Street repair shall be performed by the City and billed to the Contractor. Owner shall reimburse Contractor for cost of City's street repairs.

B. Work Not Included: Installation of primary electrical service and gas service. Cost of these services will be billed to and paid by the Owner.

1.02 RELATED WORK DESCRIBED ELSEWHERE

A. Section 31 00 00: Earthwork

B. Section 31 23 16: Trenching

C. Section 33 21 00: Water Supply

D. Section 33 40 00: Sanitary and Storm Sewerage

E. Section 22 10 00: Plumbing

F. Section 22 05 53: Plumbing Identification

1.03 QUALITY ASSURANCE

A. Qualification of Installers: Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Standards: Comply with all State of Wisconsin Construction Codes and with county and other local requirements.

1.04 SUBMITTALS

Product Data: Within 15 calendar days after award of the Contract, submit:

A. Complete materials list of all items proposed to be furnished and installed under this Section.

B. Manufacturers' specifications and other data required to demonstrate compliance with the specified requirements.

C. Manufacturers' recommended installation procedures which, when approved by the Architect/Engineer, shall become the basis for inspecting and accepting or rejecting actual

installation procedures used on the Work.

1.05 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the work and materials of all other trades.

B. Protection of Utilities: Protect existing utilities as specified in Section 02 30 00.

C. Delivery and Storage: Deliver all materials to the job site in their original containers with all labels intact and legible at time of use. Store in strict accordance with the manufacturers' recommendations as approved by the Architect/Engineer.

D. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 PIPE MATERIALS

A. Natural Gas Piping:

1. Underground gas piping shall be X-Tru-Coat Plastic Coated Schedule 40 steel pipe meeting ASTM A 53/ A 53M with welded hot wrapped joints grounded with magnesium anodes and appropriate intervals (approximately 20 feet). Underground gas piping installed by municipal gas utility, up to meter may be plastic pipe meeting local codes and requirements of respective municipal gas utility.
2. Above ground gas piping shall be Schedule 40 black steel A53 with 150 pound malleable iron screwed or 150 pound welded fittings.
3. Exterior gas valves shall be lubricated plug valves equal to Rockwell 114 2" and below, or 115 above 2".

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the timely and proper completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PLACING PIPE

A. General:

1. Carefully examine each pipe prior to placing. Promptly set aside all defective pipe and all damaged pipe. Clearly identify all defects. Do not install defective pipe or damaged pipe.
2. Place all pipe to the grades and alignment shown, with a tolerance of one in 1000 vertical and one in 500 horizontal.
3. Provide all required equipment for lowering pipe safely into the trenches.
4. Do not place pipe in water, or place pipe when trench or weather is unsuitable for such work.
5. Where clay soils are encountered back fill the top two feet of the trench with clay to prevent rainwater from entering the pipe trench.

3.03 IDENTIFICATION

A. General:

1. Provide underground utility identification per specification section 22 05 53, plumbing identification.

3.04 BACKFILLING

A. General:

1. Backfill in accordance with the provisions of Section 31 00 00, and as specified herein. Take all necessary care to assure thorough compaction of fill under haunches of the pipe, without damage or misalignment of the pipe.
2. Where approved by the Architect/Engineer, sheeting and portions of bracing used may be left in place. Do not leave untreated sheeting in place beneath structures or pavements.

B. Movement of Construction Machinery: Use all means necessary to avoid displacement of, and injury to, the pipe and structures while compacting by rolling or operating equipment parallel with the pipe. Movement of equipment over piping at any stage of construction is solely at the risk of the Contractor.

C. Bedding: Provide a bedding surface for the pipe with a firm foundation of uniform density throughout the entire length of the pipe. Bed pipe carefully in a soil foundation accurately shaped and rounded to conform to the lower ¼ of the outside perimeter of the circular pipe, or set the pipe in a bed of sand. Tamp bedding when necessary. Provide bell holes and depressions for pipe joints of only the length, depth, and width required for properly making the particular joint.

D. Backfilling Pipe in Fill Sections: For pipe placed in fill sections, after the backfill has reached at least 12" above the top of the pipe, place the remainder of the fill by compacting in layers not exceeding 8" in compacted depth.

E. Compaction: Backfill over and around the pipe, backfill around and adjacent to all other drainage structures, and compact to the minimum densities specified in Section 31 00 00, or at least 95% Proctor Density.

3.05 SURFACE CONDITIONS

A. General:

1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that site utilities may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect/Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.06 EXISTING SERVICES

A. Where existing sewers, domestic, and heating piping, gas, potable water, electric, or other services are encountered in areas in which their presence was unknown by best available information (including information from local utility companies), each affected Contractor shall take adequate steps to protect such services.

B. If such existing services require relocation, make written request for ruling from the Architect/Engineer. Do not proceed on such portions of the Work until written instructions are received.

C. Inactive services shall be plugged, capped, or removed. Notify utility companies, municipal agencies having jurisdiction and Architect/Engineer. Protect or remove as directed.

3.07 CLOSING IN UN-INSPECTED WORK

A. General: Do not cover up or enclose work until it has been properly and completely tested, inspected, and approved.

B. Non-Compliance: Should any of the work be covered up or enclosed prior to all required

inspections and approvals, uncover the work as required and, after it has been completely inspected and approved, make all repairs and replacements with such materials as are necessary to the approval of the Architect/Engineer and at no additional cost to the Owner.

END OF SECTION

SECTION 33 10 00
WATER SUPPLY

PART 1 - GENERAL

1.01 SECTION INCLUDED

A. Furnishing and installing water main, valves, and hydrants.

1.02 RELATED SECTIONS

A. Section 31 00 00 - Earthwork

B. Section 31 23 16 - Trenching

C. Section 22 10 00 - Plumbing

1.03 REFERENCES

A. AWWA C104-1990 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

B. AWWA C110-2003 - Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids.

C. AWWA C111-2000 - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe.

D. AWWA C151-2002 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids.

E. AWWA C500-1986 - Gate Valves for Water and Sewerage.

F. AWWA C502-1985 - Dry-Barrel Fire Hydrants.

G. AWWA C600-1999 - Installation of Ductile-Iron Water Mains and Their Appurtenances.

H. AWWA C651-1999 - Disinfecting Water Mains.

I. ASTM B 88- Standard Specification for Seamless Copper Water Tube.

1.04 SUBMITTALS

A. Submit documents under provisions of Section 01 33 00.

B. Submit product data for pipe, fittings, joints, valves, valve boxes, gate valve adaptors and hydrants.

C. Submit bacteriological test results.

PART 2 - PRODUCTS

2.01 PIPE

A. Ductile Iron (3" and larger)

1. Ductile iron pipe meeting requirements of AWWA C151-2002, Class 52. Pipe to be cement-mortar lined in accordance with AWWA C104.
2. Provide push-on or mechanical joints meeting requirements of AWWA C111-2000.
3. Electrical Conductivity: Provide bonding straps capable of carrying 600 amps. Terminals to be factory applied.
4. Fittings: Cast iron fittings meeting the requirements of AWWA C110-2003, mechanical joint with a 250 PSI pressure rating.

2.02 GATE VALVES

A. Cast iron bodied gate valve meeting requirements of AWWA C500-1986. Valve shall have mechanical joint ends with conductive gaskets, be of the non-rising stem design, open left and have a square operating nut.

B. Valve Box: Cast-iron, three-piece valve box with screw type adjustment. It shall have the word "water" cast into the cover.

C. Valve Box Extensions: Screw type adjustment, 5.1/4” shaft.

1. Tyler, or approved equal.

D. All valves shall be supplied with a gate valve adaptor as manufactured by Adaptor, Inc., or approved equal. All adaptors shall have a metal frame and be supplied with a three quarter (3/4”) inch rubber gasket. All adaptors must be sized to fit the brand of valve being supplied.

2.03 HYDRANTS

A. Dry barrel type meeting requirements of AWWA C502-1985.

B. Hydrant construction shall include:

1. Breakaway design.
2. Five inch main valve opening.
3. 6'-6" bury minimum. Verify with site grading and utility plans. The standpipe may be furnished either as a single piece or in two sections.
4. (2) 2 1/2" and (1) 4 1/2" nozzles with National Standard Threads as described in Appendix ‘A’ of AWWA C502. All nozzles shall be at the same elevation. Nozzle shall be capable of being threaded into the upper barrel and shall be mechanically locked in place.
5. 6-inch mechanical joint bottom.
6. Open left.
7. Valve Closure: Valve shall be designed to provide full contact with the entire sealing face of the main valve rubber and open against main pressure.
8. Direction of Operation: Open counter-clockwise.
9. Operating Nut and Nozzle Cap Nut: Pentagon design shall conform to Section 4.6.5.5 of AWWA C502. Material of the operating nut shall be either hardened bronze or ductile iron.
10. All water main joints from valve to hydrant shall be MegaLug® Series 1100.
11. Corrosion Resistant Bolts and Nuts: All exterior fasteners, including all bolts and nuts, plugs, pins and external accessories shall be made from low zinc bronze or 300 series 18-8 stainless steel or other approved equal corrosion resistant material.
12. Lubrication: The lubrication shall be nontoxic and suitable for a temperature range of -30° F to +120° F. Lubrication shall be approved for use in contact with potable water where such contact occurs.
13. All new hydrants shall be equipped with a reflective locating device.
    a. Hydra-Finder, as manufactured by RoDon Corp., or approved equal

C. Hydrants shall meet the standard requirements of the local Fire Department. The Contractor shall verify the hydrant type, connections and manufacturer with the local Fire Department and Director of Public Works for sweeper wash-down prior to submittal of shop drawings.

D. Acceptable Hydrant Models:

1. Kennedy Guardian K-81
2. Mueller Super Centurion A423
3. Waterous Pacer WB-67
4. Or Approved equal

2.04 TRACER WIRE

A. Mark all non-conductive piping that connects with public utility with a locating wire system.

B. Locating wire system consists of the following:

1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE. Install to enable electronic locating of underground utility.
   a. Color of tracer wire shall be:
      i. Green for Sanitary
      ii. Blue for Potable Water
      iii. Brown for Storm Sewer
2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
   a. Manufacturer: Valvco, Inc., Model C.P. Mini Box, or an approved equal.

PART 3 - EXECUTION

3.01 HANDLING OF MATERIALS

A. Handle materials with care to avoid damage. Do not drop or dump materials.

B. Remove all defective materials from job site.

3.02 LINES AND GRADE

A. Benchmark and Construction Layout:
   1. Contractor shall provide and verify vertical and horizontal control.
   2. Contractor shall provide construction layout.

B. Locate the water main, valves and hydrants as shown on the Drawings. Lay the pipe with a depth of cover of 7'- 0" from finished grade.

3.03 LAYING OF PIPE

A. Remove all lumps, blisters and excess coating from the socket and plain ends of each pipe, and the outside of the plain end and wipe clean the inside of the bell end shall be wiped clean and dry prior to laying the pipe.

B. Prevent foreign materials from entering the pipe during placement in the trench.

C. Assemble the joints in accordance with AWWA C600-1999.

D. Rest each pipe on the full length of its barrel.

E. When pipe laying is not in progress, plug the end of the pipe with a watertight plug. Do not let trench water enter the pipe.

F. Whenever it is necessary to deflect the pipe from a straight line in either the horizontal or the vertical, the amount of deflection shall not exceed the limits shown in the following table:

Maximum Deflection Full-Length Pipe

Push-On Joints

Pipe Diameter	Maximum Deflection Per Length, Inches	
Inches	18-foot	20-foot
3	19	21
4	19	21
6	19	21

8	19	21
10	19	21
12	19	21

Maximum Deflection Full-Length Pipe

Mechanical Joints

Pipe Diameter	Maximum Deflection Per Length, Inches	
Inches	18-foot	20-foot
3	31	35
4	31	35
6	27	30
8	20	22
10	20	22
12	20	22

3.04 BEDDING

A. Provide crushed stone, crushed stone screenings or sand meeting the requirements of Section 31 23 16.13.

B. Use Class C bedding. Provide a minimum of four inches of bedding material under the pipe barrel and three inches under the bell. Place bedding material around the pipe up to a level of six inches above the pipe. Lightly consolidate the material making sure the material fills the void beneath the haunch area of the pipe.

3.05 BACKFILLING

A. Backfill in accordance with Section 31 00 00.

3.06 THRUST BLOCKING

A. Provide thrust blocking behind all hydrants, tees, caps, plugs and bends over 22 1/2 degrees. Blocking shall be poured concrete placed against firm mature ground. Joints shall be kept free of concrete.

3.07 SETTING SPECIALS

A. Valves:

1. Set box vertical with cover flush with finish grade.
2. Adjust valves so that they operate easily. Check all nuts for tightness. Leave in the closed position.

