Project Manual
TECHNICAL SPECIFICATIONS

MADISON METRO TRANSIT SATELLITE FACILITY – CONTROLS UPGRADE

CITY OF MADISON METRO TRANSIT
3829 AND 3901 HANSON RD. MADISON, WI

Bid Documents
JANUARY 6, 2022

Madison Contract No. 9136

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SECTION 00 31 46
PERMITS

PART 1 – GENERAL

1.1. SUMMARY

A. Each project has varying requirements for permits, inspections, and fees based on the scope, size, and location of the project.

B. The City of Madison (Owner) is subject to all permits, inspections and associated fees for construction, demolition, utility connection, storm water management, and other similar requirements that may be required to complete the scope of work associated with these contract documents.

C. The General Contractor (GC) shall be responsible for obtaining all permits, inspections and paying for all associated fees unless specifically identified within this specification.

1.2. REFERENCES

A. The following references are not intended to be all inclusive. It shall be the GC's responsibility to determine all requirements based on the scope of work in the contract documents.

B. City of Madison Ordinances: Review all ordinances that may require a permit or fee that may be connected with a required permit. Contact the following City Agencies to determine the exact requirements during bidding
   1. Building Inspection
   2. Zoning
   3. Engineering
   4. Water Utility
   5. Traffic Engineering
   6. Others as may be specified by the contract documents.

B. State Statutes

C. Other Regulatory Regulations

D. Other Agencies or companies that may have related requirements
   1. Madison Metropolitan Sewerage District
   2. Local gas and electric utility companies
   3. Other utility companies

1.3. GENERAL CONTRACTORS REQUIREMENTS

A. The GC shall be responsible for all of the following:
   1. Execute application for all required permits as may be required by the scope of work described within the contract documents.
   2. Scheduling all required inspections that may be conditions of any required permits.
   3. Paying for other permits not explicitly stated as excluded in this section.

B. The GC is not responsible for paying for the City Building, City HVAC, City Electrical, City Plumbing, Madison Fire Department Sprinkler and Madison Fire Department Fire Alarm permits.

C. The GC shall provide high quality scanned images of all required permits and inspections to the City Project Manager (CPM).

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 00 43 25
SUBSTITUTION REQUEST FORM (DURING BIDDING)

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison uses a specific list of preferred products for various specification items to establish standards of quality, utility, and appearance required.

B. The City of Madison will not allow substitutions for specified Products except as follows:

1. The Product is no longer produced or the product manufacturer is no longer in business.
2. The manufacturer has significantly changed performance data, product dimensions, or other such design criteria for the specified Product(s).
3. Products specified by naming one or more Products or manufacturer's and "or approved equal" or "approved equivalent."

C. The procedures in this specification shall apply to all proposals by Contractors, Suppliers, Vendors, and Manufacturers when the conditions in item 1.1.B. above have been met during the bidding phase.

1.2. RELATED SPECIFICATIONS

A. 01 25 13 Product Substitution Procedures

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. REQUESTING A SUBSTITUTION DURING BIDDING

A. In the event that a substitution is requested during the bidding phase the Contractor, Supplier, Vendor, or Manufacturer shall do all of the following:

1. Submit a Substitution Request Form for each different product. Use a printed/scanned copy of the form at the end of this specification as a cover sheet.
2. Support your request with complete data, drawings, specifications, performance data and samples as appropriate. A complete submission shall include the following:
   a. Substitution Request Form as a cover sheet
   b Comparison of qualities of the proposed substitutions with that specified.
   c. Changes required in other elements of the Work because of the substitution.
   d. Effect on the construction schedule.
   e. Cost data comparing the proposed substitution with the Product specified.
   f. Any required license fees or royalties.
   g. Availability of maintenance service and source of replacement materials.
3. Submit the Substitution Request Form and all required supporting documentation to the City Project Manager and Project Architect.
   a. Submissions to be done as complete PDF files for each product, appropriately titled
   b. Email submissions to the Project Architect and City Project Manager at the email addresses provided on the last page of Section D of the contract documents.
      i. The subject line shall include the contract number and "Request for Substitution". Example: Contract 1234 – Request for Substitution
4. Submissions must be received by the substitution request deadline specified in Section A of the Contract Documents.

3.2. SUBMISSION REVIEW

A. The Project Architect, City Project Manager, members of the design team, and the Owners staff shall review all submissions for substitutions during the bidding phase.

3.3. SUBSTITUTION APPROVAL

A. All requests for substitutions that have been approved shall be published by Addenda to the bid documents.

NOTE SEE NEXT PAGE FOR SAMPLE SUBSTITUTION REQUEST FORM.

3.4. SUBSTITUTION REQUEST FORM

For Pre-bid Substitution Requests all text boxes on this form are required information for a complete request.

Substitution Request

Today's Date:

Project Title:

Project Number: *Contract Number:*

By completing and submitting this form for review the General Contractor affirms that all of the following statements are correct:

1. The General Contractor affirms that this request is in compliance with the requirements described in ***Specification 01 25 13 Product Substitution Procedures.***
2. The function, appearance, and quality of the proposed substitution are equal or superior to the specified item.
3. The proposed substitution does not affect dimensions shown on the drawings.
4. The proposed substitution will have no adverse affects on other trades, the construction schedule, or any specified warranty requirements.
5. Maintenance and service parts will be locally available for the proposed substitution. (GC shall provide supporting documentation in the attachments section below.)
6. The General Contractor shall be responsible for any and all costs associated with this substitution request if approved. This includes but is not to limited to fees for building design, engineering design fees, detailing fees, plan review fees, construction costs, and inspection fees.

GC Substitution Request:

General Title:

Related Specification:

Reason for Substitution:

Proposed Substitution:
(include Name, Model, etc.)

Submitted By: *Phone:*

Company: *Email:*

END OF SECTION

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SECTION 00 43 43
WAGE RATES FORM

PART 1 – GENERAL

1.1. SUMMARY

A. The Reimbursable Hourly Worksheet is a contractor provided document that indicates the basic rate of pay, fringe benefits, and each companies cost of required insurance for all Trades and Classifications that will be performing productive labor during the execution of this contract.
   1. Rates shall be similar to recognized rates published by the Bureau of Labor Statistics, Associated General Contractors (AGC), Associated Builders and Contractors (ABC), appropriate union contracts, and other similar organizations or documents.

B. The Reimbursable Labor Rate Worksheet shall provide the basis for labor rates being used on Change Order Request forms.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 57 Change Order Request
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 23 Project Management Web Site (SharePoint)
D. Section 01 32 19 Submittals Schedule

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

A. Prior to the Pre-Construction Meeting the City Project Manager (CPM) or the City Construction Manager (CCM) shall provide the GC a copy of the *Reimbursable Labor Rate Worksheet.xls*.
   1. See the last page of this specification for an example of the worksheet.

B. The GC shall provide all subcontractors that will be performing productive labor during the execution of this contract with additional copies of the worksheet as needed.

C. All contractors shall be required to fill out and submit completed worksheets for all Trades and Classifications of labor that will be performing productive labor during the execution of this contract.

3.2. GENERAL CONTRACTORS RESPONSIBILITIES

A. The GC shall consolidate all Trades and Classifications into one master Excel Workbook of all trades.

B. The GC shall provide the combined workbook as required by Section 1.6 of Specification 01 32 19 Submittals Schedule for review and approval by the Owners Representatives.
   1. Submittal shall be an Exported PDF of the completed Excel Workbook.
      a. As an Exported PDF the individual worksheets will be bookmarked and the document will be word searchable for easy reference.

C. The GC shall only use the rates posted in the approved submittal throughout the execution of this contract.

Reimbursable Hourly Rate Worksheet

(see bottm of page for instructions)

Project Name:

Project Location:

Project Number:

Contractor:

Rates are based on the following documentaton:

Enter TRADE Here:

Carpenter

Classification:		Foreman	Journeyman	Laborer	Apprt 1	Other	Other	Other
Base Rate (BR)		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Vacation		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Health Insurance		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Pension		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Apprenticeship		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Sub-total		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
BR Sub-total		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Work. Comp	% of BR	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Gen Liability	% of BR	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
WI Unemploy	% of BR	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Fed Unemploy	% of BR	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
FICA	% of BR	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Sub-total		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
TOTAL COST		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

Enter **YOUR** percentage of base rate in the column below.

% of BR	
0	- Work. Comp
0	- Gen Liability
0	- WI Unemploy
0.6	- Fed Unemploy
7.65	- FICA

Form Instructions:

1. Provide a work sheet for ALL Trade Classifications that will be performing on site productive labor during the execution of this project.

2. Responsible contractor to complete only boxes that are shaded, all non-shaded boxes are formula driven.

3. Contractor shall provide the name of the source used for these rates. (union contract, Bureau of Labor and Statistices, AGC, ABC, etc.) and be prepared to provide copies if so requested.

END OF SECTION

SECTION 00 62 76.13
SALES TAX FORM

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison is a qualifying tax exempt entity in the State of Wisconsin.

B. The Contractor shall refer to *Section 102.9 – Bidders Understanding* of the *City of Madison Standard Specifications for Public Works Construction* for more information on Tax Exempt Status.

C. This project constructs or remodels facilities owned by the City of Madison in Madison, Wisconsin.

1.2. RELATED SPECIFICATION SECTIONS

A. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".

1. Use the following link to access the Standard Specifications web page:
   http://www.cityofmadison.com/business/pw/specs.cfm
   a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
   b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

1.3. TAX EXEMPT FORM

A. The Contractor can access Wisconsin Sales and Use Tax Exemption Certificates (form S-211, Wisconsin Department of Revenue) from the City of Madison Finance website.

1. City of Madison tax exempt information and signature by Purchasing Supervisor is already completed.
2. Website: http://www.cityofmadison.com/employeenet/finance/purchasing
   a. Under the title *Purchasing Forms*, scroll down to the form link titled *Sales Tax Exempt Form S-211*.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 25 13
PRODUCT SUBSTITUTION PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison uses a specific list of preferred products for various specification items to establish standards of quality, utility, and appearance required.

B. The City of Madison will not allow substitutions for specified Products except as follows:

1. The Product is no longer produced or the product manufacturer is no longer in business.
2. The manufacturer has significantly changed performance data, product dimensions, or other such design criteria for the specified Product(s).
3. Products specified by naming one or more Products or manufacturer's and "or approved equal" or "approved equivalent."

C. The City of Madison will not allow substitutions for specified Products as follows:

1. For Products specified by naming only one Product and manufacturer, no substitute product will be considered.
2. For Products specified by naming several Products or manufacturers select any one of the products or manufacturers named, which complies with the specifications. No substitute product will be considered.

D. Request for substitutions from any party other than the General Contractor (GC) will not be accepted.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 33 23 Submittals

PART 2 – PRODUCTS

2.1. SUBSTITUTION REQUEST FORM

A. During bidding all contractors (General and Sub-contractors) and suppliers of materials or products shall provide hard copy of the Substitution Request form and all required attachments directly to the Project Engineer.

B. After bidding only the GC shall submit a request and shall use the form provided by CPM.

PART 3 - EXECUTION

3.1. REQUESTING A SUBSTITUTION DURING BIDDING

A. In the event that a substitution is requested during the bidding phase the Contractor or Supplier shall meet the substitution request deadline listed in the bidding documents. No substitution request will be considered during the bidding period after the stated substitution request deadline. In general this procedure shall be as follows:

1. Submit the Substitution Request Form including all required supporting documentation to the City Project Manager and Project Engineer by the substitution request deadline specified in Section A of the Contract Documents.
2. Submit a Substitution Request Form for each product, supported with complete data, drawings and samples as appropriate, including:
    i. Comparison of qualities of the proposed substitutions with that specified.
    ii. Changes required in other elements of the Work because of the substitution.
    iii. Effect on the construction schedule.
    iv. Cost data comparing the proposed substitution with the Product specified.
    v. Any required license fees or royalties.

vi. Availability of maintenance service and source of replacement materials.

3. The Owner and Engineer will review the Substitution Request Form and if approved the City of Madison will publish a bidding addendum authorizing the replacement. The Owner and Engineer may reject any substitution request without providing specific reasons.

B. Substitutions submitted and approved during the bidding phase shall be announced by the City of Madison by addenda prior to the bid due date.

3.2. REQUESTING A SUBSTITUTION AFTER AWARD OF CONTRACT

A. A substitution request will only be considered after award of contract if it meets the qualifying provisions as described in 1.1.B.1 above.

B. The GC shall submit a substitution request using the form provided by CPM.

1. Consulting Staff, Owner and Owners Representatives will review the request and provide the appropriate approvals and feed back to the GC.

3.3. UNAUTHORIZED SUBSTITUTIONS

A. Any Contractor who substitutes products without proper authorization by the Owner and Engineer will be required to immediately remove and replace the product and all costs required to conform to the Contract Documents shall be borne by the General Prime Contractor.

END OF SECTION

SECTION 01 26 13
REQUEST FOR INFORMATION (RFI)

PART 1 – GENERAL

1.1. SUMMARY

A. Contractors shall use the RFI form/process to request additional information or clarification regarding the construction documents.

B. Form will be provided by CPM.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 46 Construction Bulletin (CB)

B. Section 01 26 57 Change Order Request (COR)

C. Section 01 26 63 Change Order (CO)

1.3. PERFORMANCE REQUIREMENTS

A. RFI issues initiated by any contractor shall be done through the General Contractor (GC).

1. RFIs submitted by any Sub-contractor under the GCs control shall be returned with no response.

B. Submit a new RFI for each issue. Only multiple questions that are of a similar nature may be combined into one RFI shall be allowed and responded to.

1.4. QUALITY ASSURANCE

A. The GC shall be responsible for all of the following:

1. Ensure that any request for additional information is valid and the information being requested is not addressed in the construction documents.
2. Ensure that all requests are clearly stated and the RFI form is completely filled out.
3. Ensure that all Work associated an RFI response is carried out as intended.

B. The Project Engineer (PE) shall be responsible for the following:

1. Ensure that all responses to contractor initiated RFIs are properly responded to in a timely fashion.
   a. The CPM, Owner, consulting staff, and other City staff shall be responsible for the initial review of the RFI. The PE shall be responsible for codifying all consultant and Owner/City staff comments into a unified RFI response.

PART 2 – PRODUCTS

2.1. REQUEST FOR INFORMATION FORM

A. Will be provided by CPM.

PART 3 - EXECUTION

3.1. CONTRACTOR INITIATED RFI

A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents any contractor may initiate an RFI for additional information or clarification through the GC.

3.2. RFI RESPONSES

A. Responses to simple RFI issues shall use the response section of the RFI form and shall be completed within five (5) working days of the RFI form being submitted.

B. Responses to more complex issues may require additional time or may require a Construction Bulletin to be published. The initial RFI shall be responded to within five (5) working days stating that the RFI is being reviewed and provide an estimated date for the response.

C. The following GC generated RFIs will be returned without action:

1. Requests for approval of submittals
2. Requests for approval of substitutions
3. Requests for approval of Contractor's means and methods.
4. Requests for coordination information already indicated in the Contract Documents.
5. Requests for adjustments in the Contract Time or the Contract Sum.
6. Requests for interpretation of A/E's actions on submittals.
7. Incomplete RFI or inaccurately prepared RFI.

3.3. COMMENCEMENT OF WORK RELATED TO AN RFI

A. The GC shall only proceed with the Work of an RFI where, additional information is not required.

B. The GC shall not proceed with any Work associated with an RFI while it is under review.

C. The GC shall not proceed with any Work associated with an RFI that clearly states a CB will be issued in response to the RFI.

D. The GC will be required to immediately remove and replace unauthorized Work and all costs required to conform to the Contract Documents shall be borne by the GC.

END OF SECTION

SECTION 01 26 46
CONSTRUCTION BULLETIN (CB)

PART 1 – GENERAL

1.1. SUMMARY

A. Construction Bulletins (CB) are formal published construction documents that modify the original contract bid documents after construction has commenced. CBs may be published for many reasons, including but not limited to the following:
   1. Clarification of existing construction documents including specifications, plans, and details
   2. Change in product or equipment
   3. A response to a Request for Information
   4. Change in scope of the contract as either an add or a deduct of work

B. CBs provide a higher degree of detail in response to a Request for Information (RFI) through directives, revised plans/details, and specifications as necessary.

C. The CB may change the original contract documents through additions or deletions to the Work.

D. Where the directives of a CB are significant enough to warrant a Change Order Request (COR) the GC shall use all information provided in the CB to assemble all required back-up documentation for additions and deletions of materials, labor and other related contract costs for the COR.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 26 57 Change Order Request (COR)
C. Section 01 26 63 Change Order (CO)

1.3. PERFORMANCE REQUIREMENTS

A. Project Engineer (PE): The PE shall be the only person authorized to publish a CB as needed for any reason indicated in section 1.1.A above. The PE shall consult as necessary with any of the following while drafting the CB and shall confirm final direction with the CPM prior to issuing a CB:
   1. City Project manager (CPM)
   2. Owner
   3. Members of the consulting staff
   4. Members of city staff
   5. The General Contractor
   6. Sub-contractors

B. General Contractor: The GC shall be responsible for the following as needed:
   1. Executing the directives of the CB when he/she believes that no changes in labor, materials, equipment, or contract duration will be required for additions or deletions.
   2. Submit a COR when he/she believes that a change in labor, materials, equipment or contract duration will be required for additions or deletions.

1.4. QUALITY ASSURANCE

A. The PE shall be responsible for ensuring the final CB sufficiently provides direction, details, specifications and other information as necessary for the GC to perform the intended Work.

B. The PE shall be responsible for ensuring the final CB is published as expeditiously as practical based on the complexity of the CB being written. CBs that may affect the GC critical path shall be given priority.

PART 2 – PRODUCTS

2.1. CONSTRUCTION BULLETIN FORM

A. Will be provided by CPM.

PART 3 - EXECUTION

3.1. WRITING THE CONSTRUCTION BULLETIN

A. The PE shall draft a CB as needed using the form provided by CPM.
   1. The PE and/or consulting staff as necessary shall provide specifications, model numbers and performance data, details and other such information necessary to clearly state the intentions of the CB.
   2. The consulting staff, CPM, Owner, and other City Staff shall review the draft and recommend changes as needed.
   3. The PE shall amend the draft as necessary into a final CB for review

B. Once the final CB has been approved the PE shall submit it to the GC.

3.2. EXECUTING THE CONSTRUCTION BULLETIN

A. The GC shall acknowledge receipt of the CB.

B. The GC shall notify all Sub-contractors of the CB and publish the CB to all field sets of drawings and specifications as appropriate.

C. The GC shall execute the directives of the CB or submit COR documentation as necessary during the execution and implementation of the CB.
   1. See Specification 01 26 57 Change Order Request (COR)

END OF SECTION

SECTION 01 26 57
CHANGE ORDER REQUESTS (COR)

PART 1 – GENERAL

1.1. SUMMARY

A. Except in cases of emergency no changes in the Work required by the Contract Documents may be made by the General Contractor (GC) without having prior approval of the City Engineer or his representative.

B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in the Work by written Change Order (CO). Such changes may include additions and/or deletions.

C. Where the City desires to make changes in the Work through use of written Change Order Request (COR), the following procedures apply:

1. If requested by the City, the GC shall prepare and submit a detailed proposal, including all cost and time adjustments to which the GC believes it will be entitled if the change proposed is incorporated into the Contract. The City shall be under no legal obligation to issue a Change Order for such proposal.
2. The parties shall attempt in good faith to reach agreement on the adjustments needed to the Contract to properly incorporate the proposed change(s) into the Work. In the event that the parties agree on such adjustments, the City may issue a Change Order and incorporate such changes and agreed to adjustments, if any.
3. In some instances, it may be necessary for the City to authorize Work or direct changes in Work for which no final and binding agreement has been reached and for which unit prices are not applicable. In such cases the following shall apply.
    a. Upon written request by the City, the GC shall perform proposed Work
    b. The cost of such change may be determined in accordance with this specification.
    c. In the event agreement cannot be accomplished as contemplated herein, the City may authorize the Work to be performed by City forces or to hire others to complete the Work. Such action on the part of the City shall not be the basis of a claim by the GC for failure to allow it to perform the changed Work.

D. Where changes in the Work are made by the City through use of a force account basis, the GC shall as soon as practicable, and in no case later than ten (10) working days from the receipt of such order, unless another time period has been agreed to by both parties, give the City written Notice, stating:

1. The date, circumstances and source of the extra work; and,
2. The cost of performing extra work described by such Order, if any; and,
3. Effect of the order on the required completion date of the Project, if any.

E. The giving of each Notice by the GC as prescribed by this specification, shall be a requirement to liability of the City for payment of any additional costs incurred by the GC in implementing changes in the Work. Under this specification, no order or statement of the City shall be treated as a Change Order, or shall entitle the GC to an equitable adjustment of the terms of this Contract or damages for costs incurred by the GC on any activity for which the Notice was not given.

F. In the event Work is required due to an emergency as described in this specification the GC must request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the commencement of such emergency.

G. All GC requests for equitable adjustment shall be submitted to the CPM per the specifications below. Such requests shall set forth with specificity the amount of and reason(s) for the proposed adjustment and shall be accompanied by supporting information and documents.

H. No adjustment of any kind shall be made to this Contract, if asserted by the GC for the first time, after the date of final payment.

I. This specification shall be used by the GC when preparing documentation for any COR to ensure each has been properly and completely filled out as required by the City of Madison.

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)

B. Section 01 26 46 Construction Bulletins (CB)

C. Section 01 26 63 Change Order (CO)

D. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".

1. Use the following link to access the Standard Specifications web page:
   http://www.cityofmadison.com/business/pw/specs.cfm
   a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
   b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

1.3. DEFINITIONS AND STANDARDS

A. LABOR: The amount of time and cost associated with the performance of human effort for a defined scope of Work. Labor is further defined as follows:
   1. Labor rate is the total hourly rate which includes the base rate of pay, fringe benefits plus each company's cost of required insurance, also referred to as a reimbursable labor rate.
   2. Unit labor is the labor hours anticipated to install the corresponding unit of material.
   3. Labor cost is the labor hours multiplied by the hourly labor rates.

B. MATERIAL: Actual material cost is the amount paid, or to be paid, by the GC for materials, supplies and equipment entering permanently into the Work, including cost of transportation and applicable taxes. The cost shall not exceed the usual and customary cost for such items available in the geographical area of the project.

C. LARGE TOOLS AND MAJOR EQUIPMENT: Large tools and major equipment are those with an initial cost greater than $1,500, whether from the GC or other sources.
   1. Tool and equipment use and time allowed is only for extra work associated with change orders.
      a. Rental Rate is the machine cost associated with operating a piece of equipment for a defined length of time (hour, day, week, or month) and shall not exceed the usual and customary amount for such items available in the geographical area of the project.
      b. Rental cost is the rental rate multiplied by the anticipated duration the equipment shall be required.
   2. The GC shall provide a breakdown of all rental rates to indicate what items and costs are associated with the rate. Examples of items to include in the breakdown would be fuel consumption, lubrication, maintenance and other similar expenses but not including profit and overhead.
   3. When large tools and equipment needed for Change Order work are not already at the job site, the actual cost to get the item there is also reimbursable.

D. BOND COST: The cost shall be calculated at 1% of the total proposed change order.

E. SUB-CONTRACTOR COSTS: Sub-contractor costs are for those labor, material, and equipment costs required by subcontracted specialties to complete the Change Order work.

F. OVERHEAD AND PROFIT Markup: The allowable markup percentage to a COR by the GC and Sub-contractors for overhead and profit. All of the following are expenses associated with overhead and profit and shall not be reimbursable as individual items on any COR:
   1. CHANGE ORDER PREPARATION: All costs associated with the preparing and processing of the change order.
   2. DESIGN, ESTIMATING, AND SUPERVISION: All such efforts, unless specifically requested by Owner as additional Work to be documented as a COR or portion thereof.
   3. INSTALLATION LAYOUT: The layout required for the installation of material and equipment, and the installation design, is the responsibility of the GC.

4. SMALL TOOLS AND SUPPLIES: The cost of small hand tools with an initial cost of $1,500 or less, along with consumable supplies and expendable items such as drill bits, saw blades, gasoline, lubricating or cutting oil, and similar items.
5. GENERAL EXPENSE: The general expense, which is those items that are a specific job cost not associated with direct labor and material such as job trailers, foreman truck, and similar items.
6. RECORD DRAWINGS: The preparation of record or as-built drawings.
7. OTHER COSTS: Any miscellaneous cost not directly assessable to the execution of the Change Order including but not limited to the following:
   a. All association dues, assessments, and similar items.
   b. All education, training, and similar items.
   c. All drafting and/or engineering, unless specifically requested by Owner as additional Work to be documented as a Change Order proposal or portion thereof.
   d. All other items including but not limited to review, coordination, estimating and expediting, field and office supervision, administrative work, etc.

G. Contract Extension: The necessary amount of time to be added to the contract deadlines for the completion of a change order.

1.4. CONTRACT EXTENSION

A. The GC shall not assume that every COR will require a Contract Extension. If the GC feels a contract extension is warranted he/she shall provide sufficient scheduling information that shows how the COR being requested impacts the critical path of the project.

B. The City of Madison strongly encourages the GC to explore alternative methods and practices prior to submitting a COR with a request for contract extension.

1.5. OVERHEAD AND PROFIT MARKUP

A. Pursuant to the City of Madison Standard Specifications for Public Works Construction, Section 104.7, Extra Work, the following maximum allowable markups shall be strictly enforced on all change orders associated with the execution of this contract.
   1. The total maximum overhead and profit shall not exceed fifteen percent (15%) of the total costs.
   2. The total maximum overhead and profit shall be distributed as follows:
      a. For work performed and materials provided solely by the General Contractor, fifteen percent (15%) of the total costs.
      b. For work performed and materials provided solely by Sub-contractors and supervised by the General Contractor:
         i. Supervision of the GC, five percent (5%) of the total Sub-contractor cost.
         ii. Sub-contractors work and materials ten percent (10%) of the total Sub-contractor cost.

1.6. PERFORMANCE REQUIREMENTS

A. The GC shall become thoroughly familiar with this specification as it will identify procedures and expenses that are or are not allowed under the Change Order and Change Order Request process.

B. The GC shall be responsible for all of the following:
   1. Carefully reviewing the CB that is associated with the COR.
   2. Collecting required supporting documentation from all contractors that quantify the need for a COR.
      a. Labor hours and wage rates
      b. Material costs
      c. Equipment costs

C. The following shall apply to establishing prices for labor, materials, and equipment costs:
   1. Where Work to be completed has previously been established by individual bid items in the contract bid proposal the GC shall use the unit bid prices previously established.
   2. Where Work to be completed was bid as a Lump Sum without individual bid items the GC shall provide a breakdown of all labor, materials, equipment including unit rates and quantities required.

D. The completion date is determined by Owner. The schedule, however, is the responsibility of the GC. Time extensions for extra Work will be considered when a schedule analysis of the critical path shows that the Change Order Request places the Work beyond the completion date stated in the Contract.

1.7. QUALITY ASSURANCE

A. The GC shall be responsible for ensuring that all COR supporting documentation meets the following requirements prior to completing the COR form:

1. Sufficiently indicates labor, material, and other expenses related to completing the intent of the CB.
2. No costs exceed the usual and customary amount for such items available in the geographical area of the project, and no costs exceed those established under the contract.

B. The Project Engineer (PE), City Project Manager (CPM), other members of the consulting staff, and city staff shall review all COR requests to ensure that the intent of the CB will be met under the proposal of the COR or request additional information as necessary.

PART 2 – PRODUCTS

2.1. CHANGE ORDER REQUEST FORM

A. Will be provided by CPM.

PART 3 - EXECUTION

3.1. ESTABLISHING A CHANGE ORDER REQUEST

A. Upon receipt of a Construction Bulletin (CB) where the GC believes a significant change in contract scope warrants the submittal of a COR the GC shall do all of the following within ten (10) working days after receipt of the CB:
   1. Review the CB with all necessary trades and sub-contractors required by the change in scope.
      a. Additions or deletions to the contract scope shall be as directed within the CB.
      b. Additions or deletions of labor and materials shall be determined by the GC based on the directives of the CB.
   2. Assemble all required back-up documentation for additions and deletions ~~of~~ including material~~s~~ breakdown, labor breakdown and other related contract costs as previously outlined in this specification.
   3. Submit a COR request form.

B. Submitting a COR does not obligate the GC to complete the work associated with the COR nor does it obligate the Owner to approve the COR as a change to the contract.

3.2. CHANGE ORDER REQUEST REVIEW, APPROVAL, AND PROCESSING

A. The PE and CPM shall review all CORs submitted by the GC.
   1. Additional consulting staff and city staff having knowledge of the components of the COR shall review and advise the PE and CPM as to the accuracy of the items, quantities, and associated costs of the COR as directed by the CB.
   2. The CPM shall review the COR with the Owner.

B. If required the PE and CPM, shall in good faith, further negotiate the COR with the GC as necessary. All amendments to any COR shall be documented.

C. After final review of the COR the CPM and Owner may accept the COR.

D. The CPM shall prepare the COR in the form of an official Board of Public Works Change Order for final review and approval as outlined in Section 01 26 63 Change Order (CO).

E. The GC shall not act upon any accepted COR until it has received final approval through the Public Works process as an official CO to the Work unless instructed to do so by the CPM. Proceeding without the final approval of a fully authorized Change Order is at the GC's own risk.

3.3. EMERGENCY CHANGE ORDER REQUEST

A. In the event Work is required due to an emergency as described in the Contract Documents, the GC must request an equitable adjustment as soon as practicable, and in no case later than ten (10) working days of the commencement of such emergency.

B. The GC shall provide full documentation of all labor, materials and equipment used during the period of emergency as part of the COR submittal.

END OF SECTION

SECTION 01 26 63
CHANGE ORDER (CO)

PART 1 – GENERAL

1.1. SUMMARY

A. Except in cases of emergency, no changes in the Work required by the Contract Documents may be made by the General Contractor (GC) without having prior approval of the City Project Manager (CPM).

B. The City may at any time, without invalidating the Contract and without Notice to Sureties, order changes in the Work by written Change Order. Such changes may include additions and/or deletions.

C. The Change Order (CO) is a Board of Public Works (BPW) form that is reviewed and approved by a specific process.

D. The CO form is typically made up of multiple Change Order Requests (CORs) and/or Bid Items as appropriate depending on the type of project and how the contract was bid.

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)

B. Section 01 26 46 Construction Bulletin (CB)

C. Section 01 26 63 Change Order Request (COR)

1.3. BOARD OF PUBLIC WORKS PROCEDURE

A. The Board of Public Works has a very explicit procedure for the review and approval of all change orders associated with any Public Works Contract as follows:

1. The Supervisory Chain of the CPM shall review and approve any CO under $20,000 provided it does not include either of the following:
   a. The CO does not request a time extension to the contract.
   b. The CO does not cause the contract contingency sum to be exceeded.
2. The Board of Public Works shall review and approve any CO that requires any of the following:
   a. Any CO over $20,000.
   b. Any CO requesting a time extension to the contract regardless of the monetary value of the CO.
   c. Any CO that that causes the contract contingency sum to be exceeded.

B. The Board of Public Works generally meets every other week and only once in August and December. The GC is cautioned that, under normal scheduling, a CO requiring a BPW review will take a minimum of two (2) weeks to achieve final approval.

1. The City shall not be responsible for additional delays to the Work caused by the scheduling constraints of the Board of Public Works.

C. *SPECIAL NOTE:* The GC is cautioned to never proceed unless told to do so by the CPM. Only in rare instances may the CPM give a written notice to proceed on a COR without an approved CO. Proceeding without the written notice of the CPM or an approved CO is at the GC's own risk.

PART 2 – PRODUCTS

2.1. CHANGE ORDER FORM

A. Provided by CPM.

PART 3 - EXECUTION

3.1. PREPARATION OF THE CHANGE ORDER

A. The CPM shall prepare the required CO as follows:
   1. Provide information for all contract information.
   2. Provide a general description of the items described within the change order.
   3. Provide detailed information for each Item on the CO form. At the option of the CPM he/she may include multiple Change Order Requests each as their own item.
   4. Provide required pricing breakdown and accounting information as needed for the item.
   5. Insert attachments of contractor/architect provided information that clarifies and quantifies the CO. Attachments may include but not be limited to material lists, estimated labor breakdown, revised details or specifications, and other documents that may be related to the requested change.
   6. Save the final version of the completed CO.

3.2. EXECUTION OF THE CHANGE ORDER

A. The GC shall do the following:
   1. Review all items on the CO form.
   2. The GC shall notify the CPM immediately of any errors or discrepancies on the form and shall not sign or save it.
      a. The CPM shall make any corrections as needed, re-save the form, and notify the GC.
   3. If/when the GC concurs with the CO form as drafted the GC shall digitally sign the form.

B. The CPM shall do the following:
   1. Monitor the review process
   2. Ensure that proper BPW procedures are executed as needed by the CO approval process.
      a. Schedule the CO on the next available BPW agenda if required.
         i. Attend the BPW meeting to speak on the CO to board members and answer questions.
         ii. The GC and/or PE may be required to attend the BPW meeting to address specific information as it relates to the Work and/or materials associated with the CO.
   3. Monitor final approval and distribution of the CO.
   4. Notify the GC that the CO has been completed.
   5. Ensure that the CO is posted to the next Public Works payment schedule.
   6. Verify that the GC's next Progress Payment-Schedule of Values show the CO as part of the contract sum.

C. Upon final approval of the CO the GC may proceed with executing the Work associated with the CO.

END OF SECTION

SECTION 01 29 73
SCHEDULE OF VALUES

PART 1 – GENERAL

1.1. SUMMARY

A. The Schedule of Values (SOV) is a Contractor provided statement that allocates portions of the total contract sum to various portions of the contracted work and shall be the basis for reviewing the Contractors Progress Payment Requests.

B. AIA Document G702 – Application and Certificate for Payment and AIA Document G703 Continuation Sheet shall be filled out in sufficient detail to be used as a guideline in determining work completed and materials stored on site when verifying Progress Payment Requests.

C. The General Contractor shall be responsible for filling out, updating, and providing these work sheets with each Progress Payment Request.

1.2. RELATED SPECIFICATIONS

A. Section 01 26 63 Change Order (CO)
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 32 26 Construction Progress Reporting
D. Section 01 33 23 Submittals
E. Parts of this specification will reference articles within “The City of Madison Standard Specifications for Public Works Construction”.
   1. Use the following link to access the Standard Specifications web page:
      http://www.cityofmadison.com/business/pw/specs.cfm
      a. Click on the “Part” chapter identified in the specification text. For example if the specification says “Refer to City of Madison Standard Specification **2**10.2” click the link for Part II, the Part II PDF will open.
      b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.

1.3. RELATED DOCUMENTS

A. The following documents shall be used as the basis for initiating and maintaining the SOV worksheets throughout the execution of this contract.
   1. Drawing documents and specifications (including general provisions) as provided with the bid set documents and any published addendums.
   2. Documents associated with revisions or clarifications to number 1 above after awarding of the contract, including but not limited to:
      a. Construction Bulletins
      b. Request for Information
      c. Approved Change Orders
   3. The latest daily/weekly Construction Progress Report
   4. Other specifications as identified in Section 1.2 above

1.4. BASIS OF VALUES

A. The Contractor shall provide a breakdown of the Contract Sum in sufficient detail to assist the Engineer and City Project Manager in evaluating Progress Payment Requests. The breakdown detail may require a labor and material breakdown for each division of work or trade or as directed by the CPM.

B. The total sum of all items shall equal the Contract Sum.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. AIA DOCUMENT G702 – APPLICATION AND CERTIFICATE FOR PAYMENT

A. The Contractor shall use AIA Document G-702 Application and Certificate for Payment with each Progress Payment Request.

B. Completely fill out the Project Information section as follows:
   1. TO OWNER; provide all owner related information as provided in the contract documents.
   2. PROJECT; provide all contract information including CONTRACT NUMBER 9136, title and address.
   3. FROM CONTRACTOR; provide all contractor related information.
   4. VIA ARCHITECT; provide all the architect's related information including the architect's project reference number if different from the owners.
   5. Indicate the current APPLICATION NO., PERIOD TO date, and CONTRACT DATE.