B. Hydrants:

1. All hydrants shall be plumb and have the nozzles parallel with or at right angles to the street with the pumper nozzle facing the street.
2. Install the hydrant as indicated on the Drawings.
   a. If hydrant is to be installed in areas to be landscaped, or if final grading elevations are not clear, the hydrant should easily accommodate placement of riser extensions of various lengths so that the final hydrant installation is compatible with the final grade elevation.

3. Provide a 6-inch lead with a gate valve on the lead.

3.08 TRACER WIRE INSTALLATION

A. Lateral tracer wire originates and terminates in tracer wire access box. Install conductor tracer wire in one continuous loop.

B. Tracer wire shall be brought to the surface every 400', protected with a tracer wire access box.

C. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.

D. Field test each locating wire after installation is completed

3.09 TESTING

A. Pressure and Leakage:

1. Provide pressure and leakage testing with a test pressure of 150 PSI in accordance with AWWA C600-1999.
2. Provide pressure testing of the hydrant as specified in Section 5.1.3 of AWWA C502.
3. Provide torque testing of each assembled hydrant as specified in Sections 4.5.5 and 5.2.2 of AWWA C502.

B. Disinfection and Bacteriological Testing

1. Before being placed in service the entire line shall be flushed and chlorinated in accordance with AWWA C651-1999.
2. During the chlorination process, operate all valves and hydrants.
3. After chlorination, flush the system until the chlorine concentration in the pipe is less than 1 mg/l.
4. After final flushing and before the mains are put into service, bacteriological safe tests must be obtained. Sampling shall be done in accordance with AWWA C651-1999.

END OF SECTION

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SECTION 33 40 00
SANITARY AND STORM SEWERAGE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Sanitary and storm sewer piping, fittings and accessories.

B. Manholes.

C. Catchbasins.

1.02 RELATED SECTIONS

A. Section 31 00 00 - Earthwork.

B. Section 31 23 16 - Trenching.

C. Section 22 10 00 - Plumbing.

1.03 REFERENCES

A. ASTM A 48/A 48M: Standard Specification for Gray Iron Castings.

B. ASTM A 74: Standard Specification for Cast Iron Soil Pipe and Fittings.

C. ASTM A 615/A 615M: Standard Specification for Deformed and Plain Billet-Steel bars for Concrete Reinforcement.

D. ASTM C 76: Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

E. ASTM C 94/ C 94M: Standard Specification for Ready-Mixed Concrete.

F. ASTM C 270: Standard Specification for Mortar for Unit Masonry.

G. ASTM C 443: Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

H. ASTM C 478: Standard Specification for Precast Reinforced Concrete Manhole Sections.

I. ASTM C 564: Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

J. ASTM C 828: Standard Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

K. ASTM D 698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

L. ASTM D 1785: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

M. ASTM D 2665: Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.

N. ASTM D 3034: Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

O. ASTM D 3212: Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

P. ASTM F 477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

Q. ASTM F 2648 – Standard Specification for 2 to 60 inch Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications

1.04 REGULATORY AGENCIES

A. Conform to State of Wisconsin Administrative Code COMM 82 and 84 for materials and installation of the work of this Section.

1.05 SUBMITTALS

A. Product Data:
   1. Within 15 calendar days after Award of Contract, submit:
      a. Complete materials list of all items proposed to be furnished and installed under this Section.
      b. Manufacturer's specifications and other data required to demonstrate compliance with the specified requirements.
      c. Manufacturer's recommended installation procedures which when approved by the Architect/Engineer, shall become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

PART 2 - PRODUCTS

2.01 SANITARY AND STORM SEWER PIPE MATERIALS

A. Reinforced Concrete Pipe (Storm only)
   1. Pipe: ASTM C 76, Class III with Wall Type B; mesh reinforcement; inside nominal diameter as indicated on Drawings.
   2. Joint Device: Bell and spigot joint, ASTM C 443, rubber compression gasket joint.

B. Polyvinyl Chloride (PVC) Pipe
   1. Pipe: Pipe: ASTM D 3034, SDR 35; ASTM D 1785, Schedule 40; or ASTM D 2665.
   2. Joints: Rubber Gasket, ASTM D 3212; or solvent weld.

C. High Density Polyethylene (HDPE) Pipe (Storm only)
   1. Pipe: ASTM F 2648
      a. Acceptable Model: ADS N-12 WT IB or approved equal
   2. Joints: Watertight according to requirements of ASTM D3212.
      a. Gaskets shall meet the requirements of ASTM F477.
      b. Gaskets shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris.
      c. Joint lubricant shall be used during assembly of gasket and bell

D. Cast Iron Soil Pipe
   1. Pipe: ASTM A 74, Service Weight.
   2. Joints: Rubber gasket, ASTM C 564.

2.02 MANHOLES AND CATCHBASINS

A. Precast Concrete:
   1. Barrel: Precast concrete, ASTM C 478.
   2. Joint Sealant: Butyl rubber rope, AASHTO M-19, Type B.

B. Cast-In-Place Concrete:
   1. Ready-mixed Concrete meeting ASTM C 94 with a 28-day strength of 3000 PSI, 3 to 4 inch slump, maximum aggregate size of 1 1/2 inch and air entrainment of seven percent. Reinforcement to meet requirements of ASTM A 615/ A 615M, Grade 60.

C. General:
   1. Steps: 1/2 inch diameter, Grade 60 steel rod covered with polypropylene plastic.

2. Pipe connections: Flexible butyl rubber with stainless steel bands. Kor-N-Seal or equivalent.
3. Frame and Cover: Cast iron, ASTM A 48/ A 48M, Class 35B.
4. Mortar:
    a. ASTM C 270, Type M
    b. Do not use mortar more than 60 minutes after water has been added to dry mix or if it has developed its initial set.

2.03 BEDDING

A. Provide bedding material in accordance with Section 31 23 16.

2.04 CRUSHED STONE

A. Provide crushed stone base in accordance with Section 31 23 16.

2.05 TRACER WIRE

A. Mark all non-conductive piping that connects with public utility with a locating wire system.

B. Locating wire system consists of the following:
1. Tracer Wire: 45-mil solid copper, No. 12 HMW-PE. Install to enable electronic locating of underground utility.
    a. Color of tracer wire shall be:
        i. Green for Sanitary
        ii. Blue for Potable Water
        iii. Brown for Storm Sewer
2. Tracer Wire Locating Box: 2-1/2-inch diameter, minimum, ABS pipe with 2 point terminal box and cast iron cover.
    a. Manufacturer: Valvco, Inc., Model C.P. Mini Box, or an approved equal.

PART 3 - EXECUTION

3.01 HANDLING OF MATERIALS

A. Handle materials with care to avoid damage. Do not dump or materials. Remove all damaged or flawed materials from the Project site.

B. Arrange for suitable sites for material storage with Owner

3.02 LINES AND GRADE

A. Benchmark and Construction Layout
1. Owner will provide vertical and horizontal control.
2. Contractor shall provide construction layout.

B. Contractor shall provide all materials, equipment and labor to maintain line and grade.
1. The laser beam method is the preferred method for controlling line and grade. Equipment shall be operated in accordance with the manufacturer's instructions. A person who is competent with the operation of the laser equipment shall be present at the Project site whenever it is being used.
2. Grade boards may be used. Use straight and even-edged 2 x 6 boards nailed or clamped to substantial stakes on either side of the trench. Use stout twill line fastened at the center of the alignment, pulled sufficiently tight to remove any noticeable or measurable sag. Measure down from the line to set the alignment of the pipe. Maintain a minimum of three boards at all times.

3.03 UNSTABLE FOUNDATION

A. Remove undesirable material below the trench bottom, such as organic soils, which cannot support the pipe. Replace the material with crushed stone meeting the requirements of Section 31 23 16 for 2-inch crushed stone base material.

B. Crushed stone base material will be paid for at the unit price bid or on the basis of a negotiated price if there is no bid price. Payment for crushed stone base will be made only if the Owner's representative is notified prior to its placement. Payment will not be made for crushed stone base used for dewatering the trench.

3.04 LAYING OF PIPE

A. Lay pipe uniformly to line and grade so that the finished sewer presents a uniform bore. Noticeable variations from true alignment and grade will be sufficient cause for rejection of the work.

B. Commence at the lowest point and proceed to the upper end. Lay pipe with bell-end pointing up-grade.

C. Provide a minimum of six inches between the pipe wall and the trench wall.

D. Rest each pipe on the full length of its barrel.

E. Do not lay the next pipe until the previous pipe is back filled sufficiently to prevent movement during joining.

F. Keep water out of the pipe. Do not let water rise into or around the pipe until the trench is filled at least one foot above the pipe.

G. When work is stopped for any reason, securely plug the end of the pipe.

H. Jointing: Assemble joints in accordance with the pipe manufacturer's instructions.

3.05 BEDDING

A. Use the following bedding sections as indicated on the Drawings. When the bedding section is not indicated on the Drawings, use Class C for rigid pipe (cast iron and concrete) and Class I for flexible pipe (PVC and polyethylene).

B. Class C

1. Provide a minimum of four inches of bedding material under the pipe barrel and three inches under the bell. Provide crushed stone, crushed stone screenings or sand bedding meeting requirements of Section 31 23 16.13, Article 2. Spade or shovel-slice the material so that it fills and supports the haunch area and encases the pipe to the limits shown on the Drawings. If excavation is carried deeper than six inches below the pipe barrel, backfill the excess depth with 1 1/2 inch crushed stone base material meeting requirements of Section 31 23 16.13, Article 2.
2. After the pipe has been laid and jointed, place bedding material by hand or equally careful means around the sides of the pipe and up to a level six inches above the pipe. Lightly consolidate the material.
    a. For pipes 36 inches in diameter or larger, backfill material may be substituted for bedding material above the spring line of the pipe.

C. Class I

1. Provide a minimum of four inches of bedding material under the pipe barrel and three inches under the bell. Provide crushed stone bedding meeting requirements of Section 31 23 16.13, Article 2. Place bedding material up the sides of the pipe to the spring line. Spade or shovel-slice the material so that it fills and supports the haunch area. If excavation is carried deeper than six inches below the pipe barrel, backfill the excess depth with 1 1/2 inch crushed stone base material meeting requirements of Section 31 23 16.13, Article 2. Compact bedding to 85 percent of maximum dry density in accordance with ASTM D 698.

2. Place cover material (bedding) by hand or equally careful means from the spring line up to a level six inches above the pipe. Provide cover material meeting the requirements of Section 31 23 16.13, Article 2. Compact cover material to 95 percent of maximum dry density in accordance with ASTM D 698 beneath pavement and to 85 percent when beneath turf.

3.06 MANHOLE AND CATCHBASIN CONSTRUCTION

A. General Requirements

1. Limit the manhole excavation to the size required to install the manhole. Provide bracing and sheathing as necessary.
2. Provide six inches of 1 1/2-inch crushed stone meeting the requirements of Section 31 23 16.13, Article 2 under the manhole base.
3. Remove undesirable material such as organic soil that cannot support the manhole and replace it with 2-inch crushed stone meeting the requirements of Section 31 23 16.13, Article 2. The cost of additional stone will be paid for at the Unit Price bid. If there is no Unit Price bid a price will be negotiated. No payment will be made unless the Owner is notified prior to the use of crushed stone for stabilizing the trench bottom.
4. Inverts shall be the same size as the diameter of the largest adjoining pipe. Shape inverts in accordance with the Drawings. Provide a smooth finish.
5. Provide tongue and groove joints sealed with butyl rubber rope for precast joints.
6. Frames and Covers: Provide frames and covers in the size and type indicated on the Drawings. Finish rim elevations shall match the surrounding surface unless otherwise indicated. Slope rims to match the slope of paved surfaces.

B. Steps: Provide steps in structures indicated on the Drawings. Align the steps to form a continuous ladder with steps equally spaced. Steps shall project a minimum of four inches from the manhole wall.

3.07 OUTSIDE DROP

A. Provide an outside drop as indicated on the Drawings whenever a sewer pipe enters the manhole 24 inches or more above the spring line of the outgoing sewer.

3.08 LEAKAGE TESTING

A. Test all sanitary sewers for leakage. Either the water infiltration test or the low pressure air test may be used. Provide all materials, equipment and labor necessary to conduct the tests. Include the cost of testing in the price bid for the sewer. Perform tests under the observance of the Owner's Representative.

B. Water Infiltration Test

1. The top surface of the groundwater must be at least two feet above the pipe during the test. Contractor may simulate this condition by flooding the trench.
2. The rate of infiltration shall not exceed 200 gallons per day per inch diameter per mile of pipe. Infiltration between any two manholes shall not be greater than 250 percent of the allowable rate. The following table shows the maximum allowable infiltration rates:

ALLOWABLE LIMITS OF INFILTRATION

Diameter of Sewer Inches	Infiltration Gal/100 Ft/Hr	Diameter of Sewer Inches	Infiltration Gal/100 Ft/Hr
4	0.63	15	2.37
6	0.95	18	2.84
8	1.26	21	3.32
10	1.58	24	3.78
12	1.90	27	4.26

48" ID manhole: 0.0663 gallon per vertical foot per hour.