C. Completely fill out the Contractors Application for Payment section.
   1. Fill out lines 1 through 9 to reflect the current status of the contract through the payment date being requested.
   2. The City of Madison calculates retainage on Public Works Contracts as follows:
      a. In general, across the duration of the contract, 2.5% of the total contract sum, including change orders, is withheld for retainage as referenced from the City of Madison Standard Specification 110.2:
         i. Beginning with Progress Payment 1, 5% retainage will be withheld until such time that 50% of the total contract sum has been paid out.
         ii. No additional retainage will be withheld after 50% of the total contract sum has been paid, unless additional change orders have been approved after the 50% milestone has been reached. Per City of Madison Standard Specification 110.2, additional retainage up to 10%, may be held in the event there are holds placed by Affirmative Action or liquidated damages by BPW.
         iii. Retainage for additional change orders after the 50% milestone will be withheld at the rate of 2.5% of the total cost of the change order.
         iv. Retainage is based on the change orders posted to the City's contract worksheet at the time the progress payment is processed.

D. Completely fill out the Change Order Summary section. Only change orders that have been finalized and posted to the City of Madison's Application for Partial Payment worksheet may be itemized into the SOV documents.

E. The Contractor shall sign and date the application and it shall be properly notarized.

F. The Contractor shall not fill in any information in the Architects Certificate for Payment section.

3.2. AIA DOCUMENT G703 – CONTINUATION SHEET

A. The Contractor shall use AIA Document G-703 Continuation Sheet to itemize his/her SOV for this contract. Provide additional sheets as necessary.

B. Provide information in Column A (Item No.), Column B (Description of Work), and Column C (Scheduled Value) by any method that allocates portions of the total contract sum to various portions of the contracted work. Possible methods include combinations of the following:
   1. By division of work
   2. By contractor, sub-contractor, sub sub-contractor
   3. By specialty item or group
   4. Other methods of breakdown as may be requested by the City Project Manager or City Construction Manager at the pre-construction meeting.

C. Provide total cost of the item/description of work including proportionate shares of profit and overhead related to the item.

3.3. INITIAL SCHEDULE OF VALUES SUBMITTAL

A. The Contractor shall provide his/her initial SOV to the CPM no later than five (5) working days after the Pre-construction Meeting.
   1. The initial SOV shall provide information in Column A (Item No.), Column B (Description of Work), and Column C (Scheduled Value) only.
   2. The level of detail shall be as described in section 3.2 above.

B. The Project Engineer (PE) and the City Project Manager (CPM) shall review the SOV as any other submittal and may require modifications to reflect additional detail as necessary.

C. The Contractor shall resubmit the SOV as necessary until such time as the PE and CPM have sufficient detail for assessing and approving future Progress Payment Applications.

D. Progress Payment Application 1 will not be processed until such time as the Contractor has met this requirement regardless of the amount of work completed per the application.

3.4. SOV FOR PROGRESS PAYMENT REQUESTS

A. The Contractor shall update the initial SOV with each Progress Payment Application as follows:
   1. Initial items and values as part of Section 3.3 above will not be adjusted once the original Schedule of Values submittal has been approved.
   2. Change orders shall be added as additional items and values at the bottom of the SOV as they become approved and posted to the City's contract worksheet. The value for each change order shall be the value indicated on the SOV and shall stand alone. Values shall not be split out or combined with other existing items with similar work descriptions on the original SOV.
   3. Fill out Columns D, E, F and G to properly reflect the work completed and materials received since the last Progress Payment Application.
   4. Only materials delivered and stored on the project site may be reflected on SOV progress updates.

B. Provide updated G702 and G703 sheets with each Progress Payment application.

C. See Specification 01 29 76 Progress Payment Procedures for additional information on submitting Progress Payment Applications.

END OF SECTION

SECTION 01 29 76
PROGRESS PAYMENT PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The General Contractor (GC) shall review this and all related specifications prior to submitting progress payment requests.

B. Progress payment requests (Partial Payment-PP) for this contract shall be submitted digitally by the GC to the CPM.

C. The Project Engineer (PE) and City Project Manager (CPM) shall review and amend or approve the PP as needed.

D. After approval of the PP by the CPM, he/she shall forward the PP to the appropriate agencies for BPW contractual review and payment processing.

1.2. RELATED SPECIFICATIONS

A.	Section 01 26 63	Change Order (CO)
B.	Section 01 29 73	Schedule of Values
C.	Section 01 31 19	Progress Meetings
D.	Section 01 32 26	Construction Progress Reporting
E.	Section 01 33 23	Submittals
F.	Section 01 77 00	Closeout Procedures
G.	Section 01 78 23	Operation and Maintenance Data
H.	Section 01 78 36	Warranties
I.	Section 01 78 39	As-Built Drawings
J.	Section 01 79 00	Demonstration and Training

1.3. RELATED DOCUMENTS

A. The following documents shall be used when evaluating PP requests.

1. Construction progress reports filed since the last payment request.
2. Contractors Schedule of Values as updated from the last payment request. See Specification 01 29 73.
3. Any document that may be required to be submitted for review and approval, as noted by the specifications listed in Section 1.2 above, or the Progress Payment Milestone Schedule in Section 1.4 below, to achieve a required bench mark of contract progression or contract requirement.

1.4. PROGRESS PAYMENT MILESTONES

A. City Engineering-Facility Management has developed the Project Payment Milestone Schedule (Section 1.4 below) to assist the GC in providing required construction specific documentation and general contractual documentation in a timely manner.

B. The Progress Payment Milestone Schedule is not an all inclusive list. Multiple agencies review progress payment requests and contract closeout requests. Missing, incomplete, or incorrect documentation for any agency may be a cause for not processing progress payments. It shall be the sole responsibility of the Contractor for providing documentation as required or requested to the appropriate agencies.

C. The milestone schedule is based on the contract total sum and shall be valid for most contracts. Milestone submittals will be required with whatever progress payment hits the percentage of contract total indicated in the schedule.

D. The CPM shall review the milestone schedule with each progress payment request and at his/her option may elect to hold processing the progress payment until such time as the contractor has met the requirements for providing construction specific documentation.

E. It shall be the General Contractors responsibility to comply with all BPW Contract Administration requirements and related deadlines as outlined in the Award Letter, Award Checklist, and Start Work Letter.

Progress Payment (PP) Milestone Schedule		
Milestone Description	***Due Before***	***Remarks***
BPW Contract Administration Documentation • Workforce profiles • Best Value Contracting Documentation • Sub-contractors prequalification approval & Affirmative Action plans • Other as may be required	PP-1, or start work as applicable	• For GC and Sub-contractors before PP-1 regardless of scheduling • Sub-contractors (if applicable), due 10 days before they may start work • Sub-contractors (if applicable), due 10 days before they may start work
Required Construction Submittals/Administrative Documents • Contractors Project Directory • Schedule of Values • Submittals Schedule • • Closeout Requirement Checklist • Warranty Checklist	PP-1	References • Specification 01 31 23 • Specification 01 29 73 • Specification 01 32 19 • • Specification 01 77 00 • Specification 01 78 36
Construction Progress Milestones • Early submittals, per submittal schedule • Detailed Contract Schedules	PP-1	See specifications for specific requirements • Specification 01 32 19, Examples: concrete mix, structural steel, products with long lead times • See Specification 01 32 16
General Construction Progress Requirements are all up to date • Progress Schedules • Submittals/Re-submittals (ongoing) • Schedule of Values • Progress Reporting • • • QMOs are being addressed and closed • Progress Cleaning • As-Built Drawings	Each future PP	Verified with each Progress Payment Request • Specification 01 32 16 • Specification 01 33 23 • Specification 01 29 73 • Specification 01 32 26 • • • Specification 01 45 16 • Specification 01 74 13 • Specification 01 78 39
*** All of the above are updated as required**		
BPW Contract Administration Documentation • Weekly payroll reports • Best Value Contracting Reports • SBE Reports	25% CT or PP 2	See 1.4.E above. *This progress payment will be with held by BPW for any missing contractual documentation.*
Construction Progress Milestones • Construction/Contract Closeout Meeting #1 • Submittals/Re-submittals complete	70% CT	• Specification 01 31 19 • Specification 01 33 23
Operation and Maintenance (O & M) drafts	60% CT	Specification 01 78 23

Progress Payment (PP) Milestone Schedule		
Milestone Description	***Due Before***	***Remarks***
BPW Contract Administration Documentation • Request Finalization Review from BPW	80% CT	This is a recommendation to the GC and is not a requirement of this PP. • Specification 01 77 00
Construction Progress Milestones • Operation and Maintenance (O & M) finals, accepted • All major QMO issues resolved • As-Built Drawings, Division Trades ready for GC review	80% CT	• Specification 01 78 23 • Specification 01 45 16; Items that could prevent occupancy • Specification 01 78 39
All of the following shall be completed for this PP: • Regulatory Inspections completed • All QMO reports closed • Demonstration and Training completed • Attic Stock completed • Final Cleaning	90% CT	Contractor to determine the proper order of completion: • Governing ordinances and statutes • Specification 01 45 16 • Specification 01 79 00 • Specification 01 78 43 • Specification 01 74 13
Construction Closeout Procedures: • Letter of Substantial Compliance sent to BI and DHS as needed • Certificate of Occupancy issued • As-Built Drawings, finals, accepted • City Letter of Substantial Completion • Warranty letters dated and issued	100% CT	See Specification 01 77 00 • Generated/Signed by the Engineer • Building Inspection • Specification 01 78 39 • Signed by the City Engineer • Specification 01 78 36
*** Completion of this begins the one year warranty.**		
BPW Contract Administration Documentation Contract Closeout Procedures • Construction Closeout has been completed • Contractor requests final payment of retainage upon receiving City Letter of Substantial Completion • All BPW contractual requirements are verified	Final	See Specification 01 77 00 • Contractor must provide any missing BPW Contractual Documentation
*** Completion of this closes the contract but not the warranty period/bond.**		
NOTE: **CT = Contract Total less held retainage**		

1.5. PROGRESS PAYMENT SUBMITTAL

A. Each progress payment submittal shall be:
   1. Digital in PDF format
   2. PDF shall be in color
   3. Uploaded to the appropriate Project Management library and properly named per the tutorial instructions provided to the awarded contractor.

B. Submit all required construction progress documentation

C. In general the following shall apply to all PP requests:
   1. Materials or products:
      a. On order, being shipped, etc. may not be invoiced.

b. Received and stored on the project site may be invoiced.
c. Being manufactured off site at any location may not be invoiced (example: cabinetry, ductwork, etc.)
d. Completed products stored off site locally waiting for delivery to the project site may be invoiced with prior approval by the CPM. All of the following conditions must be met to be allowed:
i. Items must be visually inspected by CPM to verify product is complete.
ii. Item must be stored inside a compatible structure and the structure and contents must be insured.
iii. Contractor is responsible for condition until installation is completed.
2. All labor and equipment, including rental time for the current progress period may be invoiced.
3. Only completed installations may be invoiced to 100% based on the Schedule of Values.

D. DO NOT submit BPW Contract Administration Documentation for review with Progress Payment Requests, submit them directly to the correct agency and in the correct format as instructed from information in your BPW Contract Award Packet instructions.

PART 2 - PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTOR PROCEDURE

A. The GC shall provide an updated version of his/her schedule of values (AIA documents G702 & G 703) with each PP request.
1. The AIA - Application and Certificate for Payment (G702) shall be properly filled out and prepared for the Architects review. See specification 01 29 73, Schedule of Values for more information.
2. The AIA - Continuation sheets (G703) shall be properly filled out and indicate the dollar value of the completed work to date for each item on the form. See specification 01 29 73, Schedule of Values for more information.
a. The GC shall subtotal the work completed to date for all of the original Schedule of Value items.
b. Divide the sub total of work completed by the Original Contract Total to obtain a percentage complete of the original Lump Sum Bid. This percentage may be taken out to five (5) decimal places (round fifth place up or down as needed).
i. Example: $5,192.55 of completed work divided by $10,000 original Contract Total = 0.519255, round this to 0.51926
c. Write the percentage in Column 10 on the City Tabular Sheet for the original lump sum bid item in RED ink.
3. Ensure that any newly posted change orders from the City of Madison provided tabulation sheet have been entered on the G703 continuation sheets. Repeat steps a thru c above for each change order on the schedule of values and the City Tabular Sheet.

B. The GC shall fill out the City of Madison Application and Certificate of Payment cover sheet as follows:
1. The GC shall not change any pre-printed information and shall not write in the box that indicates previous progress payments.
2. The GC shall sign and date the form where indicated.
3. The GC shall provide the dates from and to for the PP being requested.
4. The GC shall provide the list of all contractors/sub-contractors that were actively working during the dates indicated above.
a. All contractors/sub-contractors named must be in compliance with all City requirements (Pre-qualified, Affirmative Action Plan on file, etc). The PP will be held and not processed by the City of Madison until all contractors/sub-contractors are in compliance.
b. Do not list the names of suppliers or manufacturers, doing so will slow down processing and require a re-submittal of the paperwork.

C. The General Contractor (GC) shall scan all of the documents listed below in the order shown, save the scan as a single PDF file for each PP request.
1. City cover sheet – Application and Certificate for Payment
2. City tabulation sheet(s)
3. AIA G702 - Application and Certificate for Payment
4. AIA G703 - Continuation Sheet(s)
5. Any miscellaneous documents that may be requested as backup documentation for the pay request.
a. Lien waivers are not required and shall not be submitted.

b. Do not provide contractual administrative documents such as pay reports with pay requests.
c. Do not supply progress deliverables with pay requests.

3.2. PROJECT ENGINEER PROCEDURE

A. The PE shall review the AIA-continuation sheets provided by the GC to determine if the Schedule of Values accurately reflects the work completed for the inclusive dates indicated.
B. The PE shall advise the CPM of any discrepancies in the schedule of values.
C. The PE shall work with the GC and the CPM to resolve any issues prior to signing the AIA - Application and Certificate for Payment.
D. When verified, the PE shall digitally sign the original PDF version of the AIA - Application and Certificate for Payment.

3.3. CITY PROJECT MANAGER PROCEDURE

A. The CPM shall review all documents submitted by the GC and work with the PE to ensure the schedule of values accurately reflects the work completed to date.
B. The CPM may elect to hold processing of any progress payment pending submittal of required progress payment milestones.
C. When verified, the CPM shall digitally sign the City Cover Sheet and forward the required documentation to the appropriate City agencies for further processing of the payment request.

END OF SECTION

SECTION 01 31 13
PROJECT COORDINATION

PART 1 – GENERAL

1.1. SUMMARY

A. Project Coordination covers many areas within the execution of the Contract Documents and the requirements of proper coordination are the applicable to all contractors executing the Work of this contract.

B. This specification provides general information regarding project coordination for the General Contractor and all Sub-contractors. All contractors shall be familiar with project coordination requirements and responsibilities that may be defined in other specification within these Contract Documents.

C. The General Contractor shall at all times be responsible for the project, project site, and execution of the Contract Documents.

1.2. RELATED SPECIFICATIONS

A.	Section 01 29 76	Progress Payment Procedures
B.	Section 01 31 19	Progress Meetings
C.	Section 01 32 16	Construction Progress Schedules
D.	Section 01 32 19	Submittals Schedule
E.	Section 01 33 23	Submittals
H.	Section 01 60 00	Product Requirements
I.	Section 01 77 00	Closeout Procedures, including all specifications referenced therein

1.3. GENERAL REQUIREMENTS

A. The following general requirements shall applicable to all contractors:

1. Cooperate with the Owner, all authorized Owner Representatives, Project Engineer and all consultants of the Owner.
2. Materials, products, and equipment shall be new, as specified and to industry standards except where otherwise noted.
3. Labor and workmanship shall be of a high quality and to industry standards.

B. Existing conditions:

1. Verify all existing conditions noted in the contract documents with actual filed locations. Verify dimensions, sizes and locations, of structural, equipment, mechanical and utility components.
2. Report any inconsistencies, errors, omissions, or code violations in writing to the General Contractor (GC) immediately.
3. Annotate any inconsistencies, errors, omissions on the GC As-Built record drawings immediately for future reference.

C. Contract Documents:

1. The Contract Documents are intended to include everything necessary to perform the work. Every item required may not be specifically mentioned, shown, or detailed.
   a. Except where specifically stated all systems and equipment shall be complete, installed, and fully operable.
   b. If a conflict exists within the contract documents the contractor shall furnish the item, system, or workmanship of the highest quality, largest, largest quantity, or most closely fits the intent of the contract documents.
   c. Manufacturers recommended installation details shall be verified and used prior to installation of products and equipment so as to not void warranties.

D. Errors and Omissions

1. No Contractor shall take any advantage of any apparent error or omission in the construction documents.

2. The City of Madison shall be permitted to make such corrections and interpretations as may be deemed necessary for the fulfillment of the intent of the construction documents.

E. Owners Representatives

1. All contractors shall be familiar with various Owner Representatives having Quality Management responsibilities for the duration of this project including but not limited to the following:
   a. Project Engineer, responsible for all decisions affecting the code compliance and design intent of the construction documents.
   b. Owner, the designated representative of the City Agency that will occupy the project upon completion.
   c. City Project Manager, responsible for all day to day decisions regarding the execution and performance of this Public Works Contract.
   d. Consulting City Staff, responsible for providing consulting services to the Project Engineer, Owner, and City Project Manager, also responsible for Quality Management of the construction documents.
2. Owner Representatives shall be attending progress meetings, pre-installation meetings, performing or being present for final testing and acceptance and quality management reporting during the execution of the contract documents as outlined in other specifications.

1.4. GENERAL CONTRACTOR PERFORMANCE REQUIREMENTS

A. Assume the responsibility for all Work specified in the Contract Documents except where specifically identified to be performed by the Owner or other contractor separately hired by the Owner.
   1. Coordinate all work by Owner, equipment provided Owner, or contractor hired by the Owner into the project schedule.

B. Provide all construction management responsibilities as specified in other Division 1 specifications including but not limited to:
   1. Scheduling of work
   2. Coordination of work between other Trades and Sub-contractors
   3. Construction administration and management
   4. Site layout, cleanliness, and protection of completed work/stored materials
   5. Waste Management
   6. Quality Assurance and Quality Control

C. Use Diggers Hotline and private utility locating companies to accurately locate all public and private utilities on the property as needed. The GC is responsible for any repair or replacement to any public or private utility damaged during the execution of the Work

D. Report any inconsistencies, errors, omissions, or code violations in writing to the Project Engineer immediately. Failure to report inconsistencies prior to beginning work shall indicate that the GC accepted all existing conditions.

E. The GC shall be responsible for assigning work and related responsibilities where the Contract Documents may not clearly state who is responsible for providing the work, material, or product.

F. Provide construction management oversight of all items described in Section 1.5 below.

1.5. SUB-CONTRACTOR PERFORMANCE REQUIREMENTS

A. Be familiar with all of the contract documents as they pertain to your Work, adjacent work and the overall progress of the project.
   1. All Sub-contractors shall be familiar with all Division 1 specifications as they may apply to progress, progress payments, quality control construction management, and closeout of the contract.

B. Coordinate your Work with all adjacent work and existing conditions.
   1. Perform your work in proper sequence according to the GC's project schedule and in relation to the work of other trades.
   2. Notify other sub-contractors and trades whose work may be connected to, combined with, or influenced by your work and allow them reasonable time and access to complete their work.
   3. Join your work to the work of others in accordance with the intent of the Contract Documents.
   4. Order materials and schedule deliveries to facilitate the general progress of the Work.

C. Cooperate with all other trades to facilitate the general progress of the work. This shall include providing every reasonable opportunity for the installation of work by others and the storage of their materials and equipment.
   1. In no case shall any contractor exclude from the premises or work any Sub-contractor or their employees.
   2. In no case shall any contractor interfere with the execution or installation of Work by any other Sub-contractor or their employees.

D. Arrange your work, equipment, and materials and dispose of your construction waste so as to not interfere with the work or storage of materials of others.

E. Coordinate all work as indicated during pre-installation meetings with Owner Representatives, the GC and other trades. Any work improperly coordinated shall be relocated as designated by the Owner Representative at no additional cost to the City.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 – EXECUTION – THIS SECTION NOT USED

END OF SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to identify various project related meetings and the responsible parties for scheduling, agendas, minutes, and required attendance.

B. This specification is not intended to be inclusive of all meeting types or a complete list of required meetings.

C. This specification is not intended to cover planning and execution meetings between the General Contractor (GC) and his/her sub-contractors.

1.2. RELATED SPECIFICATIONS

A. 01 32 16 Construction Progress Schedules

1.3. PROJECT MEETING TYPES

A. The following project meeting types may be used but not limited to the following

1. Preconstruction Meeting
2. Construction Progress Meetings
3. Pre-installation Meetings (including mock-up review meetings)
4. Weekly Trade Meetings
5. Special Meetings

1.4. GENERAL REQUIREMENTS

A. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

PART 2 – PRODUCTS – NOT USED IN THIS SECTION

PART 3 - EXECUTION

3.1. PRECONSTRUCTION MEETING

A. After execution of the Contract the City Project Manager (CPM) shall schedule and conduct the Preconstruction Meeting at the Owner's facilities. The CPM shall coordinate the meeting agenda with the Project Engineer and the GC Project Manager.

B. The CPM shall be responsible for the final agenda.

C. The CPM and Project Engineer shall take notes on the meeting and post completed meeting minutes.

D. Attendance shall be required by all of the following:

1. Owner Representative(s)
2. Engineer and applicable sub consultant(s)
3. General Contractor and applicable subcontractors and suppliers
4. City Quality Management Staff
5. Others, as may be invited for particular agenda items.

E. Topics of the Preconstruction Meeting shall include but not be limited to the following:

1. Staff and contractor introductions

2. Completion Date
3. BPW Administrative requirements and due outs
    a. Small Business Enterprise (SBE) (if applicable)
    b. Certified payroll forms
    c. Workforce profiles
    d. Best Value Contracting (BVC)
4. General Facility Management Division 1 Specifications, including:
    a. Section 01 29 76 Progress Payment Procedures
    b. Section 01 45 16 Field Quality Control Procedures
    c. Section 01 77 00 Closeout Procedures
5. Project Meeting scheduling
    a. Section 01 31 19 Project Meetings
6. Construction Schedule

3.2. CONSTRUCTION PROGRESS MEETINGS

A. In general all of the following shall apply:
    1. Representatives of Contractors, Subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
    2. The attendance shall be from the required attendance list in 3.1.D. above.
B. The General Contractor Project Manager (GCPM) shall:
    1. Schedule and conduct all construction progress meetings biweekly or more frequently as required.
    2. Prepare agenda for meetings including, but not limited to the following:
        a. Safety
        b. Current Schedule, including review of the critical path and 6-week look ahead schedule
        c. Status of project related documentation (Submittals, RFIs, CBs, etc.)
        d. Quality Observation Log and status of correction of deficient items
        e. Project questions and issues from meeting attendees
        f. BPW Administration Check
        g. Other as needed
        h. Status of CORs and COs to be reviewed outside the standard progress meeting time.
    3. Make physical arrangements for meetings.
    4. GCPM to post meeting agendas no less than two (2) working days prior to the scheduled meeting. Notify all required attendees, applicable parties to the contract, and others affected of the posted meeting agenda.
    5. Preside at meetings.
    6. Route a meeting attendance roster for attendees to sign-in on.
    7. GCPM to record the minutes of the meeting; include significant proceedings and decisions. Post meeting minutes no more than two (2) working days after the completed meeting. Meeting minutes shall include a scanned copy of the attendance sign-in sheet. Notify all required meeting attendees, applicable parties to the contract, and others affected by decisions made at the meetings.
    8. The above requirements do not apply to GC/sub-contractor meetings.

3.3. PRE-INSTALLATION MEETINGS

A. The GCPM shall schedule and conduct all pre-installation meetings, including mockup reviews, before each construction activity that requires coordination with other trades.
B. The GCPM shall be responsible for the final agenda and meeting minutes.
C. The GCPM will work with all concerned parties to resolve issues as needed and submit RFI's if necessary.
D. Required attendance shall be from the list in 3.1.D. above and shall be personnel having a stake in the outcome of the installation or knowledge of the system being installed.
E. In the event the Contractor installs equipment or materials without a pre-installation meeting the Contractor shall be solely responsible for removing, replacing, repositioning materials and equipment as instructed by the Project Engineer or City Project Manager at no additional cost to the City.

3.4 PRE-CONTRACT CLOSEOUT MEETINGS

A. One (1) Pre-contract Closeout Meetings shall be held to review the closeout procedures, requirements, and contract deliverables.
    1. Pre-contract Closeout Meeting #1 shall be scheduled prior to the 80% Progress Payment Request is being requested. This meeting shall discuss, but not be limited to, the status of scheduling final regulatory

inspections, cleaning up outstanding QMO's, demonstration and training, O&M manuals, attic stock; and finalization review of payroll and other related documents.

B. The GCPM shall schedule, coordinate, and make physical arrangements for both meetings.

C. All of the following shall be required to attend both meetings:
   1. The GCPM and the GC Field superintendent
   2. All Subcontractor Project Managers regardless of the current status of their work.
      a. The GCPM may excuse a Subcontractor PM if he is confident that all contractual requirements for closeout by the subcontractor have been completed and/or delivered to the GCPM. The list of attendees shall be reviewed and agreed upon with CPM ahead of the meeting.
      b. At the option of these project managers the field supervisors may also attend.
   3. The Project Architect and at least one design consultant from each discipline represented by the plans and specifications to address open QMOs, final tests, reports, etc.
   4. The Owner
   5. The CPM
   6. Quality Management staff as needed to address open QMOs, final tests, reports, etc.
   7. The Commissioning Agent

D. The CPM shall publish an agenda and chair the meeting.

3.5 OTHER SPECIAL MEETINGS

A. The Contractor shall schedule special meetings per the requirements of these specifications.

B. Special meetings may include but are not limited to the following:
   1. Equipment start up meetings
   2. Testing and balancing meetings
   3. Other meetings as necessitated by the contract documents

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULES

PART 1 – GENERAL

1.1. SCOPE

A. This specification is to identify various project related schedules associated with indicating construction progress and outlook. The following schedules are the responsibility of the General Contractor (GC).
   1. Overall Project Schedule

B. This specification is not intended to include internal schedules generated by the contractors during their planning and execution of the contract.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 31 19 Progress Meetings
C. Section 01 74 13 Progress Cleaning
D. Section 01 77 00 Closeout Procedures
E. Section 01 78 23 Operation and Maintenance Data
F. Section 01 78 36 Warranties
G. Section 01 78 39 As-Built Drawings
H. Section 01 79 00 Demonstration and Training
I. Other specification within the construction documents that may indicate the need for scheduling any event with Owner, Project Engineer, Owner Representatives, including any owner provided equipment.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. OVERALL PROJECT SCHEDULE (OPS)

A. The GC shall prepare an OPS that covers the duration of the contract from the pre-construction meeting through the end of construction to final contract closeout.
   1. The GC shall review Specification 01 77 00 Closeout Procedures to become familiar with definitions, differences, and requirements for closing out the construction and contract including the association with progress payments.

B. The GC shall provide copies and lead a discussion on the OPS during the pre-construction meeting.
C. The OPS shall indicate start and end dates of each task associated with the project.
D. The OPS shall clearly indicate the critical path of the project.
E. The GC shall update the OPS as often as necessary during the duration of the project. Updates will be briefed as needed during progress meetings.

END OF SECTION

SECTION 01 33 23
SUBMITTALS

PART 1 – GENERAL

1.1. SUMMARY

A. The General Contractor (GC) shall be responsible for providing submittals for review of all contractors and sub-contractors as designated in the construction documents. Submittals shall include but not be limited to all of the following:
   1. Equipment specified and pre-approved in the specification; to ensure quality, construction, and performance specifications have not changed since final design.
   2. Equipment specified by performance in the specification; to ensure that the intended quality, construction, and performance specified is met by the selected material or product.
   3. Shop, piece, erection, and other such drawings as indicated in the specifications to ensure all structural, dimensional, and assembly requirements are being met.
   4. Submittals indicating installation sequencing
   5. Submittals indicating control sequencing
   6. Contractor licensing, certification, and other such regulatory documentation when required by a specification.
   7. Other submittals as may be required by individual specifications.

B. The submittal process shall not be used to determine alternates to specified products or equipment. All considerations shall be reviewed during the bidding process and acceptable alternates shall be acknowledged by addendum prior to the closing of bidding. See bidding instructions for the information on submitting alternates for consideration.

D. In the event that a manufacturer has significantly changed a product (discontinued a model, changed dimension or performance data changed available colors, etc.) since bid opening the GC shall submit a Request for Information (RFI) to the Project Engineer requesting other approved alternates prior to uploading a digital submittal.

E. Contractors and sub-contractors shall be responsible for knowing the submittal requirements of ALL sections within their scope of work under the contract. The Owner reserves the right to request documentation on any materials, equipment, or product being installed where a submittal is not on file. If the material, equipment, or product installed is determined not to meet the intent of the specification the contractor/sub-contractor shall be required to remove and replace the items involved. The GC shall be solely responsible for all costs associated with the removal and replacement.

1.2. RELATED REFERENCES

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 32 19 Submittals Schedule
C. Section 01 32 26 Construction Progress Reporting
D. All Technical Specifications, contract documents, construction drawings, and any published addendums during the bidding process.
E. All contract documents generated during the execution of the contract including but not limited to Requests for Information (RFI) and Construction Bulletins (CB).

1.3. SUBMITTAL REQUIREMENTS

A. A completed submittal shall meet the following requirements:
   1. Digital submittal shall be original PDF of manufacturer's data sheets or high quality color scan of the same.

a. Submittals shall not include sales fliers or other similar documents that typically do not provide complete manufacturers data.

2. Documents within the PDF submittal shall be printable to a sized sheet no less than 8-1/2 by 11 inches and no larger than 24 by 36 inches.

3. At the beginning of each submittal the contractor shall identify the plan reference (WC-1, EF-3, etc.) in RED block letters that the submittal is for.

4. Where multiple model numbers appear in a table the contractor shall identify the specific model being submitted by using a RED square, box, or other designation to distinguish the correct model from others on the page.

B. A complete submittal will include all information associated with the product or equipment as presented in plans, equipment tables, and specifications. Information shall include but not be limited to the following:

1. Dimensional data
2. Performance data
3. Resource requirements, power, water, waste, etc
4. Clearance and maintenance requirements
5. Finish information, colors, textures, etc.
6. Warranty information

C. Where a submittal includes material samples (carpet, tile, paint draw downs, etc.) the contractor shall do the following:

1. The Contractor shall submit the sample(s) as indicated in the specification.
2. The Contractor shall include a quality photograph(s) of the product with the digital submittal. Photographs shall meet the following requirements:
   a. Formatted to be between 500Kb and 1.0 Mb in file size
   b. Have no glare or flash reflection on the sample
   c. Sample fills the frame of the photo and shows detail as needed. Include multiple photos from other angles as needed.
   d. Scanned copies of products or photos are not acceptable.

D. Uploaded submittals should be relative and related to a specific written specification.

1. Do not upload submittals under a broad category or division (I.E. HVAC 23 00 00). Always upload by the specific specification that identifies a required product or performance to be met.
2. Group related items together if the specification is written that way. (I.E. all of the plumbing fixtures and trim relative to one specific specification should be submitted together).
3. Submittals shall be grouped and adhere to the divisions in the submittal schedule. Submittals that do not conform to the submittal schedule and/or specification divisions will be rejected for re-submittal.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTORS PROCEDURES

A. All required submittals will be submitted electronically by the GC.

B. Uploading the submittal indicates that the GC has reviewed and approved the submittal against the contract document requirements.

C. The GC shall discuss submittal status at all progress meetings and shall monitor submittal review/approval/re-submittal so as to not incur delays in the project schedule.

D. The GC and sub-contractors shall provide re-submittals as required.

3.2. SUBMITTAL REVIEW

A. The submittal shall be reviewed internally by the required Architect/Engineer and Owner Representative in a timely fashion and provide commentary on missing items, incorrect information, or incomplete shop drawings, etc as needed.

B. When the internal review is completed the CPM will notify the Project Engineer the submittal is ready for final review.

C. Information will be transmitted electronically.

3.3. PROJECT ENGINEERS REVIEW

A. Upon completion of the internal review the Project Engineer shall review all internal review comments, confer with the CPM as needed and determine the appropriate disposition status for the submittal (approved or resubmit).

B. The Project Engineer shall summarize final internal review comments onto the submittal cover sheet, provide a final disposition of the submittal and update the review status of the submittal to "Complete…" (with or w/o comments) or "Rejected".

C. A completed Final Review status initiates the CPM to notify the GC and appropriate sub-contractor(s) that the review of the submittal has been completed.

D. Information will be transmitted electronically.

END OF SECTION

SECTION 01 41 00
REGULATORY REQUIREMENTS

PART 1 – GENERAL

1.1. REQUIREMENT INCLUDED

Unless otherwise specifically directed by Contractor each Subcontractor and each Sub-subcontractor shall comply with provisions of this Section as required for proper execution and completion of their Work or portions thereof

1.2. PROCEDURES

Comply with and give notices required by applicable laws, statutes, ordinances, codes, rules, and regulations, and lawful orders of public authorities having jurisdiction applicable to performance of the Work. Comply with and give notices required by Owner's and Contractor's insurance companies, local utilities and labor regulations relating to the performance of the Work, the protection of adjacent property, and the maintenance of passage ways, guard fences and other protective facilities.

The Contractor shall acquire all permits, licenses, and approvals necessary for the execution of this Contract and performance of the Work and provide evidence of such applicable permits, licenses, and approvals at the Pre-Construction Meeting or before commencement of the Work.

Where Contract Documents require abatement of asbestos containing materials, prior written Notice to the State of Wisconsin, Department of Natural Resources is required. The Contractor shall provide evidence of such Notice prior to commencement of the Work.

Procure all certificates of inspection, use, and occupancy, and all permits and licenses, pay all charges and fees and give all notices necessary and incidental to the due and lawful prosecution of the Work. Certificates of inspection, use and occupancy shall be delivered to the Owner upon completion of the Work in sufficient time for occupation of the Project in accordance with the approved schedule for the Work. The costs of such procurement, payment and delivery shall be included within the Base Bid.

Exercise precaution at all times for the protection of persons (including employees) and property. Observe the safety provisions of applicable laws, building and construction codes. Refer to the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America.

It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations. However, if Contractor observes that portions of the Contract Documents are at variance therewith, Contractor shall promptly notify A/E and Owner in writing, and necessary changes shall be accomplished by appropriate Modification.

If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities having jurisdiction, the Contractor shall assume full responsibility for such Work and shall bear the costs attributable to correction.

Refer to the Sections of the Work for referenced codes, standards, tests, etc., applicable to the Work.

1.3. NOTICES

Concealed or Unknown Conditions:

If the Contractor encounters conditions at the site are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual

nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Engineer before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Engineer will promptly investigate such conditions and, if the Engineer determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any of the Work, will recommend and equitable adjustment in the Contract Sum or Contract Time, or both. If the Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Engineer shall promptly notify the Owner and Contractor in writing, stating the reasons.

If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites, or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Engineer. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume operations. The Contractor shall continue to suspend operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features.

1.4 PERMITS

Permits, Fees, Licenses, and Inspections: Unless otherwise provided in the Contract Documents, Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, inspections and approvals by government and utility agencies, necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

Owner will obtain plan approvals and pay all fees required by the Wisconsin Department of Safety and Professional Services.

Contractor shall obtain all permits and pay all fees required by local utilities for permanent electric and gas service.

Contractor shall obtain copies of all required permits and certificates of inspection applicable to the work.

Contractor shall furnish A/E and Owner with copy of all required permits and certificates.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 – EXECUTION - THIS SECTION NOT USED

END OF SECTION

SECTION 01 45 16
FIELD QUALITY CONTROL PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The City of Madison has developed a multi-faceted Quality Management Program that begins with contract signing and runs through contract closeout to ensure the best quality materials, workmanship, and product are delivered for the contracted Work.

2. The Quality Management Observation (QMO) is an ongoing observation of the construction process as it progresses. The City of Madison does not use a “Punch List” or “Corrections List” as it is typically known throughout the construction industry. The QMO process acts as an “in progress punch list”.

a. By using the QMO process the City of Madison’s goal is to have a zero item punch list prior to the 90% progress payment and owner occupancy.

B. All contractors shall be required to review the specifications identified in Section 1.2 below, and other related specifications identified therein to become familiar with the terminology and expectations of this City of Madison Public Works contract.

C. It is the intent of this specification to outline the requirements, expectations, and responsibilities of the General Contractor (GC), Project Engineer, and other representatives of the Owner for items of Quality Assurance and Quality Control.

1. This specification is not intended to conflict other specifications requiring testing and inspecting services.
2. This specification does not relieve the GC from any requirements associated with regulatory inspections performed by the City of Madison Building Inspection Unit, or inspectors from other agencies as required by code.
3. Any testing performed by an Owner’s Representative does not relieve the GC from performing any testing that may required by the construction documents.