C. Low Pressure Test

1. Conduct test in accordance with ASTM C 828.
2. Procedure:
   a. Clean and flush line to be tested.
   b. Determine test time for the section of line to be tested using Table 1.
   c. Plug all openings in test section.
   d. Add air until the internal pressure of the line is raised to 4.0 PSI. Allow air pressure to stabilize (usually 2 - 5 minutes).
   e. When pressure is stabilized, reduce pressure to the starting pressure of 3.5 PSI. If the pressure drops more than 1.0 PSI during the calculated test time, the line is presumed to have failed.
   f. If the test section is below the groundwater level, determine the height of groundwater above the spring line of the pipe at each end of the test section and compute the average. For every foot of groundwater above the spring line of the pipe, increase the test pressure by 0.43 PSI.

3.09 DEFLECTION TESTING

A. Test all PVC sanitary sewers with a go-no-go testing device. The device must pass through the entire section between manholes in one pass when pulled by hand without the use of excessive force. Repair and retest any section that does not meet this requirement.

B. Perform the test in the presence of the Owner's Representative. Provide all labor and equipment necessary to perform the test. Include the cost of the test in the cost of the sewer.

C. The dimensions of the device shall be based on a pipe deflection of five percent or seven and one-half percent. If testing is done less than 30 days after installation, use the 95 percent device. The 92.5 percent device may be used if the test is done 30 days or more after installation.

D. Perform test after backfilling and compaction are completed.

TABLE 1 (ASTM C 828)
MINIMUM TEST TIME FOR VARIOUS PIPE SIZES

Nominal Pipe Size, Inches	T (Time) Min/100 Ft	Nominal Pipe Size, Inches	T (Time) Min/100 Ft
4	0.3	15	2.1
6	0.7	18	2.4
8	1.2	21	3.0
10	1.5	24	3.6
12	1.8	27	4.2

3.10 TRACER WIRE INSTALLATION

A. Lateral tracer wire originates and terminates in tracer wire access box. Install conductor tracer wire in one continuous loop.

B. Tracer wire shall be brought to the surface every 400', protected with a tracer wire access box.

C. Tape conductor tracer wire to top of pipe at minimum 10-foot intervals. Wrapping conductor tracer wire around pipe is prohibited.

D. Field test each locating wire after installation is completed.

3.11 SEPARATION FROM WATERMAIN

A. Provide a minimum horizontal separation of eight feet.

B. Vertical Separation

1. When a sewer crosses over a watermain, provide a minimum of 18 inches between the bottom of the sewer and the top of the watermain.
2. When a sewer crosses under a watermain, provide a minimum of 12 inches between the bottom of the watermain and the top of the sewer.

END OF SECTION

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SECTION 41 22 13
BRIDGE CRANES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes

1. Work under this section includes all labor, materials, equipment, and services necessary to complete the bridge crane work as shown on the drawings and herein specified. This includes, but is not limited to:
    a. Crane rails with clamps and accessories
    b. Crane stops and their connections to the runway beams/girders
    c. Crane controls and mainline electrical conductor

B. Related Sections

1. Division 5 Section – "Structural Steel" for structural steel runway beams/girders and their connections to the supporting structure.
2. Division 26 Section – "General Electrical Provisions" for electrical power requirements.
3. Division 26 Section – "Conductors and Cables" for electrical power to the crane.
4. Division 26 Section – "Raceway and Boxes" for junction box at electrical connection to crane conductor.
5. Division 26 Section – "Disconnect Switches" for electrical disconnect of the crane.

1.02 DEFINITIONS

A. Manufacturer: A manufacturer who is regularly engaged in the manufacture of the product.

B. Erector: Builder, contractor, or subcontractor who is responsible for the field storage, handling, erection, and temporary bracing of the product.

1.03 SUBMITTALS

A. Submittals shall be in accordance with Division 1 Section – "Submittals." Preliminary and Final component submittals are required.

B. Product Data

1. Complete materials list of all items to be furnished and installed.

C. Shop Drawings

1. Erection Drawings - Detail product installation including:
    a. Indicate project name and location, architect/engineer's name, project number, contact information including address and telephone number, and contractor's name, project number, contact information including address and telephone number.
    b. Each member's designation (identification or piece mark), shape and size shall be clearly indicated and completely dimensioned.
    c. Plans and elevations shall locate each member by designation, define all work provided under this section, and indicate sequence of erection for stability, handling requirements, or for other special conditions.
    d. Sections and details shall show member connections and relationship of members to adjacent materials, to the structure, and other construction.
    e. Indicate all loading used in the design

D. Quality Assurance/Control Submittals

1. Design Data
    a. Submit structural design calculations.

b. The structural design calculations shall bear the seal, registration number, and signature of a qualified structural engineer responsible for their preparation. The structural engineer shall be registered in the state applicable to work and project location.

c. Submit electrical design information

i. Include motor sizes and wiring diagrams

2. Manufacturer's and Erector's qualification statements.

3. Manufacturer's recommended installation procedures.

a. The manufacturer's recommended installation procedures will become the basis for inspecting and accepting or rejecting actual installation procedures used on this work.

4. Plan for testing the crane capacity. The plan shall include the name of the responsible testing agency and procedures for performing the actual testing.

E. Closeout Submittals

1. Provide 3 copies of all closeout submittals.

2. Provide Operation and Maintenance Manuals in accordance with Division 1 Section – "Operation and Maintenance Data" including, but not limited to:

a. A standard service manual with erection information and diagrams identifying parts for proper care of equipment maintenance.

b. Product data for each crane component.

c. Recommended spare parts list and prices.

d. Structural design calculations.

e. Electrical design information including wiring diagrams.

3. Submit manufacturer's certificate of compliance with specifications.

4. Submit load test certificate

5. Warranty

1.04 QUALITY ASSURANCE

A. Qualifications

1. Manufacturer Qualifications:

a. The manufacturer must have produced product similar to the product being specified for a minimum of two years with a record of successful in-service performance.

2. Erector Qualifications:

a. Erector must have been regularly engaged for at least five years in erection for products similar in material, design, and extent to that required on this project with a record of successful in-service performance. The erector shall be manufacturer-trained and authorized by the manufacturer to install their products.

3. Professional Engineer Qualifications:

a. Legally authorized to practice in the jurisdiction where the project is located and who is experienced in providing engineering services to the kind indicated that have resulted in installations similar to those required on this project and with a record of successful in-service performance.

B. Regulatory Requirements

1. Conform to requirements of local, state, and federal rules and regulations applicable to work and project location.

a. Outdoor cranes shall be designed considering wind forces.

2. Conform to the applicable requirements and recommendations of the following codes, specifications, and standards except as modified by the Contract Documents and

herein:

a. AISI Technical Report #13 – 2003 – “Guide for the Design and Construction of Mill Buildings.”

b. MH27.1 - 2003 - “Specifications for Patented Track Underhung Cranes and Monorail Systems.”

c. MH27.2 - 2003 - “Specifications for Enclosed Track Underhung Cranes and Monorail Systems.”

d. CMAA Specification No. 70 - 2004 - “Specification for Top Running and Gantry Type Multiple Girder Electric Traveling Cranes.”

e. CMAA Specification No. 74 - 2004 - “Specification for Top Running and Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist.”

f. Comply with the current OSHA standards including, but not limited to, 29 CFR 1910.179 for Overhead and Gantry Cranes and 29 CFR 1926.550 for Cranes and Derricks.

g. Comply with ANSI/ASME B30.2, B30.17, and B30.18 as applicable for cranes.

h. Comply with ANSI/ASME HST 1-6, B30.7, B30.16, and B30.21 as applicable for hoists.

i. Comply with Federal specification RR-W-410 and the Wire Rope Users Manual or ASTM A1023/A for wire rope.

j. Comply with the latest editions of the Underwriter's Laboratory, Inc., National Electrical Code (NEC), National Electrical Manufacturers Association (NEMA) standards, and Industrial Control Systems (ICS) standards including but not limited to:

   i. NEMA Standard Publication No 250-2003, “Enclosures for Electrical Equipment (1000 Volts Maximum)

   ii. NEMA MG-1 for name plates.

   iii. ICS1-1993

3. Where provisions of pertinent regulations, codes, and standards conflict with this specification, the more stringent provisions shall govern.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packing, Shipping, Handling, and Unloading

1. Deliver all materials to the Project site in their original unopened containers with all labels intact and legible at time of installation.

B. Storage and Protection

1. Store in strict accordance with manufacturer's recommendations, under cover, and off the floor. Provide protection against freezing at all times.

1.06 WARRANTY

A. Provide a one year manufacturer's warranty as specified in the General Conditions of the Contract. During this period the Contractor shall effect any repairs required, without cost to the Owner, due to failures caused by material, workmanship, normal usage, design or construction.

1.07 SYSTEM STARTUP

A. Manufacturer’s representative shall be on site during startup and testing of the product.

1.08 MAINTENANCE

A. Maintenance Service

1. Maintenance and call-back service for all equipment shall be provided for a period of 5

years after Substantial Completion of the project.

2. This service shall include annual examinations by competent and trained personnel, all necessary adjustments, greasing, oiling, cleaning, and parts to keep equipment in perfect condition; except such part made necessary by misuse, accidents or negligence not caused by the Contractor.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. KCI Konecranes America, Inc., www.konecranesamerica.com

B. DeMag Cranes & Components, www.demag-us.com

C. Abell-Howe, www.abellhowe.com

D. Overhead Material Handling, www.omhinc.com

E. Morris Material Handling, www.morriscranes.com

F. Zenar Corporation, www.zenarcrane.com

G. Superior Crane Corporation, www.superiorcrane.com

H. North American Industries, Inc., www.naicranes.com

I. Sievert Electric Service and Sales Company, www.sievertelectric.com

J. TC/American, www.tcamerican.com

K. Substitutions are permitted and shall conform to Division 1 Section – Product Substitution Procedures.

2.02 MATERIALS

A. Rails and Rail Accessories

1. Confirm rail size with structural design.
2. Rails shall be Control Cooled with Ends Hardened / Heat Treated
3. Rail joints shall be “Tight Fit”
4. Rails and splice bars shall be provided by a single source and shall have holes drilled for splice bars prior to arrival on site.
5. Bolted / Welded Splices
6. Rail splices shall be staggered on each side of runway a minimum of 1 foot and shall not equal the wheel spacing.
7. Rail splices shall not occur at crane beam splices
8. Rail lengths shall be a minimum of 10 feet.
9. Rail clamps shall provide “fixed” rails for CMAA Class A, B, or C cranes except for when expansion joints are used in the crane runway beam. In that case “floating” rails shall be provided.
10. Rail clamps shall provided “floating” rails for CMAA Class D, E, or F cranes.

B. Crane stops

1. Align longitudinally along the crane runway

2.03 EQUIPMENT

A. (1) 6 Ton Capacity Bridge Crane

1. Type:

a.	Bridge:	Electric Motor Driven
b.	Trolley:	Electric Motor Driven
c.	Auxiliary Trolley:	None

d. Hoist: Electric Motor Driven
e. Auxiliary Hoist: None

2. Construction:
   a. Bridge: Underhung
   b. End Trucks: Rubber bumpers
   c. Hardened steel wheels
3. Capacity:
   a. Bridge: 6 tons (short)
   b. Trolley: 6 tons (short)
   c. Auxiliary Trolley: Not Applicable
   d. Hoist: 6 tons (short)
   e. Auxiliary Hoist: Not Applicable
4. Dimensional Criteria:
   a. Span: Center to center of runway rails – as shown on the drawings.
   b. Vertical Lift: Main hook – as shown on the drawings.
5. Service Classifications:
   a. CMAA Class C
   b. HMI Class H4
6. Operating Environment:
   a. Location: Indoor
   b. Classification: Non-Hazardous
   c. Temperature: 40 – 100 degrees F
7. Controls
   a. Primary Method: Festooned Pendant
   b. Secondary Method: None
   c. Lockable
   d. Pendent Control Criteria
      i. Start and Stop Buttons
      ii. Directional Buttons labeled based on compass directions
      iii. Options:
         (a.) Fixed
         (b.) Detachable
         (c.) Indicator Lights on Pendent
         (d.) Festooned / Suspended from Trolley
8. Crane Speeds - Full Load Speed(AC)
   a. Bridge: VFD (variable frequency drive) – 60 FPM minimum and 150 FPM maximum
   b. Trolley: VFD (variable frequency drive) – 50 FPM minimum and 80 FPM maximum
   c. Auxiliary Trolley: Not Applicable
   d. Hoist VFD (variable frequency drive) – 5 FPM minimum and 20 FPM maximum
   e. Auxiliary Hoist: Not Applicable
9. Hoist Data
   a. Reeving
      i. Type: Single

ii. Hoist cable: 4 part wire rope

iii. Auxiliary Hoist cable: Not Applicable

10. Safety
    a. Capacity Overload Protection
        i. Overload Lockout
        ii. Overload protection set at 100% rated capacity
    b. Travel limits are not required
    c. Load moment indicators are not required
    d. Crane maintenance walkways are not required
11. When Multiple Cranes are Present on Runway
    a. Special spacings are not required
    b. Collision avoidance interlocks are required
12. Electrification
    a. Branch Circuit: 480vAC 3 phase, 60 hertz, number wires 4
    b. Main disconnect switch (external operating handle mounted on enclosure door arranged for locking in either "on" or "off" position).
    c. Branch circuit breaker – confirm size with electrical design.
13. Crane Manufacturing Motor Criteria
    a. Motor Type - Squirrel Cage(AC)
    b. Motor Rating – 30 Minute Continuous and Totally Enclosed
    c. Provide oil and grease tight gear cases
14. Crane Manufacturing Electrification Criteria
    a. Mainline conductors per manufacturers recommendations with mounting hardware throughout for a complete and proper installation - coordinate location with electrical power supply
    b. Fused disconnect between crane and mainline conductor.
    c. Motor overload protection for each motion
    d. Low voltage protection for each motion
    e. Cross conductors shall be festooned cables.
    f. NEMA 12, Front Wired, Rear Mounted Enclosures
    g. Control circuit transformer with fuses providing 115 volt power for control circuits.
    h. Indicator lights on bridge

2.04 ACCESSORIES

A. Provide any special tools required for the equipment.

2.05 FINISHES

A. Surface Preparation:
    1. SSPC-SP1: The Society for Protective Coatings “Surface Preparation Specification No. 1 – Solvent Cleaning”, September 1, 2000 Edition and SSPC-SP2: “Surface Preparation Specification No. 6 – Commercial Blast Cleaning”, September 1, 2000 Edition.

B. The crane shall be given a minimum of one prime coat and a minimum of two finish coats of standard safety yellow paint.

C. Paint compass directions legend in a visible location on the underside of the crane.

2.06 SOURCE QUALITY CONTROL

A. Tests, Inspection

1. Factory test crane for motions and capacities

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be installed. Correct conditions detrimental to proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Verify spacing of bridge crane beams/girders, rails, structural clearances, and other items affecting the installation of the crane or crane accessories.

3.02 PREPARATION

A. Crane Electrification

1. Diagrams coordinating crane electrification shall be provided by the crane supplier to the General and Electrical Contractors. The Electrical Contractor is responsible for hard wiring a disconnect switch and up to a junction box at the mainline conductor. The crane supplier is responsible for the crane electrification from the junction box to the crane.
2. Field installed control wiring greater than 24V shall be installed by a licensed electrician.

B. Crane Structural Installation

1. Diagrams coordinating crane installation with the structure and crane beams/girders shall be provided by the crane supplier to the General Contractor.

3.03 INSTALLATION

A. Installation shall be per manufacturer's recommendations.

3.04 CONSTRUCTION

A. Site Tolerances

1. Crane girder and rail tolerances shall be per AISI Technical Report #13.

3.05 REPAIR/RESTORATION

A. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect/Engineer, at no additional cost to the Owner.

3.06 FIELD QUALITY CONTROL

A. Site Tests, Inspection

1. Engage a testing agency acceptable to Architect to perform testing responsibilities of the Contractor as specified.
2. Contractor shall pay all costs of tests and transportation of test material.
3. Provide testing and certified testing reports of the bridge crane lifting capacities. All test reports shall be signed by the individual authorized in the testing plan approved by the Architect/Engineer and submitted prior to final payment.

3.07 DEMONSTRATION

A. Manufacturer’s representative shall set appointment time with the owner to provide instruction of operation and maintenance to owner’s personnel. Instruction shall include, but is not limited to:

1. Equipment functions

2. Required maintenance
3. Possible adjustments necessary for proper operation and maintenance.

3.08 PROTECTION

A. Use all means necessary to protect materials before, during, and after installation and to protect installed work and materials of all other trades.

END OF SECTION

CGC, Inc.
Construction • Geotechnical
Consulting Engineering/Testing

APPENDIX A

October 26, 2011
C11054-33

Mr. Randall Wiesner
City of Madison Engineering Division
1600 Emil Street
Madison, WI 53713

Re: Geotechnical Exploration Report
Proposed Warm Storage Building
402 South Point Road
Madison, Wisconsin

Dear Mr. Wiesner:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the geotechnical exploration program for the project referenced above. The purpose of this exploration program was to evaluate the subsurface conditions within the proposed construction area and to provide geotechnical recommendations regarding site preparation, foundation, floor slab, loading dock and asphalt pavement design/construction. Seismic design category and stormwater infiltration potential are also discussed. An electronic copy of this report is provided for your use, and paper copies can be provided upon request. An electronic copy is also being sent to Ms. Katie Udell at Angus Young Associates (AYA).

PROJECT DESCRIPTION

We understand that a one-story building with an area of about 25,000 sq ft is planned. Slab grade will tentatively be set near EL 971 (USGS datum), and there will not be a basement. Column loads for the building are anticipated to be on the order of 100 kips. At-grade parking areas will also be included, as well as stormwater infiltration features. Based on original contour information supplied to CGC, fills on the order of 3 to 4 ft are anticipated to establish proposed slab grade after a topsoil stockpile is removed that exists in the building area.

SITE CONDITIONS

The site is located east of an existing salt storage building. The asphalt paved drive to the salt storage facility exists south of the site, with a grassy field to the east and north and a drainage swale to the northwest. A topsoil stockpile that is estimated to be about 10 ft high is situated where the building is proposed. The site slopes gently downward from the east to west with estimated ground surface elevations across the building footprint (excluding the topsoil stockpile) estimated between about EL 1069 to EL 1068 (to be field confirmed later by others).

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
FAX: 608/288-7887

SUBSURFACE CONDITIONS

Subsurface conditions on site were explored by drilling eight Standard Penetration Test (SPT) soil borings. The boring depths were extended from 10 to 25 ft deep, with B-1 extended 35 ft below the surface of the topsoil stockpile. The borings were drilled by J&J Soil Testing (under subcontract to CGC) on October 19 and 20, 2011 near locations selected by AYA. The approximate boring locations are shown on the Boring Location Map in Appendix B. Ground surface elevations at the borehole locations were estimated based on topographical contour information supplied to us, and the values should be considered approximate. (Note that boring locations and elevations will be determined by others at a later date.)* The specific procedures used for drilling and sampling are described in Appendix A.

* Surveyed on 11/11/11

The subsurface profile at the boring locations is somewhat variable, but can be described by the following generalized layers (in descending order):

- 5 to 30 in. of ***topsoil*** (except at B-1 drilled from the top of the topsoil stockpile where the thickness was 10.5 ft); over
- 1 to 3 ft of stiff to very stiff/hard ***lean clay***; followed by
- 7 to 13.5 ft of very soft to medium stiff/stiff lean ***clay*** and/or very loose to medium dense ***sand*** with trace to some silt; over
- ***Sand*** with various amounts of silt and gravel to the maximum depth explored (except at B-6 because the boring was only drilled 10 ft). The sands are generally medium dense to dense based on SPT blow counts (i.e., N-values). The sands graded to ***silt*** in B-4 near 17 to 22 ft in depth.

As exceptions to the generalized profile noted above:

1) About 5 ft of fill overlies the clay in B-5 involving silt and clay soils;
2) A thin 1-in. layer of sandy fill overlies the topsoil in B-7; and
3) 1.5 ft thick layer of loose sand was sandwiched between the clay in B-8.

Groundwater was not encountered within the drilled depths during or shortly after drilling. However, groundwater levels are expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B.

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is suitable for the proposed construction and that the structure can be supported by conventional spread footing foundations. However, some undercutting of loose sands and/or soft clays likely to be encountered at footing grade is anticipated. Our design/construction recommendations for site preparation, foundation, floor slab, loading dock walls and asphalt pavement are presented in the following subsections. Stormwater infiltration potential is also discussed. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Site Preparation

We recommend that the surficial topsoil be stripped/removed (including the topsoil stockpile) at least 5 ft beyond the proposed construction areas, including areas required for cuts and fills beyond the proposed building footprint or pavement limits. The topsoil can be stockpiled on-site and re-used as fill in landscaped areas.

Following topsoil removal, the exposed subgrades are expected to consist of native clay and possibly sand/silt soils (including fill near B-5). Exposed soils in areas to receive fill or at final grade should be proof-rolled with a large, rubber-tired piece of construction equipment (e.g., loaded dump truck, front-end loader or scraper). Where soft areas are detected, they should be undercut/removed or stabilized with 6-in. lifts of 3-in. dense graded base (breaker rock) with minimal fines that is worked into the subgrade until deflection ceases. Grade should be re-established using either granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557) or compacted breaker run stone.

We recommend using granular soils as fill if possible in building areas because these soils are generally easier to place and compact in most weather conditions. We do not recommend using clay/silt soils as structural fill because moisture conditioning will be required to achieve required compaction levels, which could delay construction progress. Silt/clay soils can be used as fill in landscaped areas, or in parking/drive areas if the schedule permits clay aeration, where needed. Fill/backfill should be compacted to at least 95% (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D, with lesser levels acceptable in pavement areas as stated in Appendix D. Periodic field density tests should be taken by CGC staff within the fill/backfill to document the adequacy of compactive effort. Note that the fill should be placed early in the construction sequence to allow for consolidation of the softer soils at the site to occur prior to building construction, with some of this consolidation already occurring due to the topsoil stockpile that effectively surcharged the majority of the building area.

2. Foundation Design

In our opinion, the proposed structure can be supported on reinforced concrete spread footing foundations bearing on the native soils near an anticipated grade at EL 1067+/-. *Where encountered, soft clays or loose sands should be undercut/removed below foundations.* The following parameters should be used for foundation design:

- Maximum allowable bearing pressure: 2,000 psf
- Minimum foundation widths:
  - -- Continuous wall footings: 8 in.
  - -- Column pad footings: 30 in.
- Minimum footing depths:
  - -- Exterior/perimeter footings: 4 ft
  - -- Interior footings: no minimum requirement

Undercutting/replacement below footing grade will be required if loose sands or clays with pocket penetrometer readings (an estimate of the unconfined compressive strength of cohesive soils) less than 1.0 ton/sq ft are observed at or slightly below footing grade. This possibility includes fill material near B-5. Where undercutting is required, the base of the undercut excavations should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Grade should be restored using granular fill compacted to 95 percent compaction (ASTM D 1557) or compacted stone (i.e., 3-in. dense graded base with fines or ¾-in. base course). CGC should be present during footing excavations to verify adequate soil conditions exist or recommend corrective measures, if necessary. We recommend an allowance be established to involve an *estimated* 12-in. undercut for one-third of the footing excavations.

We recommend using a smooth-edged backhoe bucket for footing excavations. Furthermore, sand footing subgrade soils should be recompacted with a large vibratory plate compactor or hoe-pak, and clay soils should be recompacted with a jumping jack to densify soils loosened/disturbed during excavation. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements will be on the order of 1.0 and 0.5 in., respectively.

3. Site Class for Seismic Design

In our opinion, the average soil/rock properties in the upper 100 ft of the site (based on SPT blow counts (N-values) of greater than 15 blows/ft, on average, in the granular soils underlying the site) may

be characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code (see Table 1615.1.1).

4. Floor Slab

Based on anticipated site grades, the floor slab for the building will likely be supported by granular fill, and a subgrade modulus of 125 pci should be used in slab design. The floor slab areas should be proof-rolled as discussed in the Site Preparation section of this report, and soft/yielding or loose areas should be undercut/removed. The final 4 to 6 in. of fill placed below the floor slab should consist of imported, well-graded sand or gravel having no more than 5 percent passing a No. 200 U.S. standard sieve. To minimize the potential for moisture migration, a plastic vapor barrier should also be utilized. Fill and drainage course material placed below the floor slab should be placed as described in the Site Preparation section of this report. The slab should be structurally separate from the foundations and have construction joints and reinforcement for crack control.