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 26 13 Request for Information (RFI)
B. Section 01 29 76 Progress Payment Procedures
C. Section 01 31 13 Project Coordination
D. Section 01 77 00 Closeout Procedures

1.3. PERFORMANCE REQUIREMENTS

A. All contractors shall be responsible for a proper quality assurance/quality control (QA/QC) program throughout the execution of the Work defined within the construction documents, including all recognized construction industry standards and all applicable regulatory codes.

B. The GC shall be responsible for all of the following:

1. Monitor the quality of all workmanship, supplies, materials, and products being installed by all contractors and installers to ensure they meet or exceed the minimum requirements set forth by the construction documents.
2. Submit a Request for Information (RFI) whenever manufacturers’ instructions or referenced standards conflict with the construction documents before proceeding with the Work.

3. Ensure that Work requiring special certifications or licensing is being performed by is being performed and supervised by personnel that meet the appropriate requirements.
    a. Ensure that all certificates and licenses are current throughout the execution of the project.

C. The City of Madison and its representatives shall perform quality assurance and quality control activities throughout the execution of this project. This in no way relieves the GC of maintaining an acceptable QA/QC program.

1.4. QUALITY ASSURANCE

A. The GC shall be responsible for the following:
1. All materials, equipment, and products shall be new, clean, undamaged, and meet the performance specifications defined within the construction documents including favorably reviewed submittals.
    a. Any material, equipment, or product that does not meet the requirements of the construction documents shall be removed and replaced, including any adjacent and related work, at the GCs expense.
2. All Work shall be performed by persons properly trained and/or qualified to produce workmanship of the quality specified in the construction documents.
3. Providing access to updated as-builts, addenda, submittals, bulletins and other related construction documents at the project site.

B. The City of Madison and its representatives may be responsible for any of the following:
1. Attend pre-installation meetings
2. Attend construction progress meetings
3. Review all submittals
4. Conduct field visits for QA/QC purposes, provide feedback to the GC and sub-contractors using Quality Management Observation (QMO) reports.
5. Review delivered equipment
6. Witness equipment installations, startups, testing as specified in other specifications

1.5. QUALITY MANAGEMENT OBSERVATION REPORT

A. The Quality Management Observation report or QMO is used as a QA/QC tool by those entities responsible for QA/QC activities, including but not limited to, the GC, CoM, PE, Cx agent, etc.

B. QMOs are designed to be an early observation of non-conforming construction work before it becomes buried by follow on work. As such it is most often used as an “in progress punch list”.

C. QMO reports and tracking will be distributed electronically. The distribution list will be established by the GC and CPM.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. QUALITY MANAGEMENT RESPONSIBILITIES

A. While making routine progress visits to the construction project the GC, CPM, and PE, and applicable others shall observe the details of the construction and installations to ensure that the intent of the construction documents is being followed.

B. If during the progress visit there is a determination of contract non-conformance a QMO report shall be initiated to begin the documentation process.
1. The GC field superintendent shall be informed immediately of any issue that may cause harm, damage to finished work, or be buried prior to properly filing a QMO report.

C. The following information will be included in a QMO report:
1. The date and time of the field visit
2. References to construction documents if any (examples; specification, drawing page, details, approved submittals, RFI, CB, etc)
3. Short title for the observation being made
4. Detailed description of the observation being made
5. Assignment of categories (Sitework, Structure, Enclosure, Interior, etc) from the given list that may apply to the observation being reported.
6. Assignment of responsible contractor(s) that may need to be aware of the observation.
7. Any attachments that may help provide reference to the observation.

3.2. RESPONDING TO A QMO

A. All contractors receiving email notification of a QMO Observation shall review the details of the observation.

B. The GC shall be responsible for determining the course of action required to remedy the non-conforming issue and shall coordinate and direct the contractor(s) responsible for any work related to the observation.

C. All contractors assigned to remedy the observation by the GC shall provide follow-up responses on the QMO report as follows:

1. In the "Follow-Up Response" area enter a description of your follow-up response in the box provided.
2. Add attachments (pictures) if needed to show the work has been completed.

3.3. GENERAL CONTRACTORS FOLLOW-UP

A. The GC shall inspect the work to ensure that all assigned contractors have remedied the observation to the intent of the construction documents.

B. The GC shall respond with any additional comments in his/her response box.

3.4. QMO CLOSEOUT PROCEDURE

A. The person who initiated the QMO shall review the remedied work and if properly corrected shall close and date the QMO form.

3.5. CONSTRUCTION CLOSEOUT

A. The GC shall note that successful close out QMOs are required for construction closeout as follows:

1. Certain progress payments as identified in Specification 01 29 76 are contingent QMO reports being properly closed out.
2. Specification 01 77 00 defines all construction closeout requirements.

END OF SECTION

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes general procedural requirements for temporary facilities and controls including, but not limited to the following:
   1. Temporary Utilities
   2. Barriers
   3. Fencing
   4. Exterior Enclosures
   5. Security
   6. Vehicular Access and Parking
   7. Waste Removal
   8. Project Identification

1.2. RELATED SPECIFICATION SECTIONS

A. Section 01 31 19 Progress Meetings
B. Section 01 74 19 Construction Waste Management and Disposal

1.3. QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
   1. Building Code requirements
   2. Health and safety regulations
   3. Utility company regulations
   4. Police, Fire Department and Rescue Squad rules
   5. Environmental protection regulations
   6. Joint Commission - Hospital Accreditation Standards

B. Standards: Comply with NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations," ANSI A10 Series standards for "Safety Requirements for Construction and Demolition," and NECA Electrical Design Library "Temporary Electrical Facilities".

C. Electrical Service: Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70 "National Electric Code".

1.4. TEMPORARY UTILITIES

A. Owner or Contractor (choose one) will provide the following:

1. Electrical power and metering, consisting of existing facilities.
2. Water supply, consisting of existing facilities.

B. General:
1. Existing facilities may be used.
2. New permanent facilities may be used.

C. Water Service: water is available from existing building services.
1. Use trigger-operated nozzles for water hoses, to avoid waste of water.

D. Temporary Electric Power Service: Electrical Contractor shall extend temporary power from existing building services.

1.5. BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

1.6. FENCING

A. Construction: Contractors option.

1.7. EXTERIOR ENCLOSURES

A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.8. SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.9. VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

1.10. WASTE REMOVAL

A. See Section 01 74 19 - Waste Management, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.11. PROJECT IDENTIFICATION

A. Provide project identification sign of design and construction indicated in Section 01 58 13.

B. Erect on site at location determined by Owner .

C. No other signs are allowed without Owner permission except those required by law.

PART 2 - PRODUCTS

2.1. TEMPORARY PARTITIONS

A. Provide dustproof partitions to limit dust and dirt migration and to separate occupied areas from fumes and noise.
1. Non-fire rated partitions, standard
a. Wood stud framing, 6-mil polyethylene

2.2. EQUIPMENT

A. Temporary Lifts and Hoists: Contractors requiring temporary lifts and hoists shall provide facilities for hoisting materials and employees.

B. Electrical Outlets: Electrical Contractor shall provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.

C. Electrical Power Cords: Contractors requiring power cords shall provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

D. Lamps and Light Fixtures: Electrical Contractor shall provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.

E. Heating Units: General Contractor shall provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.

F. First Aid Supplies: General Contractor shall provide first aid supplies complying with governing regulations.

G. Fire Extinguishers: General Contractor shall provide hand-carried, portable UL-rated, fire extinguishers of NFPA recommended classes for the exposures, extinguishing agent and size required by location and class of fire exposure.

PART 3 - EXECUTION

3.1. TEMPORARY FIRE PROTECTION

A. Until fire protection needs are supplied by permanent facilities, General Contractor shall install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses.

B. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations".

C. Locate fire extinguishers where convenient and effective for their intended purpose.

D. Store combustible materials in containers in fire-safe locations.

E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires.

F. Prohibit smoking on the premises.

G. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

H. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site

I. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

3.2. COLLECTION AND DISPOSAL OF WASTE

A. Collect waste from construction areas and elsewhere daily

B. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly.

C. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to rise above 80 deg F.

D. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of material in a lawful manner.

3.3. ENVIRONMENTAL PROTECTION

A. Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted, or that other undesirable effects might result.

B. Avoid use of tools and equipment which produce harmful noise.

C. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide general guidelines and responsibilities related to the receiving, handling, and storage of all materials and products from arrival on the job site through installation.
   1. Immediate inspection of delivered goods means a timely replacement if damaged.
   2. Proper storage helps prevent damage and loss by weather, vandalism, theft, and job site accidents.
   3. Proper storage helps with job site performance and safety.
   4. Proper handling helps prevent damage and job site accidents.

B. Each Contractor shall be directly responsible for the receiving, handling, and storage of all materials and products associated with the Work of their Division or Trade.

C. Each Contractor responsible for Work associated with Owner provided materials or products shall be responsible for the receiving, handling and storage of the material/product as outlined in Section 3.8 below..

1.2. RELATED SPECIFICATIONS

A. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".
   1. Use the following link to access the Standard Specifications web page:
      http://www.cityofmadison.com/business/pw/specs.cfm
      a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
      b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
      c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.

B. Section 01 74 13 Progress Cleaning

C. Section 01 76 00 Protecting Installed Construction

D. Other Divisions and Specifications that may address more specifically the requirements for the storage and handling of materials and products associated Work of other Divisions or Trades.

1.3. QUALITY ASSURANCE

A. The GC shall be responsible for ensuring that these minimum storage and handling requirements are met by all contractors on the project site including but not limited to the following:
   1. Receiving deliveries of materials, products, and equipment.
      a. Inspect all deliveries upon arrival for damage, completeness, and compliance with the construction documents.
         i. Deliveries shall remain in original packaging or crates, shipping manifest shall be kept with the delivery and the packaging shall have visible identification of the items within the packaging.

b. Immediately report any damaged products or equipment to the GC, begin arrangements for immediate replacement.
c. Materials or equipment that have been damaged, are incomplete, or do not comply with the construction documents shall not be permitted to be installed.

2. All materials and products shall be stored within the designated limits of the project site. Only store the amount of material necessary for upcoming operations so as not to interfere with other construction activities and access to Work by the Owner and Engineer. Any offsite storage shall be at the expense of the contractor storing the material or product. All offsite storage requirements shall comply with this specification. All offsite storage of materials is subject to Owner Representative Quality Management review at any time.
3. Large storage containers may be used but shall be weather tight, securable, placed on concrete blocks, timbers, or jack stands and shall be level.
4. When lifting equipment is required the equipment rating shall be greater than the loading requirements of the item being lifted. In addition all of the following shall apply as necessary:
   a. Only designated and/or designed lift points shall be used.
   b. Large items shall have tag lines and handlers at all times during lifting operations.
   c. Lift at multiple points as needed to prevent bending.
5. Materials and products stored inside of the structure shall comply with all of the following:
   a. Storage shall not be allowed to impede the flow of work in progress.
   b. Storage shall not be allowed to hide completed work from review and inspections.
   c. Storage shall not exceed the design loads of the structural components it is being stored upon.
6. All materials and products shall be stored according the manufacturers minimum recommended requirements. All of the following shall be considered before storing any product or material:
   a. Dust and dirt
   b. Moisture and humidity, including rain and snow
   c. Excessive temperatures, direct sun, etc
   d. Product or material weight and size
   e. Potential for breakage
   f. Product incompatibility with other products such as corrosiveness, chemical reactions, flammability, etc.
   g. Product or material value and replacement cost
7. The Contractor shall be responsible for providing fully functional tarps or plastic wrap, to protect materials and products from the weather. All coverings shall be free of large holes and tears, and shall be tied, strapped, or weighted down to resist blowing.
8. The Contractor shall be responsible for any temporary heating, cooling, or other utility requirement that may be associated with the storage of a material or product.
9. The Contractor shall be responsible for securing materials and products of value such as copper, A/V equipment, etc. Such items shall be stored in securable shipping containers, job trailers or other such storage devices. Container shall be kept secured when not in use.

B. The GC shall inspect the job site daily to ensure that all products and materials stay weather tight and are secured against vandalism or theft as required by this specification.
C. The Owners Representative may at any time request improvements regarding storage of any material or product being provided under these construction documents.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL CONTRACTOR REQUIREMENTS

A. Designate material storage and handling areas as needed including all of the following:
   1. Designate specific areas of the site for delivery and storage of materials to be used during the execution of the Work.
   2. Designated areas shall not be located so as to interfere with the installation of any Work including Work by others such as the installation of utilities or the maintenance of existing utilities. This shall include not storing items in active utility easements as designated by the site plan.
B. Arrange for openings in the building as needed to allow delivery and installation of large items. Openings shall be appropriately sized to include the use of booms, slings, and other such lifting devices that may be larger than the item being installed.

1. When openings are required in completed Work (new or existing) the GC shall be responsible for providing an appropriate opening and for restoring the opening to the original or better condition upon completion. Restoration shall be weather tight and complete.

C. Repeated moving and handling of items being stored shall not be allowed. The GC shall be responsible for any damage and replacement because of mishandling or excessive handling.

3.2. BULK MATERIAL

A. Bulk material such as sand, gravel, top soil and other types of fill shall be stored away from the construction area and shall be stock piled as follows:
1. All bulk material shall be piled safely and efficiently in as small an area as practical. Only store the amount of material necessary for upcoming operations so as not to interfere with other construction activities and access to Work by the Owner and Engineer.
2. All stock piles shall have silt fence/sock properly installed around the perimeter to prevent erosion and loss of material. Refer to City of Madison Standard Specification Section 210.1(f) and other related specification or details.
3. Fine grained material shall be protected with tarps to prevent blowing. Tarps shall be weighted or staked to stay in place.

B. Bulk material such as brick, concrete block, stone, and other palletized materials shall be stored on original shipping pallets until ready for use.

3.3. DRY PACKAGED MATERIAL

A. Dry packaged material such as cement, mortar, etc shall be stored on pallets, on slightly elevated ground or clear stone pad to keep water away from the base of the material being stored. Protect from moisture.

3.4. STRUCTURAL AND FRAMING MATERIAL

A. All structural and framing material shall be stored in an organized manner arranged by type, size and dimension. Materials shall be stored on pallets or timbers as necessary and shall not be allowed to lie directly on the ground.

B. Long and heavy items shall be supported at several points to prevent bending and warping.

3.5. EQUIPMENT

A. Equipment delivered to the site shall be stored away from all construction activities until the item can either be moved inside or properly installed.

B. Equipment shall be stored on slightly elevated ground or clear stone pad to keep water away from the base of the equipment.

3.6. FINISH PRODUCTS

A. Finish products such as flooring, tile, counters, lockers, toilets, partitions, lighting, and other similar items should not be delivered and stored until the structure has been enclosed, is weather tight, temperature controlled and the contractor is ready for such items to be installed.
1. Storage of finished products outside for any length of time shall not be allowed.

B. Products that cannot be stored inside the structure shall be stored in secured containers or job trailers until such time as they are ready to be installed.

C. Products with a high potential for breakage such as glass, mirrors, tiles, toilet fixtures, etc. shall be stored with additional protection as necessary such as but not limited to the following:
1. Store in original shipping containers until ready for installation.
2. Do not store in high traffic areas.
3. Shield with other materials such as cardboard, plywood, or similar products.

3.7. DUCTWORK, PIPING, AND CONDUIT

A. All piping and conduit shall be stored horizontally unless otherwise specified by the manufacturer or Division and Trade Specifications.
1. Do not store directly on grade.
2. Cover metal pipes and tubes to prevent rust and corrosion, allow ventilation to prevent condensation.
3. Whenever possible use pipe stands for storing pipe and conduit to prevent tripping and rolling hazards.

B. All ductwork shall be stored horizontally or vertically as necessary unless otherwise specified by the manufacturer or Division and Trade Specifications.
1. During storage, both ends of each duct shall be protected with plastic sheathing to prevent dust and dirt from getting inside the duct. Sheathing shall be sufficiently taped to the duct.

2. After installation, free/open ends shall remain protected with taped plastic sheathing and or temporary filters as specified by division or Trade specifications.

3.8. OWNER PROVIDED, CONTRACTOR INSTALLED EQUIPMENT

A. Section 3.8.A. shall apply to all equipment being provided to any contractor directly from the Owner for installation under the contract.
   1. The Owner or Owners Representative shall do the following:
      a. Inspect all deliveries upon receipt and notify manufacturer of any issues directly.
      b. Review the received shipment with the contractor.
         i. Only provide products or materials to the contractor that were not damaged through shipping or handling.
         ii. Confirm missing products or materials and anticipated delivery schedule if known.
   2. The Contractor responsible for the installation of Work associated with Owner provided materials or products shall "take ownership" and provide safe and secure storage and handling as previously described within this specification.
      i. The Contractor shall be liable for the repair or replacement of any material or product damaged after taking ownership of the product from receipt through final acceptance.

B. Section 3.8.B. shall apply to all equipment being provided by the Owner but shipped directly to any sub-contractor or the project site for installation under the contract.
   1. The GC and/or Contractor responsible for the Work associated with the Owner provided materials or products shall do the following:
      a. Inspect all deliveries upon receipt and notify the Owner or Owners Representative of any issues directly.
         i. Owner or Owners Representative shall notify manufacturer of any issues directly.
      b. Review the received shipment with the Owner or Owners Representative
         i. Confirm missing products or materials and anticipated delivery schedule if known.
   2. The Contractor shall "take ownership" and provide safe and secure storage and handling as previously described within this specification.
      i. The Contractor shall be liable for the repair or replacement of any material or product damaged after taking ownership of the product from receipt through final acceptance.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 – GENERAL

1.1. SUMMARY

A. This Section includes general procedural requirements for cutting and patching including, but not limited to the following:
   1. Examination
   2. Preparation
   3. Performance
   4. Cleanup and Restoration

1.2. RELATED SPECIFICATION SECTIONS

A. Divisions 02 through 32 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
B. Division 07 Section "Penetration Fire Stopping" for patching fire-rated construction.

1.3. DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work.
B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
C. Level Alpha

1.4. QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
B. Operational Elements: Do not cut and patch operating elements and related components ina manner that results in reducing their capacity to perform as intended or that may result in increased maintenance or decreased operational life or safety.
C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that may result in increased maintenance or decreased operational life or safety. Some miscellaneous elements include the following:
   1. Water, moisture, or vapor barriers
   2. Membranes and flashings
   3. Exterior curtain-wall construction
   4. Equipment supports
   5. Piping, ductwork, vessels, and equipment
   6. Noise and vibration control elements and systems
D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.5. WARRANTY

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

B. All cutting and patching work performed under this contract shall be warranted like new work as defined by the Specification governing the work.