5. Below-Grade Wall (Loading Dock)

We anticipate that loading dock walls (if any) will be laterally restrained by the floor slab of the building. Therefore, *at-rest lateral earth pressures* should be used during design. To minimize the development of such pressures, granular backfill should be placed within 4 to 6 ft of the walls. Weep holes should be incorporated to address the potential build-up of hydrostatic water pressure. Compaction of the backfill within 4 to 6 ft of the walls should be performed with lightweight compaction equipment. The granular backfill should be compacted to a minimum of 95% modified Proctor (ASTM D1557) following Appendix D guidelines. Walls constructed in accordance with the above recommendations may be designed for an equivalent fluid pressure of 55 psf per foot of depth. The wall design should also take into account surcharge effects which could be applied during or after construction.

6. Pavement Design

Depending on final site grades, the subgrade soils within the parking/drive areas will probably consist of native clay or additional clay/silt fill and possibly compacted granular fill. Pavement subgrades should be proof-rolled/recompacted as described in the Site Preparation section of this report and stabilized as needed with breaker rock or replaced with compacted granular fill. We assume that the parking lot pavement will be subjected to mainly automobile traffic with minimal truck traffic (i.e., Traffic Class I, which includes less than 1 design daily equivalent 18-kip single axle loads – ESALs and parking lots with less than 50 stalls). Drive areas will experience additional truck traffic and require a thicker pavement section. The clay soils encountered across the site will control the pavement thickness design. Accordingly, the pavement section tabulated below was selected assuming a CBR value of approximately 2 to 5 and a design life of 20 years.

TABLE 1
RECOMMENDED PAVEMENT SECTIONS

Material	Thickness (in.)		WDOT Specification1
	Light Duty	Heavy Duty	
Bituminous Upper Layer (Surface Course)	1.5	1.5	Section 460, Table 460-1, 9.5 mm
Bituminous Lower Layer (Binder Course)	1.5	2.5	Section 460, Table 460-1, 12.5 mm and Section 460.3.2
Crushed Aggregate Base Course	8.0	10.0	Sections 301 and 305, 31.5 mm and 75 mm
TOTAL THICKNESS	**11.0**	**14.0**	

Notes:

1. Wisconsin DOT *Standard Specifications for Highway and Structure Construction*, Latest Edition, including supplement specifications, but excluding Section 460.3.2 relating layer thickness to aggregate size.

2. Compaction requirements:
   - Bituminous concrete: Refer to Section 460-3.
   - Base course: Refer to Section 301.3.4.2, Standard Compaction

3. Mixture Type E-1 bituminous pavement is recommended; refer to Section 460, Table 460-2 of the *Standard Specifications.*

Note that if traffic volumes are greater than those assumed, CGC should be allowed to review the recommended pavement section and adjust it accordingly. The pavement design assumes a stable/non-yielding subgrade and a regular program of preventative maintenance. Alternative pavement designs may prove applicable and should be reviewed by CGC. If there is a delay between subgrade preparation and placing the base course, the subgrade should be recompacted.

Pavement areas subjected to concentrated wheel loads (i.e., loading docks, dumpster pads, etc.) should be constructed of Portland cement concrete. The slab should be a minimum of 6-in. thick and should contain mesh reinforcement for crack control. A subgrade modulus of 125 pci should be used for concrete pavement design founded on recompacted/stable subgrades.

7. Stormwater Infilration Potential

We understand that a stormwater management pond is planned northwest of the proposed building, and smaller stormwater infiltration areas are planned northeast and southeast of the building. The soil conditions northwest of the building (see Borings 7 and 8) consisted primarily of low permeability silty clay loam to depths of 12.5 to 13.5 ft over deeper more permeable sand. Similarly, low permeability soils or soils with low permeability soil seams were encountered in Borings 2 and 4 to depths 19 to 22 ft. Redoximorphic features (i.e., redox or mottling) were encountered in the clayey soils in Borings 2, 7 and 8, which suggests seasonal or past saturation, and redox is considered a limiting layer to stormwater infiltration. According to NR 151.12, this site is likely classified as "excluded" based on insufficient separation between the bottom of the infiltration feature and high groundwater (or redox/mottling). Additionally, the site is likely classified as "exempt" based on a low infiltration rates in the upper 12.5 ft or more of the site. The following parameters should be considered for design of infiltration features:

Infiltration Potential: The following infiltration parameters were estimated using Table 2 of the WDNR Conservation Practice Standard 1002, *Site Evaluation for Storm Water Infiltration*. The estimated infiltration rates are as follows:

- Silty clay loam 0.04 in./hr
- Silt loam 0.13 in./hr
- Sandy Loam 0.5 in./hr
- Loamy Sand 1.63 in./hr
- Sand 3.6 in./hr

Note that the infiltration rates should be considered very approximate. The Wisconsin Department of Commerce Soil Evaluation forms for the four infiltration borings are included in Appendix E. Where lower permeable layers/seams of soil are present in otherwise higher permeability soil, the lower permeable seams/layers will govern the infiltration rate. We recommend that the soils at and a few feet below the bottom of the infiltration devices be checked during construction to document that the soils at the bottom meet or exceed the design infiltration rates.

Groundwater: Apparent perched groundwater was encountered in Borings 7 and 8 at 9 to 9.5 ft below existing site grades during after drilling. Additionally, redoximorphic features were encountered in the clayey soils in Borings 2, 7 and 8 at 4 to 8 ft below existing site grades, which may indicate seasonal or past saturation. Seasonal variations in groundwater levels should be expected, as previously discussed.

Bedrock: Bedrock was not encountered in the borings to the maximum depth explored.

During construction of the proposed buildings and related site work, appropriate erosion control should be provided to prevent eroded soil from contaminating the infiltration areas. Where appropriate, the basin design should include pretreatment to remove fine-grained soils (silt/clay) from stormwater prior to entering the infiltration area. Additionally, a regular maintenance plan should be developed to remove silt/clay soils that may accumulate in the bottom of the infiltration basin over time. Failure to adequately control fine-grained soils from entering the infiltration area or failure to regularly remove fine-grained soils that accumulate at the base of the infiltration basin will likely cause the basin to fail. Refer to WDNR Conservation Practice Standard 1002 and NR 151 for additional information.

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties which could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- If the schedule requires that construction proceed during adverse weather conditions, typically encountered during fall through spring, the budget should include a contingency for undercutting/stabilizing disturbed soils.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

- Based on observations made during the field exploration, groundwater infiltration into footing excavations is not expected to be a problem. Water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation, floor slab and pavement subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping/subgrade proof-rolling within the construction areas;
- Fill/backfill placement and compaction;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

* * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

Michael N. Schultz, P.E.
Principal/Consulting Professional

William W. Wuellner, P.E.
Senior Geotechnical Engineer

Encl.: Appendix A - Field Exploration
Appendix B - Soil Boring Location Map
Logs of Test Borings (8)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications
Appendix E - Wisconsin Department of Commerce – Soil Evaluation Storm Form (4 Borings)

cc: Ms. Katie Udell - Angus Young Associates

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

Eight Standard Penetration Test (SPT) soil borings were drilled on October 19 and 20, 2011 near locations selected by AYA. The approximate locations of the borings are shown on the Boring Location Map presented in Appendix B. The borings were drilled by J&J Soil Testing (under subcontract to CGC) using a truck-mounted, rotary drill rig using hollow-stem augers. The borings were drilled to depths up to 35 ft below existing site grades. The borings were marked in the field by CGC. The ground surface elevations at the boring locations will be determined using methods described in the report text.* Note that the City of Madison provided a front end loader to develop an access ramp so that B-1 could be drilled on the topsoil stockpile surface. * Surveyed on 11/11/11

In the exterior each soil borings, soil samples were generally obtained at 2.5 foot intervals to a depth of 10 feet and at 5 foot intervals thereafter. Additional samples were gathered in B-3. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

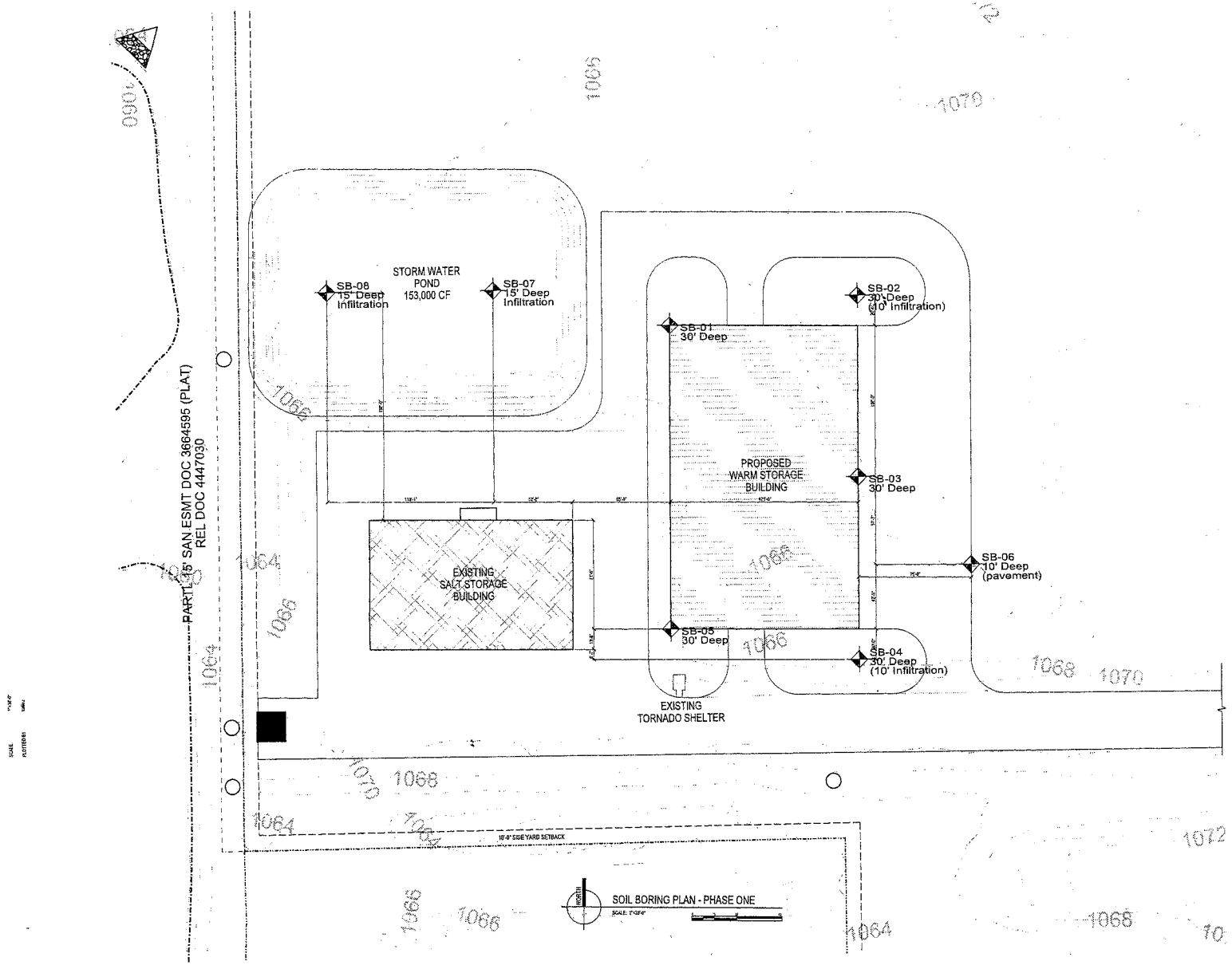
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance. Recovered samples are first classified as to texture by the driller.

During the field exploration, the driller visually classified the soil and prepared a field log. Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope. Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite in accordance with WDNR regulations, and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soils were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

TEST BORING LOCATION MAP
LOGS OF TEST BORINGS (8)
LOG OF TEST BORING-GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



D-452

Legend

◆ Denotes Soil Boring Location and Number

Notes

1. Soil borings conducted by J&J Soil Testing in October 2011.
2. Base map provided by Angus Young Associates.
3. Boring locations are approximate.

Date: 10/11 Job No. C11054.33	CGC, Inc.	**SOIL BORING LOCATION MAP** **Proposed Warm Storage Building** **402 South Point Road** **Madison, Wisconsin**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. 1
Surface Elevation (ft) ~~1077±~~ 1076.0 *
Job No. C11054-33
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
					0	FILL: Dark Gray/Black Clayey Topsoil					
1		18	M	5	5						
2A/B		18	M	24	10	Stiff, Brown to Gray Lean CLAY; Trace Sand and Gravel (CL)	(4.5+)				
3A/B		18	M	6		Medium Dense, Brown Fine to Medium SAND; Some Silt, Trace Gravel and Clay (SM)					
4		15	M/W	1	15 ▽	Loose, Brown/Gray (Laminated) Fine to Medium SAND; Trace Silt (SP), SILT (ML) and Lean CLAY (CL)					
5		18	M	17		Very Soft, Brown/Gray (Mottled) Lean CLAY; Trace Sand (CL)	(<0.25)				
					20	Medium Dense, Brown Fine to Medium SAND; Trace Silt and Gravel (SP)					
6		18	M	31		Medium Dense to Dense, Brown Fine to Medium SAND; Some Silt, Little Gravel (SM)					
					25						
7		18	W	22							
					30						
8		18	W	29							
					35	End of Boring at 35 ft Backfilled with Bentonite Chips					
					40	* Surveyed elevation 11/11/11					

WATER LEVEL OBSERVATIONS

While Drilling ▽ **15.5'** Upon Completion of Drilling **NW**
Time After Drilling **(perched)**
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/19/11** End **10/19/11**
Driller **J&J** Chief **JP** Rig CME-45
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope &**
Cathead Hammer

LOG OF TEST BORING

CGC Inc.

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **2** 1068.3*
Surface Elevation (ft) ~~1069±~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						5 in. Clayey TOPSOIL (OL) USDA: 10YR3/2 Silty Clay Loam					
1A/B		18	M	12		Very Stiff, Brown Lean CLAY; Trace Sand and Gravel (CL) USDA: 10YR4/3 Silty Clay Loam	(3.5)				
2		14	M	4	5	Loose to Medium Dense, Orange Brown Fine to Medium SAND; Little Silt, Trace Gravel, Scattered Silt and Clay Seams (SP-SM) USDA: 10YR4/6 Loamy Sand with Silty Clay Loam and Silt Loam Seams					
3		18	M	10							
4		18	M	7	10	Soft to Medium Stiff Sandy Lean Clay Seam Near 5 ft (Qp=0.25-0.5 tsf)	(0.25-0.5)				
5A/B		18	M	19	15	Soft to Stiff, Gray/Brown (Mottled) Silty CLAY; Trace Sand, Scattered Sand Seams (CL-ML) USDA: 10YR5/2 Silty Clay Loam (Redox C2D 10YR6/6)	(1.25-1.5)				
6		18	M	34	20	Medium Dense, Brown Fine to Medium SAND; Trace to Little Silt and Gravel, Scattered Silt Pockets (SP/SP-SM) USDA: 10YR6/4 Loamy Sand with Silt Loam Pockets					
						Dense, Brown Fine to Medium SAND, Some Silt, Trace Gravel (SM) USDA: 10YR 5/4 Sandy Loam					
					25	End of Boring at 20 ft Backfilled with Bentonite Chips					
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

	While Drilling	Upon Completion of Drilling		
Time After Drilling				
Depth to Water	▽ NW	NW		▼
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/19/11** End **10/20/11**
Driller **J&J** Chief **JP** Rig CME-45
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope &**
Cathead Hammer

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **3** 1068.1*
Surface Elevation (ft) ~~1068~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						14 in. Clayey TOPSOIL (OL)					
1	■	14	M	8		Stiff, Dark Brown Lean CLAY; Trace Sand (CL)	(1.5-2.0)				
2	■	18	M	6	5	Loose, Orange-Brown Fine to Medium SAND; Trace to Little Silt, Scattered Silt Seams (SP/SP-SM)					
3	■	18	M/W	4							
4	■	18	M	15	10	Medium Dense, Brown Fine to Medium SAND; Some Gravel, Trace Silt, Scattered Silt Pockets (SP)					
5	■	18	M	22	15	Medium Dense to Dense, Brown (Lightly Mottled) Fine to Medium SAND; Some Silt, Little Gravel (SM)					
6	■	18	M	47	20						
7	■	18	M	30	25	End of Boring at 25 ft Backfilled with Bentonite Chips					
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽	NW	Upon Completion of Drilling	NW	
Time After Drilling				
Depth to Water				▼
Depth to Cave in				

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/20/11** End **10/20/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **4** 1068.1*
Surface Elevation (ft) ~~1068±~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						30 in. of Dark Brown to Black Clayey TOPSOIL (OL - POSSIBLE FILL) USDA: 10YR 3/2 Silty Clay Loam					
1		12	M	10							
2		18	M	4	5	Brown Lean CLAY; Little Sand, Trace Gravel (CL-Based on Driller's Description) USDA: 10YR4/3 Silty Clay Loam					
3		18	M	3		Very Loose, Orange Brown Fine to Medium SAND; Little Silt, Trace Gravel, Scattered Silt and Clay Seams (SP-SM) USDA: 10YR4/6 Loamy Sand with Silty Clay Loam and Silt Loam Seams					
4		18	M	6	10						
5		18	M	28	15	Loose to Medium Dense, Orange Brown to Brown Fine to Medium SAND; Trace Silt and Gravel, Scattered Silt Seams (SP) USDA: 10YR4/4 to 10YR7/4 Sand with Silt Loam Seams					
6		18	M	26	20	Medium Dense, Gray to Brown SILT; Trace to Little Sand, Scattered Sand Seams (ML) USDA: 10YR 5/3 Silt Loam					
7		18	M/W	31	25	Dense, Brown Fine to Medium SAND; Some Silt, Trace to Little Gravel (SM) USDA: 10YR5/4 Sandy Loam					
						End of Boring at 25 ft Backfilled with Bentonite Chips					
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽ **NW** Upon Completion of Drilling **NW**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/20/11** End **10/20/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **5** 1069.7*
Surface Elevation (ft) ~~1069~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						7 in. Black Topsoil FILL (OL)					
1A/B	■	18	M	12		FILL: Very Stiff, Gray/Brown Lean Clay, Trace to Little Organics and Sand	(3.5)				
2A/B	■	18	M	7	5	FILL: Loose to Medium Dense, Brown to Gray Silty Fine to Medium Sand, Scattered Clay and Topsoil Seams					
3	■	18	M	8		Stiff, Brown to Gray Lean CLAY; Little Sand, Trace Gravel (CL)	(1.25)				
4	■	18	M	8	10	Loose to Medium Dense, Brown Fine to Medium SAND; Little to Some Gravel, Trace Silt, Scattered Silt Pockets (SP)					
5	■	18	M	19	15	Grades to Light Brown with Less Gravel with Depth					
6	■	18	M	31	20	Dense, Brown Fine to Medium SAND; Some Silt, Little Gravel (SM)					
7	■	18	M	32	25	End of Boring at 25 ft Backfilled with Bentonite Chips					
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽ NW Upon Completion of Drilling NW
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/19/11** End **10/19/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **6** 1068.3*
Surface Elevation (ft) ~~1068±~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						10 in. Clayey TOPSOIL (OL)					
1		12	M	11		Very Stiff, Brown Lean CLAY; Trace Sand and Gravel (CL)	(3.0)				
2		18	M	7	5	Loose to Medium Dense, Orange Brown to Light Brown Fine to Medium SAND; Trace Silt and Gravel (SP)					
3		18	M	10							
4		18	M	27	10	End of Boring at 10 ft Backfilled with Soil Cuttings					
					15						
					20						
					25						
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽ **NW** Upon Completion of Drilling **NW**
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/20/11** End **10/20/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **7** 1065.3*
Surface Elevation (ft) ~~1066±~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						1 in. +/- Sand FILL					
1		12	M	5		Stiff, Dark Brown Lean CLAY; Trace Sand, Trace to Little Organics (CL/OL-Topsoil) USDA: 10YR3/2 Silty Clay Loam	(1.75)				
2		18	M	6	5	Stiff, Brown/Gray (Mottled) Lean CLAY; Some Sand, Scattered Sand Seams (CL) USDA: 10YR4/4 Silty Clay Loam (Redox C2D 10YR6/6)	(1.25)				
3		18	M	2			(0.25-0.5)				
4A/B		18	M/W	2	▽ 10	Very Soft to Soft, Brown/Gray (Mottled) Lean CLAY; Trace Sand, Scattered Silt and Sand Seams (CL) USDA: 10YR4/3 Silty Clay Loam (Redox C2D 10YR5/6)	(<0.25)				
5		18	M	24	15	Medium Dense, Brown Fine to Medium SAND; Trace to Little Silt and Gravel (SP/SP-SM) USDA: 10YR6/4 Loamy Sand					
						End of Boring at 15 ft Backfilled with Bentonite Chips					
					20						
					25						
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽ **9.0'** Upon Completion of Drilling **NW**
Time After Drilling **(perched)**
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/19/11** End **10/19/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

CGC Inc.

LOG OF TEST BORING

Project **Prop. Public Works Warm Storage Building**
402 South Point Road
Location **Madison, Wisconsin**

Boring No. **8** 1065.6*
Surface Elevation (ft) ~~1066±~~
Job No. **C11054-33**
Sheet **1** of **1**

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES qu (qa) (tsf)	W	LL	PL	LI
						13 in. Clayey TOPSOIL (OL)					
1	■	10	M	8		USDA: 10YR2/2 Silty Clay Loam					
						Stiff, Brown Lean CLAY; Trace Sand and Gravel (CL)					
2A/B	■	18	M	5		USDA: 10YR4/3 Silty Clay Loam	(1.5)				
					5	Loose, Orange Brown Fine to Medium SAND; Some Silt, Scattered Silt Seams (SM)					
3	■	18	M	4		USDA: 10YR4/4 Sandy Loam with Silt Loam Seams	(0.25-0.5)				
4	■	18	M/W	6	▽		(0.25-0.5)				
					10	Stiff, Brown/Gray (Mottled) Lean CLAY; Some Sand, Scattered Sand Seams (CL)					
						USDA: 10YR4/4 Silty Clay Loam (Redox C2D 10YR6/6)					
5	■	18	M	18							
					15	Very Soft to Soft, Brown/Gray (Mottled) Lean CLAY; Trace Sand (CL)					
						USDA: 10YR4/3 Silty Clay Loam (Redox C2D 10YR5/6)					
						Medium Dense, Brown Fine to Medium SAND; Trace to Little Gravel, Trace Silt (SP)					
					20	USDA: 10YR6/4 Sand					
						End of Boring at 15 ft					
						Backfilled with Bentonite Chips					
					25						
					30						
					35						
					40						

* Surveyed elevation 11/11/11

WATER LEVEL OBSERVATIONS

While Drilling ▽ **9.5'** Upon Completion of Drilling **NW**
Time After Drilling **(perched)**
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start **10/19/11** End **10/19/11**
Driller **J&J** Chief **JP** Rig **CME-45**
Logger **JP** Editor **DAS**
Drill Method **2.25" HSA; Rope & Cathead Hammer**

APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, , *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not Informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where surface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgement and opinion, geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's recommendations if we do not perform construction observation.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having CGC participate in prebid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

GEOENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of ASFE, for more information.

Modified and reprinted with permission from:

ASFE/The Best People on Earth
881 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55	75 (2)		
No. 40			5-20	8-28	10-35	15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

APPENDIX E

WISCONSIN DEPARTMENT OF COMMERCE – SOIL EVALUATION STORM FORM (4 BORINGS)

Wisconsin Department of Commerce
Division of Safety and Buildings

SOIL EVALUATION - STORM

in accordance with Comm 82.365 & 85, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s.15.04 (1) (m)).