PART 2 - MATERIALS

2.1. GENERAL

A. Comply with requirements specified within other sections of the Specifications.

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

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

PART 3 - EXECUTION

3.1. EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions havebeen corrected.

3.2. PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. If the failure to protect, or the lack of protection, of in-place construction and/or existing conditions results in damage, the contractor shall be responsible for repair to previous condition.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

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

3.3. PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces totheir original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retainedor adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 3l Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

D. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

3.4. CLEANUP AND RESTORATION

A. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
   1. Clean piping, conduit, and similar features before applying paint or other finishing materials.
   2. Restore damaged pipe covering to its original condition.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   5. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather tight condition.
   7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
   8. Any smoke and fire caulking that has been disturbed must be replaced by the Contractor as required by code.

END OF SECTION

SECTION 01 74 13
PROGRESS CLEANING

PART 1 – GENERAL

1.1. SUMMARY

A. Throughout the execution of this contract all contractors shall be responsible for maintaining the project site in a standard of cleanliness as described in this specification.

B. All contractors shall also comply with the requirements for cleaning as described in other specifications.

C. Work included in this specification shall include but not be limited to:

1. Safety Cleaning
2. Project Site Cleaning
3. Progress Cleaning
4. Final Cleaning

1.2. RELATED SPECIFICAITONS

A. Section 01 60 00 Product Requirements

B. Section 01 74 19 Construction Waste Management and Disposal

C. Section 01 76 00 Protecting Installed Construction

1.3. QUALITY ASSURANCE

A. The General Contractor (GC) shall conduct daily inspections, more often if necessary, of the entire project site to ensure the requirements of cleanliness are being met as described within these specifications.

B. All contractors shall comply with other regulatory requirements as they apply to waste recycling, reuse, hauling, and disposal requirements of any governmental authority having jurisdiction.

C. The Owner reserves the right to have work done by others in the event any contractor fails to perform cleaning as described within these specifications. The cost of any Owner provided cleaning shall be charged to the contractor through a deduct change order.

PART 2 - PRODUCTS

2.1. CLEANING MATERIALS AND EQUIPMENT

A. The Contractor shall provide all required personnel, equipment, and materials necessary to maintain the required level of cleanliness as described in this specification.

B. Use only cleaning materials and equipment that are compatible with the surface being cleaned, as recommended by the manufacturer, or as approved by the A/E.

C. Use only cleaning materials, equipment, and methods as recommended in the manufacturers care and use guide of the material, finish or equipment being cleaned.

PART 3 - EXECUTION

3.1. SAFETY CLEANING

A. All Contractors shall be responsible for safety cleaning as required by OSHA and other regulatory requirements as applicable.

B. Safety Cleaning shall include but not be limited to the following:

1. All work areas, passageways, ramps, and stairs shall be kept free of debris, scrap materials, pallets, and other large items that would obstruct exiting routes. Small items such as tools, electrical cords, etc are picked up when not in use.
2. Form and scrap lumber shall have nails/screws removed or bent over. Lumber shall be neatly stacked in an area designated by the GC.
3. Spills of oil, grease, and other such liquids shall be cleaned immediately or sprinkled with sand/oil-dry first, then cleaned.
4. Oily, flammable, or hazardous items shall be stored in appropriate covered containers and storage devices unless actively being used.
5. Oily, or flammable rags, and other such waste shall only be disposed of in authorized covered containers.
6. Disposal by burning shall not be allowed at any time.

3.2. PROJECT SITE CLEANING

A. This section applies to the general cleanliness of the project site as a whole for the duration of the execution of this contract.

B. Exterior Project Site Areas

1. The GC and other Contractors as appropriate shall ensure the following levels of cleanliness are applied to the exterior project site areas.
   a. The overall appearance of the project site is neat and orderly. Defined areas for material storage, material waste, job trailers, and the project area are clean and well maintained.
   b. The construction fence is maintained, erect with no gaps, and properly posted per all regulatory requirements.
   c. All erosion control measures are properly maintained, cleaned, and repaired as necessary.
   d. All loose materials (construction or waste) are properly tied or weighted down to resist blowing.
   e. All construction materials are properly covered with fully functional tarps or plastic wrap, protected from the weather, coverings are tied, strapped, or weighted down to resist blowing.
   f. Dust control is applied as necessary or as required by any regulatory requirement.

C. Interior Project Site Areas

1. All Contractors shall ensure the following levels of cleanliness are applied to the interior project site areas.
   a. The overall appearance of the project site is neat and orderly. Defined areas for material storage, material waste, and project area are clean and well maintained.
   b. Stored materials are kept in original shipping containers whenever possible. Stored materials not in shipping containers are properly stored and protected according to other applicable specifications.
   c. All scraps and debris shall be properly disposed of as often as necessary to keep work areas, passageways, stairs, and ramps free of debris and clear for emergency exiting.
   d. Boxes, pallets, and other such shipping containers, are broken down, stored in a consolidated area or, disposed of as often as is necessary.
   e. Hand tools, supplies, materials, electrical cords not being used are picked up and sptored in gang boxes, not left as walking hazards in work areas, passageways, etc.

D. Job Trailer

1. The interior of the job trailer shall be kept clean and available as a work space at all times. The GC shall ensure that the following is provided for within the job trailer:
   a. Meeting space including tables and chairs.
   b. Sufficient space for all contractors to access the official construction documents, provide updates, etc.

3.3. PROGRESS CLEANING

A. This sub-section shall apply to all Progress Cleaning prior to the installation of finishes, fixtures, and trim (IE rough-in).

1. For the purposes of this section “clean” shall be defined as a level of cleanliness free of dust and other material capable of being removed by use of reasonable effort using a good quality janitor broom and shop-vac.
2. Daily cleanings shall be conducted by all contractors at the end of the work day as follows:
   a. Debris in excavated areas shall be removed prior to backfill and compaction.
   b. Debris in wall cavities, chase spaces, etc shall be removed prior to enclosing the spaces.
   c. Large items shall be properly stored, returned to designated areas, or disposed of as necessary.

d. Loose materials shall be properly secured.
e. Flammable or hazardous materials are properly stored or disposed of.

3. Weekly cleaning shall be conducted by all contractors as designated by the GC. Weekly cleanings shall include all the above for a daily cleaning and other necessary cleaning as designated by the GC.

B. This sub-section shall apply to Progress Cleaning in preparation for the installation of finishes, fixtures, and trim.
   a. Surfaces receiving finishes shall be thoroughly cleaned prior to contractors applying finish materials. The GC shall be responsible for inspecting the area and surfaces being cleaned for finish prior to the sub-contractor applying the finish. This shall include but not be limited to the following:
      i. Wall surfaces shall be wiped clean of dirt and oily residues, vacuumed free of dust, and shall be free of surface imperfections prior to painting or installing wall coverings.
      ii. Metal surfaces shall be wiped clean of dirt and oily residues, and be free of surface imperfections prior to painting.
      iii. Flooring shall be broom swept of large and loose items then vacuumed clean of dust and small particles, and damp mopped clean and dried prior to installing any flooring finish. Additional cleaning may be required depending on the preparation requirements recommended by the flooring material manufacturer.

C. This sub-section shall apply to Progress Cleaning after the installation of finishes, fixtures, and trim.
   1. For the purposes of this section “clean” shall be defined as a level of cleanliness free of dust and other material capable of damaging or visually disfiguring finished work, finishes, fixtures, and trim.
   2. Progress Cleaning at this point in the contract shall be conducted immediately as follows:
      a. Dust, dirt, etc shall be swept and vacuumed off of finish flooring and trim.
      b. Liquid spills shall be cleaned up according to the spill type. This shall include drips and spills caused by paint, stain, sealants, and other such items.
   3. The Contractor(s) at no additional cost to the Owner shall be responsible for replacing any finished work, finishes, fixtures, and trim damaged or disfigured because of inadequate or improper cleaning.

3.4. FINAL CLEANING

A. As noted in Specification 01 29 76 Progress Payment Procedures, Progress Payment Milestone Schedule, Final Cleaning shall not be conducted prior to requesting the 90% contract total progress payment and all of the following shall be complete:
   1. All final regulatory inspections including but not limited to Building Inspection Department and Madison Fire Department inspections have been successfully completed.
   2. All Quality Management Observation (QMO) reports have been closed out.
   3. All Demonstration and Training has been completed.
   4. All Attic Stock has been consolidated and located to its designated area
   5. All protection for installed construction shall be removed prior to final cleaning by the contractor responsible for providing the protections. This shall include the removal of any adhesive residues left behind from tapes. Contractors shall only use manufacturer authorized cleaning materials for removing adhesives, etc.

B. For the purposes of this section “clean” shall be defined as a level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

C. The GC shall be responsible for ensuring that all requirements under this section are being met.

D. General Requirements
   1. Employ experienced personnel or professional cleaners for final cleaning as necessary for the areas or equipment being cleaned.
   2. Cleaning equipment used shall be commercial grade equipment commonly used by professional cleaners.
   3. Cleaning equipment and materials shall be cleaned, rinsed, or replaced to ensure a uniform level of cleanliness is being maintained during the final cleaning. This shall include but not be limited to the following:
      a. Vacuum cleaner bags and/or filters are changed and/or cleaned as often as necessary.
      b. Dust & wipe down rags are washed, rinsed, or replaced before starting each room.
      c. Mopping equipment
         i. Mop water for washing shall have cleaning solution added to the amount and temperature per manufacturer’s recommendations. Mop washing water shall be replaced often to maintain the levels of the cleaning solution and temperature required.
         ii. Mop water for rinsing shall remain clean, clear, and be replaced as often as necessary.
         iii. Mop heads shall be rinsed often and replaced as necessary.

iv. Mop heads and buckets shall be thoroughly rinsed with each change of water.
v. Only new mop heads shall be used for rinsing.

E. Refer to all other specifications in this contract for specific requirements regarding final cleaning of finishes, fixtures, equipment, etc.

F. Exterior Cleaning shall include but not be limited to the following:
1. All exterior glazing surfaces have been professionally cleaned and are free of dust and streaking.
2. Metal roofs, siding, and other surfaces shall be clean of dirt and free of splashed or excess materials such as sealants, mortar, paint, etc.
3. All exterior furnishings shall be clean, waste receptacles shall be empty.
4. Paved areas shall be clean, free of dirt, oily stains and other such blemishes
5. Exterior lights and diffusers are clean and free of dust.

G. Interior Cleaning shall include but not be limited to the following:
1. Remove all labels, stickers, tags, and other such items which are not required by code as permanent labels.
2. All interior glazing surfaces, including mirrors, have been professionally cleaned and are free of dust and streaking.
3. All interior surfaces have been cleaned of excess materials such as paint, sealants, etc and have been wiped free of dust.
4. Interior metals, fixtures, and trim have been cleaned free of dust and oily residues
5. Carpet flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains removed per manufacturers use and care instructions.
6. Resilient flooring has been thoroughly cleaned; vacuumed free of dust, excess glues and other stains removed, mopped and buffed per manufacturers use and care instructions.
7. Interior non-occupied concrete floors shall be broom cleaned, vacuumed free of dust, excess glues and other stains removed per manufacturers use and care instructions.
8. Light fixtures, lamps, diffusers and other such items have been dusted and cleaned as necessary.

3.5. CALL BACK WORK

A. The GC shall be responsible for ensuring that any contractor returning to the project site for completion or correction work has re-cleaned and restored the area to the levels described in section 3.4 above upon completion of the work. This shall include but not be limited to the following:
1. The immediate area(s) where work was completed.
2. Adjacent areas where dust or debris may have traveled.
3. Other areas occupied during the completion of the call back work.
4. Path of entrance/exit, to/from the area(s) of work.

END OF SECTION

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 – GENERAL

1.1. SUMMARY

A. This specification includes administrative and procedural requirements for the recycling, re-use, salvaging, and disposal of non-hazardous construction and demolition waste.

B. The General Contractor (GC) shall be fully responsible for complying with all applicable ordinances and other such regulatory requirements during the execution of this contract.

1.2. RELATED SPECIFICAITONS

A. 01 29 76 Progress Payment Procedures

B. 01 33 23 Submittals

C. 01 77 00 Closeout Procedures

D. Other Divisions and Specifications that may address the proper disposal of construction or demolition waste as it pertains to work being conducted under that particular specification.

1.3. CITY ORDINANCES

A. There are two (2) Madison General Ordinances (MGO) that the City of Madison has regarding construction and demolition waste.

1. MGO 10.185, Recycling and Reuse of Construction and Demolition Debris, describes the requirements associated with this ordinance including definitions, documentation requirements, and penalties.
2. MGO 28.185, Approval of Demolition (Razing, Wrecking) and Removal, describes the requirements associated with applying for and receiving a demolition permit.

B. All City of Madison, Board of Public Works, contracts being conducted by City Engineering, Facility Management, for construction, remodeling, or demolition shall comply with the above ordinances regardless of project type or size.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL GUIDELINES FOR ALL WASTES

A. Recycle all paper and beverage containers used by workers, sub-contractors, suppliers and visitors to the project site.

B. All revenues, savings, rebates, tax credits, and other such incentives received from recycling, reusing, or salvaging waste materials shall accrue to the GC unless specified otherwise in the contract documents.

C. Separate recyclable, reusable, and salvageable waste from other waste materials, trash, and debris except where Waste Management Disposal Company allows comingled waste materials, see section 1.8.D above.

1. Separate by type in appropriate containers or designated areas according to the approved waste management plan away from the construction area. Do not store within the drip lines of existing trees.
2. Inspect containers and bins frequently for contamination and inappropriately sorted materials. Remove contaminated materials and resort as necessary.

3. Stockpile bulk materials such as sand, topsoil, stone, etc., on site away from the construction area and without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water, and cover to prevent windblown dust. Do not store within the drip lines of existing trees.
4. Whenever possible store items off the ground and/or protect them from the weather.

3.2. GUIDELINES FOR RECYCLABLE, RE-USABLE, AND SALVAGEABLE WASTE

A. The following guidelines is not a complete or all inclusive list and shall be adjusted as needed by the methods and procedures identified in the Waste Management Plan.
B. Asphalt Paving: Break-up into transportable pieces or grind, transport to an authorized recycling facility.
C. Carpet and Pad: Separate carpet and pad scraps, containerize and transport to an authorized recycling facility.
D. Ceiling System Components: Suspended ceiling system components shall be sorted by material type as follows:
   1. Broken, cut, or damaged tiles shall be containerized, transport to an authorized recycling facility.
   2. Damaged, or cut tracks, trim and other metal grid system components shall be sorted with other metals of similar types, palletize, transport to an authorized recycling facility.
E. Clean Fill: When allowed by Division 31 Specifications; concrete, masonry, stone, asphalt pavement, sand and other such materials may be used as clean fill on this project site. The GC shall verify with the Project Engineer, Structural Engineer, or Civil Engineer as necessary prior to using any materials as clean fill. Materials shall be processed, placed, and compacted as specified. If not being re-used on site, transport to an authorized recycling facility.
F. Clean Wood Materials: Including but not limited framing cutoffs, wood sheathing or paneling materials, structural or engineered wood products, and pallets or crates. Clean Wood shall be free of paints, stains, oils, preservatives and other such contaminates.
   1. Useable pieces shall be sorted by type and dimension, bundled and transported off site by the GC or returned to the supplier.
   2. Non-useable pieces shall be palletized or containerized, transport to an authorized recycling facility.
   3. Clean, uncontaminated sawdust and wood shavings shall be bagged, transport to an authorized recycling facility.
G. Concrete: Break-up into transportable pieces, remove all reinforcing and other metals, transport to an authorized recycling facility.
H. Glass Products: Shall be sorted by types, do not include light fixture lamps and bulbs. Products broken in shipment shall be returned to the supplier. Broken or cracked items still in frames shall be taped to prevent further breakage and injury to workers. Transport to an authorized recycling facility.
I. Gypsum Board: Stack large clean pieces on wooden pallets or container, store in a dry location, transport to an authorized recycling facility.
J. Light Fixture Lamps and Bulbs: Fluorescent tubes shall be containerized, transport to an authorized recycling facility.
K. Masonry and CMU: Remove all metal reinforcing, anchors, and ties, clean undamaged pieces and neatly stack on pallets, transport damaged pieces to an authorized recycling facility.
L. Metals: Sort metals by type as follows, this does not include piping:
   1. Architectural metals including but not limited to siding, soffit, and roofing panels shall be sorted by material, palletize or bundle as needed and transport to an authorized recycling facility.
   2. Structural steel, sort by size and type; palletize and transport to an authorized recycling facility.
   3. Miscellaneous metals such as aluminum, brass, bronze, etc shall be sorted by type, containerized or palletized as necessary, transport to an authorized recycling facility.
M. Packaging and shipping materials
   1. Cardboard boxes and containers: Breakdown all cardboard boxes and containers into flat sheets. Bundle and store in a dry location until transported for recycling.
   2. Pallets:
      a. Whenever possible require deliveries using pallets to remove them from the project site.
      b. Neatly stack pallets in preparation for reusing them or providing them to other companies for salvage or re-use.
      c. Break down pallets into component wood pieces that comply with the requirements for recycling clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
   3. Crates: Break down crates into component wood pieces that comply with the requirements for recycling clean wood materials. Neatly stack or palletize pieces in preparation for transportation.
   4. Polystyrene Packaging: Separate and bag materials.

N. Piping and conduit: Reduce all piping and conduit to straight lengths, sort and store by size, material and type. Remove supports, hangers, valves, boxes, sprinkler heads, and other such components, sort and store by size, material and type. Transport to authorized recycling facilities according to material types.

O. Roofing: Roofing materials shall be sorted and containerized by type, transport to authorized recycling facilities according to material types.

P. Site-Clearing Waste: Sort all site waste by type.

1. Only stockpile soils types and quantities required for re-use on the project site. All remaining quantities shall be transported off site to an authorized facility that receives such materials.
2. Brush, branches, and trees with no marketable re-use shall be transported to facilities for chipping into mulch.
3. Trees with a marketable re-use shall be salvaged and transported to facilities that specialize in processing trees for future use as wood products.