County	
Dane	
Parcel I.D.	070828201031
Review by	**Date**

Property Owner	**Property Location**
City of Madison Streets	**Govt. Lot** 1/4 **NW** 1/4 **S** 28 **T** 7 **N R** 8 **E**
Property Owner's Mailing Address	**Lot #** **Block #** **Subd. Name or CSM#**
1501 W. Badger Road	2 CSM 9957
City / **State** / **Zip Code** / **Phone Number**	[X] **City** [ ] **Village** [ ] **Town** **Nearest Road**
Madison / WI / 53713	Madison 402 South Point Road

Drainage area _____ [ ] **sq. ft.** [ ] **acres**

Optional:

Test Site Suitable for (check all that apply)

[ ] **Irrigation** [ ] **Bioretention trench** [ ] **Trench(es)**

[ ] **Rain Garden** [ ] **Grassed Swale** [ ] **Reuse**

[ ] **Infiltration trench** [ ] **SDS (>15' wide)** [ ] **Other** _____

Hydraulic Application Test Method

[X] **Morphological Evaluation**

[ ] **Double-Ring Infiltrometer**

[ ] **Other (Specify)**_____

2 **Obs. #** [X] **Boring** [ ] **Pit** **Ground Surface Elev.** 1069 **ft** **Depth to limiting factor** 96 **in.**

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 5	10YR 3/2	None	SiCL	1msbk	mvfr	cs	<5	0.04
2	5 - 24	10 YR 4/3	None	SiCL	2msbk	mfr	gs	<5	0.04
3	24 - 96	10 YR 4/6	None	LS/SiCL/SiL	0sg	ml	gs	<5	0.04 - 1.63
4	96 - 174	10 YR 5/2	C2D 10 YR 6/6	SiCL	1msbk/0m	mvfr	gs	<5	0.04
5	174 - 228	10 YR 6/4	None	LS/SiL	0sg	ml	gs	5 - 10	0.13 - 1.63
6	228 - 240	10 YR 5/4	None	SL	1msbk	mvfr		<5	0.5

4 **Obs. #** [X] **Boring** [ ] **Pit** **Ground Surface Elev.** 1068.0 **ft** **Depth to limiting factor** >300 **in.**

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 30	10YR 3/2	None	SiCL	1msbk	mvfr	cs	<5	0.04
2	30 - 42	10 YR 4/3	None	SiCL	2msbk	mfr	gs	<5	0.04
3	42 - 96	10 YR 4/6	None	LS/SiCL/SiL	0sg	ml	gs	<5	0.04 - 1.63
4	96 - 204	10 YR 4/4, 7/4	None	S/SiL	0sg	ml	gs	<5	0.13 - 3.6
5	204 - 264	10 YR 5/3	None	SiL	1msbk	mvfr	gs	<5	0.13
6	264 - 300	10 YR 5/4	None	SL	1msbk	mvfr		5 - 10	0.5

CST/PSS Name (Please Print)	**Signature**	**CST/PSS Number**
David Staab	David Staab	1042602
Address	**Date Evaluation Conducted**	**Telephone Number**
3911 Mineral Point Road	10/24/2011	608/288-4100

SBD-10793 (R.1/05)

7 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 1066 ft Depth to limiting factor 30 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 1	10YR 7/3	Fill - SL		variable	variable	cs	<5	0.5
2	1 - 30	10 YR 3/2	None	SiCL	1msbk	mvfr	gs	<5	0.04
3	30 - 66	10 YR 4/4	C2D 10 YR 6/6	SiCL	1msbk	mvfr	gs	<5	0.04
4	66 - 162	10 YR 4/3	C2D 10 YR 5/6	SiCL	1msbk/0m	mvfr	gs	<5	0.04
5	162 - 180	10 YR 6/6	None	LS	0sg	ml		5 - 10	1.63
		Apparent perched groundwater at 108 in. in boring.							

8 Obs. # [X] Boring [ ] Pit Ground Surface Elev. 1066 ft Depth to limiting factor 66 in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr
1	0 - 13	10YR 2/2	None	SiCL	1msbk	mvfr	cs	<5	0.04
2	13 - 30	10 YR 4/3	None	SiCL	1msbk	mvfr	gs	<5	0.04
3	30 - 48	10 YR 4/4	None	SL/SiL	1msbk	mvfr	gs	<5	0.13 - 0.5
4	48 - 66	10 YR 4/4	C2D 10 YR 6/6	SiCL	1msbk	mfi	gs	<5	0.04
5	66 - 150	10 YR 4/3	C2D 10 YR 5/6	SiCL	1msbk/0m	mvfr	gs	<5	0.04
6	150 - 180	10 YR 6/4	None	S	0sg	ml		5 - 10	3.6
		Apparent perched groundwater at 114 in. in boring.							

Obs. # [ ] Boring [ ] Pit Ground Surface Elev. _____ ft Depth to limiting factor _____ in.

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate Inches/Hr

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SECTION E: BIDDERS ACKNOWLEDGEMENT

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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. _____ through _____ 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 _____ (name of corporation, partnership, or person submitting bid) a corporation organized and existing under the laws of the State of _____ a partnership consisting of _____; an individual trading as _____; of the City of _____ State of _____; that I have examined and carefully prepared this Proposal, from the plans and specifications and have checked the same in detail before submitting this Proposal; that I have fully authority to make such statements and submit this Proposal in (its, their) behalf; and that the said statements are true and correct.

_____
SIGNATURE

_____
TITLE, IF ANY

Sworn and subscribed to before me this
_____ day of _____, 20_____.

_____
(Notary Public or other officer authorized to administer oaths)
My Commission Expires _____
Bidders shall not add any conditions or qualifying statements to this Proposal.

SECTION F: DISCLOSURE OF OWNERSHIP & BEST VALUE CONTRACTING

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

State of Wisconsin
Department of Workforce Development
Equal Rights Division
Labor Standards Bureau

Disclosure of Ownership

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) and 103.49(7)(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), Wisconsin Statutes. 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) and 103.50(2), Wisconsin Statutes.

(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 P O Box	City	State	Zip Code
Name of Business			
Street Address or P O Box	City	State	Zip Code
Name of Business			
Street Address or P O Box	City	State	Zip Code

I hereby state under penalty of perjury that the information, contained in this document, is true and accurate according to my knowledge and belief.

Print the Name of Authorized Officer	
Signature of Authorized Officer	Date Signed
Name of Corporation, Partnership or Sole Proprietorship	

Street Address or P O Box	City	State	Zip Code

If you have any questions call (608) 266-0028

ERD-7777-E (R. 09/2003)

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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 & FROST)
- ☐ IRON WORKER
- ☐ IRON WORKER (ASSEMBLER, METAL BLDGS)
- ☐ PAINTER & DECORATOR
- ☐ PLASTERER
- ☐ PLUMBER
- ☐ RESIDENTIAL ELECTRICIAN
- ☐ ROOFER & WATER PROOFER
- ☐ SHEET METAL WORKER
- ☐ SPRINKLER FITTER
- ☐ STEAMFITTER
- ☐ STEAMFITTER (REFRIGERATION)
- ☐ STEAMFITTER (SERVICE)
- ☐ TAPER & FINISHER
- ☐ TELECOMMUNICATIONS (VOICE, DATA & VIDEO) INSTALLER-TECHNICIAN
- ☐ TILE SETTER

SECTION G: BID BOND

KNOW ALL MEN BY THESE PRESENT, THAT _____ (a corporation of the State of _____) (individual), (partnership), hereinafter referred to as the "Principal") and _____, a corporation of the State of _____ (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:

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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.

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

	Principal	Date
By:		
	Name of Surety	
By:		
		Date

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. _____ for the year _____, 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.

Date	Agent
	Address
	City, State and Zip Code
	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.

Certificate of Biennial Bid Bond

TIME PERIOD - VALID (FROM/TO)
NAME OF SURETY
NAME OF CONTRACTOR
CERTIFICATE HOLDER City of Madison, Wisconsin

This is to certify that a biennial bid bond issued by the above-named Surety is currently on file with the City of Madison.

This certificate is issued as a matter of information and conveys no rights upon the certificate holder and does not amend, extend or alter the coverage of the biennial bid bond.

Cancellation: Should the above policy be cancelled before the expiration date, the issuing Surety will give thirty (30) days written notice to the certificate holder indicated above.

Signature of Authorized Contractor Representative

Date

SECTION H: AGREEMENT

THIS AGREEMENT made this _____ day of _____ in the year Two Thousand and Thirteen between _____ 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 _____, 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:

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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 _____($_____) 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.

   "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, 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 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 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 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 Director of Affirmative Action.

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.

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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:

_____
Company Name

_____ _____
Witness Date President Date

_____ _____
Witness Date 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 City Attorney

Signed this _____ day of _____, 20____

_____ _____
Witness Mayor Date

_____ _____
Witness City Clerk Date

SECTION I: PAYMENT AND PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, that we _____
as principal, and
_____
Company of _____as surety, are held and firmly bound unto the City of Madison, Wisconsin, in the sum of _____($_____) 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:

SOUTH POINT ROAD WARM STORAGE BUILDING
CONTRACT NO. 6962

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 _____day of _____

Countersigned:

_____
Company Name (Principal)

_____ _____
Witness President Seal

_____
Secretary

Approved as to form:

_____
Surety Seal
☐ Salary Employee ☐ Commission

_____ By _____
City Attorney Attorney-in-Fact

This certifies that I have been duly licensed as an agent for the above company in Wisconsin under License No. _____ for the year 20_____, and appointed as attorney-in-fact with authority to execute this payment and performance bond which power of attorney has not been revoked.

_____ _____
Date Agent Signature

SECTION J: PREVAILING WAGE RATES

PREVAILING WAGE RATE DETERMINATION
Issued by the State of Wisconsin
Department of Workforce Development
Pursuant to s. 66.0903, Wis. Stats.
Issued On: 01/10/2013
Amended On: 02/18/2013

DETERMINATION NUMBER:	201300080
EXPIRATION DATE:	Prime Contracts MUST Be Awarded or Negotiated On Or Before 12/31/2013. 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

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	30.16	15.31	45.47
102	Boilermaker	31.09	24.52	55.61
103	Bricklayer, Blocklayer or Stonemason Future Increase(s): Add $ .80 on 6/1/2013 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	30.16	15.31	45.47
105	Carpenter	30.16	15.31	45.47
106	Carpet Layer or Soft Floor Coverer	30.16	15.31	45.47
107	Cement Finisher	31.48	13.19	44.67
108	Drywall Taper or Finisher	25.10	14.78	39.88
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.	32.94	18.80	51.74
110	Elevator Constructor	44.94	23.84	68.78
111	Fence Erector	22.50	3.98	26.48
112	Fire Sprinkler Fitter	36.07	18.60	54.67
113	Glazier	37.13	12.32	49.45
114	Heat or Frost Insulator	33.93	23.26	57.19
115	Insulator (Batt or Blown)	27.47	19.16	46.63
116	Ironworker	30.90	19.11	50.01
117	Lather	30.16	15.31	45.47
118	Line Constructor (Electrical)	37.05	16.94	53.99

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
119	Marble Finisher	20.00	0.00	20.00
120	Marble Mason	32.01	16.85	48.86
121	Metal Building Erector	18.05	8.08	26.13
122	Millwright	31.76	15.36	47.12
123	Overhead Door Installer	13.50	0.00	13.50
124	Painter	24.80	14.78	39.58
125	Pavement Marking Operator	30.00	0.00	30.00
126	Piledriver	30.66	15.31	45.97
127	Pipeline Fuser or Welder (Gas or Utility)	30.18	19.29	49.47
129	Plasterer	30.03	16.36	46.39
130	Plumber	36.17	15.37	51.54
132	Refrigeration Mechanic	42.45	16.71	59.16
133	Roofer or Waterproofer	30.40	2.23	32.63
134	Sheet Metal Worker	34.23	20.19	54.42
135	Steamfitter	41.20	16.28	57.48
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.	21.89	11.85	33.74
138	Temperature Control Installer	41.20	16.21	57.41
139	Terrazzo Finisher Future Increase(s): Add $ .80 on 6/1/2013	26.57	16.50	43.07
140	Terrazzo Mechanic	29.51	17.63	47.14
141	Tile Finisher Future Increase(s): Add $ .80/hr on 6/1/2013.	23.77	16.50	40.27
142	Tile Setter Future Increase(s): Add $ .80/hr on 6/1/2013.	29.71	16.50	46.21
143	Tuckpointer, Caulker or Cleaner Future Increase(s): Add $ .80 on 6/1/2013 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

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
144	Underwater Diver (Except on Great Lakes)	34.16	15.31	49.47
146	Well Driller or Pump Installer Future Increase(s): Add $.20/hr on 06/01/2013.	25.32	15.45	40.77
147	Siding Installer	37.20	17.01	54.21
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	24.00	11.57	35.57

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	31.89	17.98	49.87
203	Three or More Axle	18.00	11.45	29.45
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
205	Pavement Marking Vehicle	20.85	11.02	31.87
207	Truck Mechanic	18.00	11.45	29.45

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 Future Increase(s): Add $.75/hr. on 06/03/2013 Premium Increase(s): Add $1.00/hr for certified welder; Add $.25/hr for mason tender	24.19	13.90	38.09
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper	15.00	3.90	18.90
310	Gas or Utility Pipeline Laborer (Other Than Sewer and Water)	20.94	12.65	33.59

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	18.31	12.67	30.98
314	Railroad Track Laborer	23.41	6.91	30.32
315	Final Construction Clean-Up Worker	24.69	12.90	37.59

HEAVY EQUIPMENT OPERATORS
SITE PREPARATION, UTILITY OR LANDSCAPING WORK ONLY

CODE	Fringe Benefits Must Be Paid On All Hours Worked 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). Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
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). Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
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. Future Increase(s): Add $1/hr on 6/2/2013.	30.32	18.46	48.78

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
504	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
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. Future Increase(s): Add $2.19/hr on 01/01/2013; Add $2.00/hr on 01/01/2014. Premium Increase(s): Add $.50/hr for Friction Crane, Lattice Boom or Crane Certification (CCO).	38.80	20.17	58.97
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. Future Increase(s): Add $2.08/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	34.50	20.04	54.54
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. Future Increase(s): Add $1.88/hr on 01/01/2013; Add $2.00/hr on 01/01/2014.	28.70	19.86	48.56