3.3. GUIDELINES FOR DISPOSAL OF WASTES

A. The following guidelines shall be adjusted as needed by the methods and procedures identified in the Waste Management Plan.

B. Any waste that is contaminated, organic, or cannot be recycled, re-used, or salvaged shall be legally disposed of in an authorized landfill or incinerator. Disposal methods shall follow all applicable regulatory requirements.

C. No waste material of any kind, except those types designated as clean fill in section 3.4 above, shall be allowed to be buried on the project site at any time.

D. No burning of any kind of waste material shall be permitted on this project site at any time.

E. Paint and Stain: Paints, stains, and their containers shall be disposed of as follows:

1. Whenever possible containers should be thoroughly cleaned immediately after emptying and sorted with as appropriate (metal or plastic) for recycling
2. Empty containers, regardless of type or base material, may be disposed of with lids off with general garbage.
3. Latex paint may be placed with general garbage if properly solidified as follows:
   a. Small amounts (an inch or less in can): Remove lids and allow paint to dry out in the can and harden. Protect cans from rain and freezing.
   b. Large amounts (more than one inch): Mix paint with equal amounts of cat litter, stir and allow to completely dry. Alternate method: mix with commercial paint hardener.
4. Oil-based or combustible paints and stains, regardless of liquid or solid, shall be transported to an approved facility that takes such items such as Dane County Clean Sweep Sites.

F. Treated Wood Materials: Treated wood materials including but not limited to wood that has been painted, stained, or chemically treated shall not be recycled or incinerated.

END OF SECTION

SECTION 01 76 00
PROTECTING INSTALLED CONSTRUCTION

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities, guide lines, and requirements related to providing protection to already installed construction.

B. Already installed construction shall include but not be limited to the following:

1. Any existing site feature such as pavement, curbs, drainage features, utilities, landscaping features (trees, shrubbery, plantings, flagpoles, etc) and other such exterior items not associated with the building whether on or adjacent to the project site.
2. Any existing structure on or adjacent to the project site.
3. Any existing interior work that may be adjacent to the new work including all paths of ingress/egress to areas associated with accessing the Work.
4. Any existing feature of any kind within the public right-of-way that may be on the project site property, adjacent to the project site or across the street from the project site.

C. All contractors shall be familiar with the specifications of their Division of Work for specific requirements on protection of the Work.

D. The requirements noted within this specification do not relieve any contractor of the responsibility for compliance with any code, statute, ordinance, or other such regulatory requirement having jurisdictional authority over these contract documents.

1.2. QUALITY ASSURANCE

A. It shall be the responsibility of every contractor and worker assigned to the project to be diligent in protecting all existing work, and newly installed construction.

B. It shall be the General Contractors' (GC) responsibility under the contract to provide all reasonable protection methods, materials, or precautionary measures required to protect new or existing construction as described in within this specification to the project as a whole.

1. The GC shall be responsible to ensure any damaged new or existing construction is repaired or replaced at no additional cost to the Contract.
2. The GC at his/her discretion may direct other contractors to provide and maintain protection of completed work associated with their Division of Work. I.E.: The carpet installer may be required by the GC to provide carpet protection along traveled paths, ingress/egress, etc after installation.

C. It shall be the responsibility of the GC to ensure that all materials being used to protect installed construction are compatible with, and/or adjacent to, the materials being protected. This shall include but not be limited to the material used as covering, tapes used to fasten protective materials, etc.

1.3. RELATED SPECIFICATIONS

A. Parts of this specification will reference articles within "The City of Madison Standard Specifications for Public Works Construction".

1. Use the following link to access the Standard Specifications web page:
   http://www.cityofmadison.com/business/pw/specs.cfm
   a. Click on the "Part" chapter identified in the specification text. For example if the specification says "Refer to City of Madison Standard Specification **2**10.2" click the link for Part II, the Part II PDF will open.
   b. Scroll through the index of Part II for specification 210.2 and click the text link which will take you to the referenced text.
   c. City Standard Detail Drawings (SDD) may be located from the index in Part VIII.

B. Section 01 60 00 Product Requirements

C. Section 01 74 13 Progress Cleaning

PART 2 - PRODUCTS

2.1. FENCING MATERIALS AND BARRICADES

A. Except where noted in other areas of the construction documents the responsible contractor may provide any of the following that sufficiently provide a sturdy physical barrier and/or visual barrier as necessary for the intended application.

1. Standard orange construction barrels each with a standard rubber base ring and reflective tape
   a. Provide flashing amber lights as needed to increase night time visibility
2. Steel "T" style fence posts
3. 4'0" high standard orange construction fence
4. Traffic barricades
5. Jersey barriers
6. Other types of fencing or barricades typically used in the construction industry

B. The contractor responsible for providing the fencing materials and barricades shall also be responsible for maintaining them. This shall include but not limited to fixing damaged fencing, standing up barrels that have been knocked over, realigning barrels, and ensuring flashing lights are fully operational at all times.

C. The following fencing and barricade designations, and their use descriptions shall be used throughout this specification to provide uniformity in describing protection requirements.

1. Type A, Jersey Barriers, to be used as permanent blocking devices to deny access to alternate project site entrances or exits.
2. Type B, Traffic Barricades, to be used as temporary blocking devices to deny access to alternate project site entrances or exits.
3. Type C, Construction Barrels without construction fencing shall be used for lane closures, temporary blocking devices to deny access and the protection of single locations (I.E. identify the location of an access structure) that do not require fencing.
4. Type D, Construction Barrels with construction fencing where it becomes necessary to surround an object with a complete visual barricade and it is impractical or unacceptable to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected.
5. Type E, Steel "T" Fence Posts with construction fencing to surround an object with a complete visual barricade and it is practical to install fence posts. The surround shall be constructed in such a manner as to provide a buffer zone around and access to the item being protected.
6. Type X, Other fencing or barricade types that may be designated and detailed within the construction documents shall use additional alpha numeric designations.

2.2. EROSION CONTROL PROTECTION

A. Refer to City of Madison Standard Specification 210.2 for authorized materials associated with erosion control materials.

2.3. INTERIOR FINISH PROTECTION MATERIALS

A. Except where noted in other areas of the construction documents or this specification the responsible contractor:

1. Shall not provide the cheapest or least effective method as an effort to meet any protection requirement.

2. Shall provide materials of sufficient quality, and durability to provide adequate protection based on the seasonal conditions and the anticipated duration at the time the protection will be needed.
3. Shall provide sufficient quantity of protection material to protect the construction as needed.

B. Prior to installing protective measures the responsible contractor shall propose to the GC, Project Engineer (PE) and City Project Manager (CPM) the proposed plan for protection, materials to be used and samples as necessary.
1. The PE and CPM reserve the right to disapprove any proposed method and/or material and/or make alternate proposals.

PART 3 - EXECUTION

3.1. GENERAL EXECUTION REQUIREMENTS

A. The GC shall be responsible for ensuring all of the following procedures and requirements are implemented as needed for the duration of the Work performed under this contract.

B. The GC shall also be responsible for the following:
1. Reporting any incident of damage to existing property, right-of-way, or utility to the CPM immediately upon rendering the incident safe, and notifying emergency response teams, and emergency utility crews as needed.
2. Conduct a site walk through prior to leaving at the end of each day to assess:
   a. Protection measures are properly in place, provide correction actions as necessary.
   b. Note damage to existing completed work and schedule repair/replacement as needed.
3. Ensure all contractors and workers are being diligent in protecting existing work, and newly installed construction.

3.2. PROTECT ADJACENT PROPERTIES

A. Whenever possible through the design process the City of Madison shall have previously provided notice to adjacent property owners that work will be occurring on or near their property. The City of Madison shall also have obtained any permanent or temporary easements that may be necessary to complete any Work on adjacent properties.

B. It shall be the responsibility of the GC to do the following for all Work under this contract being performed on or adjacent to the property line:
1. Contact the adjacent property owner and provide him/her with information on the work to be done, equipment to be used, and estimated duration of the work. Information to be updated and communicated to property owner(s) as construction progresses and site conditions change.
   a. If any adjacent property is a rented or leased space the GC shall also make contact and provide the same information to the tenants.
   b. Determine from the owner and/or tenants if there are any concerns for children, pets, special plantings, or other concerns.
2. Discuss the following with all contractors performing work on or near the property line.
   a. Work to be completed and timeline.
   b. Concerns of adjacent property owners/tenants from item 1 above.
   c. Which protective measures will be necessary to protect adjacent properties and address the concerns of adjacent property owners/tenants.
3. Ensure all protective measures are placed and maintained during the execution of Work on or adjacent to the property line. Interact with the adjacent property owners/tenants as needed.

C. Any contractor doing work on or adjacent to the property line shall install and maintain any protective measure identified in the contract documents, this specification, or as directed by the GC.

D. The GC shall be responsible for restoring any damage to structure and property located on or adjacent to the property line.
1. Restoration shall include but not be limited to repair or replacement using like materials and finishes to its original condition or better.
2. Restoration of landscaping materials shall include watering of any seed, sod, or other planting of any kind for a reasonable period of time to encourage germination and root development.

E. The GC shall keep the CPM informed directly to any issues pertaining to adjacent property owners and tenants.

3.3. PROTECT LANDSCAPING FEATURES

A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.

1. Whenever possible do not install new landscape features until exterior building construction has been completed, equipment such as scaffolding and lifts are no longer needed and have been removed, and heavy equipment operation is no longer required.
2. Whenever possible remove and temporarily store all existing landscape features such as benches, waste receptacles, signage, and other such features that will be within the area of Work that can be removed.
3. Landscape features that cannot be removed such as flag poles, light poles, light bollards, etc. shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
4. Planting beds shall be protected using Type E fencing around the exposed perimeter of the planting bed as needed.
5. The City of Madison Standard Specification 107.13 shall apply to all tree protection in and around the project site at all times.

3.4. PROTECT UTILITIES

A. The contractor shall be responsible for notifying all utilities to determine emergency response procedures and protection requirements prior to installing any construction protection.
   1. This includes requesting utility marking through Diggers Hotline.
      a. Call 811 or 1-800-242-8511 to request a public utility locate
      b. For emergency locate call (262) 432-7910 or (877) 500-9592
   2. Contact the Owner and CPM for any available private utility information on the property that may be available prior to calling a private utility locating company.

B. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
   1. Hydrants, lamp posts, electrical transformers, and other utility pedestals shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil. Fence posts shall be located so as to not be directly over the utility main.
   2. Storm sewer structures in pavement shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type C Construction Barrels when necessary.
   3. Storm sewer structures in turf and other landscaped areas shall have proper inlet protection according to City of Madison Standard Specification 210.1(g) and Type E fencing for areas on soil.
   4. Stormwater management features such as greenways, retention/detention ponds, bio-filtration ponds and other such features shall be properly protected according to the appropriate erosion control measure specified on the Erosion Control Plan. See multiple sections of City of Madison Standard Specification 210.1
      a. For the protection of hard to see items such as structures, castings, inlets, etc. in grassy areas provide Type E fencing for areas on soil.
      c. For the protection of storm water management features having special soils and plants such as bio-filtration ponds provide Type E fencing for areas on soil.
   5. Other structures and covers including but not limited to cleanouts, wiring hand holes, valve boxes, access structures, grease trap structures, etc shall be protected as follows:
      a. Provide Type E fencing for areas on soil.
      b. When paving operations are complete provide a construction barrel or cone near structures as necessary depending on required heavy construction traffic.

3.5. PROTECT PUBLIC RIGHT OF WAY

A. Except where specifically stated in other areas of the construction documents the following minimal protection requirements shall apply under this section.
   1. All public right-of-way (area from behind the sidewalk to the centerline of the street) shall remain open and accessible except during periods of active work. At such times the public right of way shall be properly closed and signed as referenced in City of Madison Standard Specification 107.9.
   2. Bus stops and bus stop structures shall remain accessible at all times.
   3. Traffic signage and traffic signals, traffic control boxes shall be protected with Type D fencing for areas on pavement or Type E fencing for areas on soil.
      a. Protection at traffic signage/signals shall not obstruct the viewing of the sign/signal for its intended purpose at any time.

B. When additional protection for traffic control is required, the use of barricades, guardrails, lane closures and other such procedures will be detailed within the construction documents.

C. When additional protection for overhead sidewalk cover is required the contract documents shall indicate the specific location and structural requirements of the protective structure.

3.6. PROTECT STORED MATERIALS

A. All contractors shall refer to Specification 01 60 00 Product Requirements for all storage and protection requirements of building materials and products delivered to the site.

3.7. PROTECT WORK - EXTERIOR

A. Provide all temporary services that may be required to protect the installed material from heat, cold, humidity, etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.

B. Open trenches, pits, and other such excavations shall be properly covered, lined, or shored as needed during periods of inclement weather to prevent the caving of soils onto existing work in progress. Refer to the appropriate specifications and/or regulatory requirements governing this type of work as necessary.

C. Provide adequate protection at all openings with heavy duty tarps, plastic sheathing, or wood framing and sheathing as needed to protect interior work in progress from inclement weather as needed.

D. Protect exterior finishes of all kinds with heavy duty tarps or plastic sheathing as needed while landscaping is being installed through full germination of seeded areas or installation of filter fabric and mulches to keep dust, dirt, and mud off of finished exterior surfaces.

E. Designate specific curb mounting points and provide wood blocking where small vehicles, skid loaders and other such equipment may need access to areas being landscaped.

F. Provide plywood turning pads for skid loaders to turn on to prevent tire marking on new pavement.

G. Do not permit the parking of vehicles with any kind of fluid leaks to park on new pavement.

H. The contractor shall be responsible for cleaning, repairing, or replacing any completed work or work in progress under this specification as deemed necessary by the CPM without additional cost to the contract.

3.8. PROTECT WORK - INTERIOR

A. The GC shall do all of the following:

1. Provide all temporary services that may be required to protect the installed material from heat, cold, humidity, etc, while materials such as concrete, mortar, sealants, paints, etc, are drying and/or curing.
2. Provide adequate visual and/or physical protection as needed to protect newly completed interior work such as paint, flooring material, sealants, grouts, etc that may be drying and/or curing.
3. Provide adequate space and materials for cleaning boots, tool boxes, supplies, and other items coming into the project site once finish work has begun.
4. Clean dirtied areas and repair/replace damaged areas immediately.

B. The contractors responsible for interior work shall be responsible for protecting their work and finishes from dirt, mud, snow, spills, splatters, and physical damage after installation as follows:

1. Protect vinyl composite, rubber composite, painted/stained concrete, and tiled flooring as follows:
   a. Define foot traffic areas and protect with Ramboard Temporary Floor Protection products as a minimum basis of design or other protection product(s) compatible with installed flooring product if Ramboard is not compatible. Products to be used shall be new.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.
      ii. Repair tears immediately, replace worn areas with like material as necessary.
2. Protect carpeted areas as follows:
   a. Define foot traffic areas and protect with a minimum of 6mil, clear, polyethylene sheeting 3 feet wide. Products to be used shall be new.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.
      ii. Repair tears immediately, replace worn areas with like materials as necessary.
3. Protect all finished walls in high traffic areas with Ramboard Temporary Wall protection products or approved equal.
      i. Tape all edges, seams, etc with a good quality tape that does not leave sticky residue. Do not allow any debris or other material between the installed flooring and the protection material.
      ii. Repair tears immediately, replace worn areas with like materials as necessary.
3. Protect counter tops, cabinets, and other finished surfaces with large sheets of thick cardboard or Ramboard products. Do not allow toolboxes, finish materials, parts and other such items to be placed on finished materials.

C. All protection shall stay in place until the CPM, PE, and GC mutually deem the project is ready for Final Cleaning. The contractors responsible for protecting the work shall be responsible for removing the protection and removing any adhesive residue at that time. Contractors shall only use manufacturer authorized cleaning materials for removing adhesives, etc.

D. Contractors doing work in un-protected areas of finished work shall be required to provide drop cloths and other protection as noted within this specification for the duration of their work.

1. Finished areas shall be sufficiently covered to accommodate all equipment, and materials being used to complete the work being done.
2. Finished areas shall be sufficiently covered to prevent splatters, over spray, etc when doing touch-up work.
3. Contractors who do not provide sufficient protection under this sub-section shall be responsible for any costs associated with cleaning, repairing or replacing already finished construction at no additional cost to the contract.

END OF SECTION

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to clearly define and quantify the requirements associated with closing a City of Madison Public Works Contract for facility related work.

B. All contracts have two distinct but related paths. Each path needs to be properly closed independently in order to close the contract as a whole.

1. Construction closeout is related to closing out all of the Work associated with the construction documents.
   a. It shall be the responsibility of all contractors to be fully aware of the required Work and closeout requirements involved in their individual trades.
2. Contract closeout is related to closing out all of the administrative aspects of the contract in general.
   a. It shall be the responsibility of all contractors to be fully aware of the administrative requirements required by the contract and to provide the supporting documentation required.
3. Construction Closeout must be completed before Contract Closeout can begin.

C. This specification will provide general knowledge associated with the following areas:

1. Construction Closeout Requirements
2. Construction Closeout Procedure
3. Contract Closeout Requirements
4. Contract Closeout Procedure
5. Final Payment and Certificate of Completion

1.2. RELATED SPECIFICATIONS

A. Contractors shall review all references to other specifications including specifications relating to the execution of the Work associated with their Division or Trade.

B. Section 01 29 76 Progress Payment Procedures
C. Section 01 32 16 Construction Progress Schedules
D. Section 01 74 13 Progress Cleaning
E. Section 01 45 16 Construction Waste Management and Disposal
F. Section 01 76 00 Protecting Installed Construction
G. Section 01 78 23 Operation and Maintenance Data
H. Section 01 78 36 Warranties
I. Section 01 78 39 As-Built Drawings
J. Section 01 79 00 Demonstration and Training
K. Other requirements as noted in the contract documents signed by the General Contractor

1.3. DEFINITIONS

A. ***Substantial Compliance***: A letter provided to the City of Madison Building Inspection and signed by the Project Engineer indicating that all Work has been completed to a level that would allow Owner Occupancy and that all construction is in compliance with the construction documents. A copy of this letter is also provided to the

State of Wisconsin Department of Health and Safety as necessary to clear plan review requirements. This letter does not represent construction closeout.

B. ***Certificate of Occupancy***: The Regulatory letter from the City of Madison Building Inspection Department indicating that all regulatory requirements and inspections have been completed and the building may now be occupied for its intended use. This letter does not represent construction closeout.