HEAVY EQUIPMENT OPERATORS
EXCLUDING SITE PREPARATION, UTILITY, PAVING LANDSCAPING WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked 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. Future Increase(s): Add $1/hr on 6/2/2013. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50 at 400 Ton / Add $2/hr at 500 Ton & Over.	35.12	18.46	53.58

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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). Future Increase(s): Add $1/hr on 6/2/2013. Premium Increase(s): Add $.25/hr for all >45 Ton lifting capacity cranes.	34.12	18.46	52.58
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).	32.42	17.97	50.39
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). Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
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. Future Increase(s): Add $1/hr on 6/2/2013.	30.32	18.46	48.78

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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. Future Increase(s): Add $1/hr on 6/2/2013.	29.69	18.46	48.15
514	Gas or Utility Pipeline, Except Sewer & Water (Primary Equipment). Future Increase(s): Add $2/hr on 1/1/2013.	34.89	20.59	55.48
515	Gas or Utility Pipeline, Except Sewer & Water (Secondary Equipment). Future Increase(s): Add $1.60/hr on 06/01/2013; Add $1.60/hr on 06/01/2014; Add $1.65/hr on 06/01/2015.	31.32	17.95	49.27
516	Fiber Optic Cable Equipment Future Increase(s): Add $1.75/hr on 02/01/2013; Add $1.75/hr on 02/01/2014	26.69	16.65	43.34

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 Future Increase(s): Add $1.45/hr on 6/01/2013 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.	35.80	16.87	52.67
105	Carpenter Future Increase(s): Add $.75/hr on 6/3/2013. 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.	32.93	19.81	52.74
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/13; 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.	32.09	16.13	48.22
109	Electrician Future Increase(s): Add $1.60/hr on 6/1/2013. 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.	32.20	21.71	53.91
111	Fence Erector	22.50	3.98	26.48
116	Ironworker	30.90	19.11	50.01
118	Line Constructor (Electrical)	37.05	16.94	53.99
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	30.66	15.31	45.97
130	Plumber	36.97	17.66	54.63

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
135	Steamfitter	41.20	16.28	57.48
137	Teledata Technician or Installer	21.26	11.75	33.01
143	Tuckpointer, Caulker or Cleaner	32.01	16.85	48.86
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
146	Well Driller or Pump Installer	21.00	2.23	23.23
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	28.24	15.10	43.34
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.64	44.28
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

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	25.87	13.00	38.87
203	Three or More Axle	17.54	13.85	31.39
204	Articulated, Euclid, Dumptor, Off Road Material Hauler	31.89	17.98	49.87
205	Pavement Marking Vehicle	20.85	11.02	31.87
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 Future Increase(s): Add $.80/hr. on 06/03/2013 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.	25.53	13.89	39.42
303	Landscaper	26.92	12.51	39.43

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
304	Flagperson or Traffic Control Person	17.33	15.53	32.86
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.81	12.22	30.03
314	Railroad Track Laborer	23.41	6.91	30.32

HEAVY EQUIPMENT OPERATORS
SEWER, WATER OR TUNNEL WORK

CODE	Fringe Benefits Must Be Paid On All Hours Worked 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. Future Increase(s): Add $1/hr on 6/2/2013. Premium Increase(s): Add $.50/hr for >200 Ton / Add $1/hr at 300 Ton / Add $1.50 at 400 Ton / Add $2/hr at 500 Ton & Over.	35.12	18.46	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). Future Increase(s): Add $1/hr on 6/2/2013.	32.92	18.46	51.38
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). Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85

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.	31.89	18.11	50.00
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. Future Increase(s): Add $1/hr on 6/2/2013.	29.69	18.46	48.15
526	Boiler (Temporary Heat); Forklift; Greaser; Oiler.	30.44	19.10	49.54
527	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
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.	37.45	19.45	56.90
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.	27.75	19.15	46.90
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.	27.75	19.15	46.90

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

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
103	Bricklayer, Blocklayer or Stonemason	35.58	19.20	54.78
105	Carpenter	30.16	15.31	45.47
107	Cement Finisher Future Increase(s): Add $1.87 on 6/1/13; 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.	32.09	16.13	48.22
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.	32.94	18.80	51.74
111	Fence Erector	28.00	4.50	32.50
116	Ironworker	30.90	19.11	50.01
118	Line Constructor (Electrical)	31.29	15.34	46.63
124	Painter	26.65	13.10	39.75
125	Pavement Marking Operator	29.22	16.71	45.93
126	Piledriver	30.66	15.31	45.97
133	Roofer or Waterproofer	30.40	2.23	32.63
137	Teledata Technician or Installer	21.26	11.75	33.01
143	Tuckpointer, Caulker or Cleaner	32.01	16.85	48.86
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	17.00	46.64
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY	35.50	15.09	50.59

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	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

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	33.22	18.90	52.12
203	Three or More Axle Future Increase(s): Add $1.85/hr on 6/1/2013. 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.	23.31	17.13	40.44
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/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 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.	27.77	19.90	47.67
205	Pavement Marking Vehicle	23.84	14.94	38.78
206	Shadow or Pilot Vehicle	33.22	18.90	52.12
207	Truck Mechanic	22.50	16.19	38.69

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 Future Increase(s): Add $1.70/hr on 6/1/2013; 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).	28.35	13.90	42.25
302	Asbestos Abatement Worker	18.00	0.00	18.00
303	Landscaper Future Increase(s): Add $1.70/hr on 6/1/13; 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).	28.35	13.90	42.25
304	Flagperson or Traffic Control Person Future Increase(s): Add $1.70/hr on 6/1/2013; 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.	24.70	13.90	38.60
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.81	12.22	30.03
314	Railroad Track Laborer	23.41	6.91	30.32

HEAVY EQUIPMENT OPERATORS
AIRPORT PAVEMENT OR STATE HIGHWAY CONSTRUCTION

Fringe Benefits Must Be Paid On All Hours Worked

CODE	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 $2/hr on 6/1/13; Add $1.75/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 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.	35.22	19.90	55.12
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 $2/hr on 6/1/13; Add $1.75/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 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.	34.72	19.90	54.62

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 $2/hr on 6/1/13; Add $1.75/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 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.	34.22	19.90	54.12
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 $2/hr on 6/1/13; Add $1.75/hr on 6/1/14. Premium Increase(s):	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
	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 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.			
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 $2/hr on 6/1/13; Add $1.75/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 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.	33.67	19.90	53.57
536	Fiber Optic Cable Equipment.	25.74	15.85	41.59
537	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
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.	37.45	19.45	56.90
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.	27.75	19.15	46.90
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.	27.75	19.15	46.90

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	33.00	15.00	48.00
105	Carpenter	30.16	15.31	45.47
107	Cement Finisher	31.48	15.68	47.16
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.	32.94	18.80	51.74
111	Fence Erector	22.50	3.98	26.48
116	Ironworker	30.90	19.11	50.01
118	Line Constructor (Electrical)	37.05	16.94	53.99
124	Painter	24.80	14.78	39.58
125	Pavement Marking Operator	28.10	15.00	43.10
126	Piledriver	30.66	15.31	45.97
133	Roofer or Waterproofer	30.40	2.23	32.63
137	Teledata Technician or Installer	21.26	11.75	33.01
143	Tuckpointer, Caulker or Cleaner	32.01	16.85	48.86
144	Underwater Diver (Except on Great Lakes)	37.45	19.45	56.90
150	Heavy Equipment Operator - ELECTRICAL LINE CONSTRUCTION ONLY	29.64	14.55	44.19
151	Light Equipment Operator -ELECTRICAL LINE CONSTRUCTION ONLY 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.	30.60	14.64	45.24
152	Heavy Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	25.94	13.57	39.51
153	Light Truck Driver - ELECTRICAL LINE CONSTRUCTION ONLY	24.08	12.96	37.04
154	Groundman - ELECTRICAL LINE CONSTRUCTION ONLY	21.75	11.90	33.65

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	25.87	13.00	38.87
203	Three or More Axle	17.00	0.00	17.00
204	Articulated, Euclid, Dumptor, Off Road Material Hauler Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
205	Pavement Marking Vehicle	20.85	11.02	31.87
206	Shadow or Pilot Vehicle	25.87	13.00	38.87
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	27.20	13.37	40.57
303	Landscaper	18.25	1.11	19.36
304	Flagperson or Traffic Control Person	17.33	15.53	32.86
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.81	12.22	30.03
314	Railroad Track Laborer	23.41	6.91	30.32

HEAVY EQUIPMENT OPERATORS
CONCRETE PAVEMENT OR BRIDGE WORK

Fringe Benefits Must Be Paid On All Hours Worked

CODE	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 $2/hr on 6/1/13; Add $1.75/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 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.	35.22	19.90	55.12
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 $2/hr on 6/1/13; Add $1.75/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 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.	34.72	19.90	54.62

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 $2/hr on 6/1/13; Add $1.75/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 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.	34.22	19.90	54.12
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. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/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 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.	33.96	19.90	53.86

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
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.	29.82	17.98	47.80
546	Fiber Optic Cable Equipment.	25.74	15.85	41.59
547	Work Performed on the Great Lakes Including Diver; Wet Tender or Hydraulic Dredge Engineer.	37.45	19.45	56.90
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.	37.45	19.45	56.90
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.	27.75	19.15	46.90
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.	27.75	19.15	46.90

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.	34.62	17.98	52.60
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/hr on 6/2/2013.	32.92	18.46	51.38

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. Future Increase(s): Add $1/hr on 6/2/2013.	32.39	18.46	50.85
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. Future Increase(s): Add $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
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 $2/hr on 6/1/13; Add $1.75/hr on 6/1/14.	33.67	19.55	53.22
556	Fiber Optic Cable Equipment.	25.74	15.85	41.59

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

Fringe Benefits Must Be Paid On All Hours Worked

CODE	TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
101	Acoustic Ceiling Tile Installer	19.50	11.10	30.60
102	Boilermaker	31.09	24.52	55.61
103	Bricklayer, Blocklayer or Stonemason	23.00	0.00	23.00
104	Cabinet Installer	16.25	3.22	19.47
105	Carpenter	30.16	1.36	31.52
106	Carpet Layer or Soft Floor Coverer	23.95	6.48	30.43
107	Cement Finisher	22.46	2.71	25.17
108	Drywall Taper or Finisher	15.50	0.00	15.50
109	Electrician	17.00	13.64	30.64
110	Elevator Constructor	44.94	23.84	68.78
111	Fence Erector	18.52	5.93	24.45
112	Fire Sprinkler Fitter	36.07	18.60	54.67
113	Glazier	37.13	12.32	49.45
114	Heat or Frost Insulator	35.00	0.00	35.00
115	Insulator (Batt or Blown)	18.50	13.98	32.48
116	Ironworker	30.90	19.11	50.01
117	Lather	30.16	1.36	31.52
119	Marble Finisher	16.50	2.38	18.88
120	Marble Mason	23.00	0.00	23.00
121	Metal Building Erector	16.52	1.82	18.34
123	Overhead Door Installer	17.00	0.00	17.00
124	Painter	23.00	11.27	34.27
125	Pavement Marking Operator	28.10	15.00	43.10

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
129	Plasterer	20.00	0.00	20.00
130	Plumber	38.90	0.00	38.90
132	Refrigeration Mechanic	33.00	1.79	34.79
133	Roofer or Waterproofer	17.50	3.73	21.23
134	Sheet Metal Worker	21.03	3.40	24.43
135	Steamfitter	41.20	16.28	57.48
137	Teledata Technician or Installer	19.23	1.46	20.69
138	Temperature Control Installer	21.00	0.00	21.00
139	Terrazzo Finisher	26.57	16.00	42.57
140	Terrazzo Mechanic	30.01	17.13	47.14
141	Tile Finisher	20.60	4.88	25.48
142	Tile Setter	19.00	0.00	19.00
143	Tuckpointer, Caulker or Cleaner	32.50	2.84	35.34
146	Well Driller or Pump Installer	19.00	7.30	26.30
147	Siding Installer	19.07	0.00	19.07

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	4.18	32.23
203	Three or More Axle	20.00	4.37	24.37
205	Pavement Marking Vehicle	20.85	11.02	31.87
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	19.80	7.22	27.02
302	Asbestos Abatement Worker	18.00	6.24	24.24
303	Landscaper	13.15	6.51	19.66

CODE	Fringe Benefits Must Be Paid On All Hours Worked TRADE OR OCCUPATION	HOURLY BASIC RATE OF PAY $	HOURLY FRINGE BENEFITS $	TOTAL $
311	Fiber Optic Laborer (Outside, Other Than Concrete Encased)	17.81	12.22	30.03
315	Final Construction Clean-Up Worker	15.00	0.00	15.00

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.	31.89	18.20	50.09
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.	28.70	4.91	33.61

********** END OF RATES **********