C. ***Certificate of Substantial Completion***: A letter provided by the Department of Public Works, signed by the City Engineer indicating that Construction activities are substantially complete. This letter does represent construction closeout and the date of this letter begins the date of the Warranty Period.

D. ***Construction Closeout***: The point in the contract where all contractual requirements associated the execution of the Work as described in the plans, specifications, and other documents have been successfully met and the items described in 1.3.A, .B, and .C above have been completed.

E. ***Final Progress Payment***: The progress payment associated with achieving Construction closeout as described in 1.3.D above. At this point the contractor may request all monies associated with the contract be paid with the exception of held retainage.

F. ***Contract Closeout***: The point in the contract where all contractual requirements associated with the City of Madison, Board of Public Works contract has been successfully met.

G. ***Final Payment***: The final contract payment submittal that may be approved by the City of Madison after all contractual requirements of the Public Works Contract have been met and any remaining monies (retainage) due to the contractor may be released for the Final Payment.

1.4. QUALITY ASSURANCE – CONSTRUCTION CLOSEOUT

A. All contractors shall be responsible for properly executing the construction closeout requirements associated with their Work as described in the specifications governing their Work.

B. The GC shall be responsible for all of the following:

1. Ensuring that all contractors have met the construction closeout requirements associated with their Work.
2. Coordinate the collection of all construction closeout deliverables from all contractors, provide the deliverables to the Project Engineer and City Project Manager for review as necessary, and ensure all contractors correct deficiencies of deliverables and resubmit as needed for final acceptance.
3. Ensure all closeout requirements identified in the Construction Closeout Checklist below have been completed as intended by the construction documents.

1.5. QUALITY ASSURANCE – CONTRACT CLOSEOUT

A. The City of Madison, Department of Civil Rights (DCR) monitors contract compliance for construction and procurement contracts to ensure that local, state and federal regulations are followed by contractors working on City of Madison Public Works (PW) projects. DCR will monitor all PW projects from contract award through the final payment at the close of the project. Contractors will be required to submit reporting paperwork throughout the PW project process.

1. Contractors are encouraged to visit the web site identified below for additional information, checklists, forms, and other information provided by DCR as it relates to Contract Compliance.
   http://www.cityofmadison.com/Business/PW/contractCompliance.cfm
2. Questions regarding the process should be directed to parties and offices as identified on the various forms, documents, and instructions or contact:
   City of Madison, Department of Civil Rights
   210 Martin Luther King Jr. Blvd., Room 523
   Madison, WI 53703
   (608) 266-4910

B. All Sub-Contractors have submitted the applicable required documents described in item 1.5.D below to the General Contractor (GC) for Contract Closeout.

C. The GC has submitted the required applicable documents described in item 1.5.D below for all contractors to the appropriate City of Madison Agency per instructions associated with each submittal.

D. The documents required for submittal to the City of Madison for Contract Closeout may include any/all of the items listed below depending on contract type. It is the sole responsibility of all contractors to know and submit the required and complete documentation in a timely fashion.

1. Weekly Payroll Reports
2. Employee Utilization Reports
3. Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination
4. Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination

5. Documentation required for Small Business Enterprise (SBE) goals
6. Other documents as maybe required or requested through the Finalization Review Process

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. CONSTRUCTION CLOSEOUT CHECKLIST

A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of all Construction Closeout Requirements to the GC.
   1. The checklist shall include all items identified within the construction documents that require any of the following (and examples) prior to moving into Contract Closeout Procedures:
      a. Documents indicating a specified level of performance has been achieved, such as:
         i. Test reports of all types
         ii. Startup reports
      b. Required documentation, such as:
         i. As-builts and record drawings
         ii. Operation and maintenance data
      c. Physical items to be turned over to the owner, such as:
         i. Attic stock
         ii. Keys
      d. Required maintenance completed, such as:
         i. Ducts cleaned
         ii. Filters replaced
      e. Owner and Maintenance Training

B. Each list shall indicate the title of the closeout requirement, the associated specification of the requirement, the required result or deliverable, the responsible contractor(s), and a column to verify the item has been turned in and completed.

C. The GC shall be responsible for all of the following:
   1. Consolidating all the closeout lists into one master Construction Closeout Checklist.
      a. The checklist shall be in a tabular data format similar to the sample below
   2. Resubmit the checklist as needed after initial reviews have been completed.

D. The GC shall work with all contractors to amend the Construction Closeout Checklist throughout the execution of the project based on changes and modifications as necessary.

Title	Specification	Description	Responsibility	Completed
Quality Management Observation Reports	01 45 16	All QMO reports have been properly responded to, reviewed and closed by the CPM.	All, GC	
As-Built Drawings	01 78 39	As-Built drawings have been reviewed and accepted per the specification	All, GC	
Testing and Balancing	23 09 23	Provide final TAB reports indicating design performance has been achieved	HVAC	

3.2. CONSTRUCTION CLOSEOUT REQUIREMENTS

A. The timely submittal or completion of closeout requirements shall go hand in hand with the Progress Payment Milestone Schedule that can be found in Specification 01 29 76 Progress Payments. No payments shall be made until all requirements for that payment have been met.
   1. The GC and all major Subcontractors, PE, and CPM, shall review all requirements for Construction/Contract Closeout during two (2) special meetings.
      a. The first meeting shall be held at the 50% Contract Total Payment milestone. This meeting shall discuss the requirements associated with various construction/contract closeout documentation and events when they are due with respect to progress payments.
      b. The second meeting shall be held at the 70% Contract Total Payment milestone. This meeting shall review the contractors progress regarding the closeout checklist, begin making plans for upcoming deadlines such as scheduling training, where to put attic stock, and when they are due with respect to progress payments.

2. The GC, PE, and CPM, shall utilize the Construction Closeout checklist to ensure that all construction closeout requirements have been met.

3.3. CONSTRUCTION CLOSEOUT PROCEDURE

A. Upon successful completion and final acceptance of all Construction Closeout Requirements the GC may submit to the CPM and PE the request for Final Progress Payment (100% contract total, less retainage).

B. The PE will confirm with the design consultants, CPM, and other City of Madison staff that all requirements of the Work have been completed and will do the following:
   1. Approve the final progress payment application
   2. Provide the required signed payment documents to the CPM
   3. Provide the required Letter of Substantial Compliance to the following as required:
      a. State Safety and Building Division
      b. Local Building Inspection office
      c. GC
      d. CPM

C. The CPM shall draft the City Letter of Substantial Completion for signature by the City Engineer. This letter shall state any of the following that may still be tied to the contract and/or warranty:
   1. Indicate that the date of the letter shall also be the beginning of the Warranty period.
   2. Indicate any allowed due outs, reasons for them, and anticipated dates of finalization.

D. The GC and all subcontractors shall finalize all warranty letters associated with their Work using the date noted on the City Letter of Substantial Completion, and provide the CPM with all warranties as described in Specification 01 78 36 Warranties. Upon receipt and final approval of the Warranties the CPM may initiate final processing of the Final Progress Payment (100% contract total, less retainage).

3.4. CONTRACT CLOSEOUT REQUIREMENTS

A. The GC and all sub-contractors shall follow all requirements associated with documenting contract compliance and provide documentation as required or requested by DCR or PW staff. All contractors are encouraged to stay current with submissions of the following documentation:
   1. Weekly Payroll Reports no later than the Progress Payment equal to 50% of the contract total.
   2. Employee Utilization Reports
   3. Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination
   4. Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination
   5. Documentation required for Small Business Enterprise (SBE) goals
   6. Other documents as maybe required or requested through the Finalization Review Process

B. Near the Progress Payment equal to 80% of the contract total the GC shall request in writing a Finalization Review. At that time DCR or PW staff shall prepare a report of all contract documentation submitted to date. A list of missing items or outstanding issues will be emailed to the GC. No additional follow-up will be generated by DCR or PW Staff.

3.5. CONTRACT CLOSEOUT PROCEDURE

A. The Contract Closeout Procedure will not begin until the Construction Closeout Procedure has been completed.

B. When the GC feels he/she has successfully met all of the Contract Closeout Requirements associated with Section 3.3 above the GC may submit to the request for Final Payment to the CPM.

C. The CPM shall sign and submit the Final Payment request for processing.

D. DCR and PW staff shall do a complete review of all documentation associated with item 3.3.A above.

E. The GC shall be notified directly by DCR or PW Staff of any documentation that may still be missing, have incomplete information, or other outstanding issues. It shall be the responsibility of the GC to continue follow-up with DCR and PW staff until all documentation has been successfully submitted and accepted.

F. When all required documentation associated with Contract Closeout has been successfully submitted and accepted by DCR and PW Staff the City of Madison shall process the Final Payment of any remaining monies including retainage.

END OF SECTION

SECTION 01 78 36
WARRANTIES

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing all Warranties and Guarantees related to the Work, workmanship, materials, equipment, and other such items required by the Construction Documents.

B. Manufacturers' disclaimers and limitations on product warranties do not relieve any contractor of the warranty on the Work that includes the product.

C. Manufacturers' disclaimers and limitations on product warranties do not relieve suppliers, manufacturers and any contractor required to provide special warranties under the contract documents.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures

B. Section 01 77 00 Closeout Procedures

C. Section 01 78 23 Operation and Maintenance Data

D. Other Divisions and Specifications that may address more specifically the requirements for Warranties related to the installation of all items and equipment installed under the execution of the Work.

1.3. DEFINITIONS

A. See specification 01 77 00 for the definitions of the following terms that may also be used in this specification:

1. Substantial Compliance
2. Certificate of Occupancy
3. Certificate of Substantial Completion
4. Construction Closeout
5. Contract Closeout

B. Emergency Repair: The Owner or Owner Representative reserves the right to make emergency repairs as required to keep equipment or materials in operation or to prevent damage to property and injury to persons without voiding the contractors warranty or bond or relieving the contractor of his/her responsibilities during the warranty period.

C. Installer: The company or contractor hired to install a finished product that was manufactured and supplied specifically for the Work within this contract. The Installer may or may not be the same company that supplied the product. See the definition for supplier.

D. Supplier: Any company that makes a specific finished product for the Work from information within the Contract Documents. Examples of suppliers would include custom cabinets, steel stairs and railings, etc. A supplier would not be a company that distributes items manufactured by others such as an electrical or plumbing supplier.

E. Warranty: A written guarantee from the manufacturer to the owner on the integrity of a product and its installation, and the manufacturers' responsibility to repair or replace the defective product or components within a specified time from the date of ownership. Warranty may also be used interchangeably with Guarantee. The following warranty types may be part of any specification within the Work associated with the Construction Documents:

1. Expressed Warranty: A warranty that provides specific repair or replacement for covered components of a product over a specified length of time.

2. Implied Warranty: A warranty that is not stated explicitly by a seller or manufacturer that the product is merchantable and fit for the intended purpose.
3. Standard Product Warranty: Preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner. Standard warranties may be for any amount of time but shall not be for anything less than one (1) year from the warranty date.
4. Special Warranty: A written warranty required by the Contract Documents either to extend the time limit provided under a standard warranty or to provide greater rights to the Owner.

F. Warranty Date: The effective date that begins all warranty periods required for products, installations, and work-manship associated with the execution of the Work for this contract. The Warranty Date shall be set by the CPM.

G. Related Damages and Losses: When correcting failed or damaged Warranted Work, remove and reinstall (or replace if necessary) the construction that has been damaged as a result of the failure or the construction that must be removed and replaced to obtain access for the correction of Warranted Work.

H. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected reinstate the warranty by a new written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation unless specifically noted otherwise in a specification.

I. Replacement Cost: All costs that may be associated with Work being replaced under warranty including but not limited to the following:
1. Related damages and losses
2. Labor, material and equipment
3. Permits and inspection fees
4. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its anticipated useful service life.

J. Replacement Work: All materials, products, required labor, and equipment necessary to replace failed or damaged warranted to an acceptable condition that complies with the requirements of the original Construction Documents.

K. Owners 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, and remedies.
1. Rejection of Warranties: The Owner reserves the right to reject any warranty and to limit the selection of products with warranties not in conflict with the requirements of the contract documents.
2. Where the Contract Documents require a Special Warranty or similar commitment on the Work or product, the Owner reserves the right to refuse acceptance of the Work until the Contractor presents evidence the entities required to countersign such required commitments have done so.

1.4. GENERAL CONTRACTORS RESPONSIBILITIES

A. The General Contractor (GC) shall be responsible to remedy, at his/her expense, any defect in the Work and any damage to City owned or controlled real or personal property when the damage is a result of:
1. The GC's failure to conform to Contract Document requirements.
a. Any substitutions not properly approved and authorized may be considered defective.
2. Any defect in workmanship, materials, equipment, or design furnished by the GC or Sub-contractors.

B. All warranties as described in this specification and these Contract Documents shall take effect on the date established by the CPM, as noted in Section 1.3F above.
1. All warranties shall remain in effect for one (1) year thereafter unless specifically stated otherwise in the Contract Documents or where standard manufacturer warranties are greater.

C. The GC's warranty with respect to Work repaired or replaced, including restored or replaced Work due to damage, will run for one (1) year from the date of Owner Acceptance of said repair or replacement.
1. This shall be regardless of any benefit the Owner may have had from the Work through any portion of its anticipated useful service life.

D. Warranty Response
1. See Section 3.5 of this specification.

PART 2 – PRODUCTS - THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. WARRANTY CHECKLIST

A. All contractors shall be responsible for reviewing the drawings and specifications within their Divisions of Work to provide a complete and comprehensive list of all Warranty Requirements to the GC.

B. Each list shall indicate the title (and plan identifier when applicable) of the warranted item, the associated specification of the warranted item, the terms of the warranty (years), and a column to verify the item has been turned in and completed.

C. The GC shall be responsible for all of the following:

1. Consolidating all the warranty lists into one master Warranty Checklist and submitting electronically.
    a. The checklist shall be in a tabular data format similar to the sample below.
2. Resubmit the schedule as needed after initial reviews have been completed.

D. The GC shall work with all contractors to amend the Warranty Checklist throughout the execution of the project based on changes and modifications as necessary.

Title	Specification	Terms	Completed
Overhead Door Operator	08 36 00	MFR 2yr	
Exterior Bench and Trash Receptacles	12 93 00	MFR 3 year warranty on finish	
Kitchen Sink (SK-1)	22 42 00	MFR 5 year	
Disposal (D-1)	22 42 00	MFR 7 year parts and in-home service	
Toilet (WC-1)	22 42 00	MFR 1 year limited	

3.2. LETTERS OF WARRANTY

A. All letters of warranty shall be in a typed letter format and provide the following information:

1. The letter shall be on official company stationary including company name, address, and phone number.
2. Indicate MADISON METRO TRANSIT SATELLITE FACILITY - CONTROLS UPGRADE, CONTRACT NUMBER 9136, and contract address the warranty is for on the reference line.
3. Provide a description of the warranty(ies) being provided.
    a. Include Division, Trade, or Specification information as necessary.
    b. Only combine warranties of related Divisional Work together. Create new letters for additional Divisions as necessary.
4. Indicate the effective Warranty Date. As noted in Section1.3.F above, the Warranty Date shall be the date the Certificate of Substantial Completion was signed by the City Engineer.
5. Contractor Letters of Warranty shall only be signed by a principal officer of the company.
6. After signing the letter provide the GC with a high quality color scanned image in PDF format and the original signed letter.

B. The GC shall be responsible for the Final Warranty submittal as identified in Section 3.4 below.

C. The GC shall obtain letters of warranty from all of the following:

1. The General Contractor shall provide warranty letters for all Work that was self performed under the contract documents, identify all trades or Divisions of Work.
2. All Sub-contractors shall provide warranty letters for Work performed under the contract documents; identify all trades or Divisions of Work.
3. Suppliers, as required by other specifications within the Construction Documents where the manufacture of a specific product unique to the Work of this contract was required.
    a. The terms and conditions of the Supplier Letter of Warranty shall be as defined by the specifications associated with the Work but shall not be less than the industry standard of repair, or replace defective materials and workmanship within one (1) year of the warranty date.
    b. When the supplier is also the installer a single written letter may be submitted identifying both the warranty for the manufacture of the product and the warranty for the installation of the product.
4. Installers as required by other specifications within the Construction Documents where the installation of a specific product unique to the Work of this contract was required.
    1. The terms and conditions of the Installer Letter of Warranty shall be as defined by the specifications associated with the Work but shall not be less than the industry standard of repair, or replace defective materials and workmanship associated with the installation of the product within one (1) year of the warranty date.
5. Special Letters of Warranty shall be required from any contractor, supplier, installer or manufacturer who agrees to provide warranty services required by any Division Specification in excess of their Standard Product Warranty.

3.3. STANDARD PRODUCT WARRANTY

A. All contractors shall be responsible for collecting and providing copies of all standard product warranties for commercially available products purchased and installed under this contract.

B. Only one copy of the manufacturers' standard warranty needs to be submitted as representative for all quantities of the same model number used throughout the Work.

C. Provide the manufacturers certificate, letter, or other standard documentation for each Standard Product Warranty submitted as follows:

1. Whenever possible a PDF version of the document shall be used.
    a. If a PDF version is used all additional information shall be completed using simple PDF editing tools such as text boxes, highlight, etc.
    b. If a PDF version is not available and an original document is furnished the additional information shall be neatly hand written and highlighted on the document in such a fashion so that it does not obscure any part of the written warranty.
2. Provide the following additional information on each warranty document:
    a. Contract warranty date.
    b. Provide the manufacturer name and model number of the product if not specified within the warranty.
        i. Where the manufacturer name and model number is specified within the warranty it shall be highlighted for visibility.
    c. Provide the plan identifier (LAV-1, WC-2, etc) when applicable.

D. Each completed warranty shall be saved as a digital PDF. The file shall be named using the specification number and item description. I.E. 22 42 00 Toilet (WC-1).pdf
    a. Where an original certificate was furnished provide a high quality colored scan of the completed document with the additional information. Save the scanned image in PDF format and use the same naming convention as indicated above.

E. Provide all PDF files and any original documents to the GC for final consolidation to be provided to the Owner.

3.4. FINAL WARRANTY SUBMITTAL

A. The GC shall receive all required warranties (digital PDF and any original documents) from all contractors, suppliers, installers and manufacturers.

B. The GC shall inventory all received warranties with the Warranty Submittal List to ensure all required warranties have been received and all warranty periods are correct according to the specifications.

C. Provide with each Operation and Maintenance Manual a complete copy of any associated warranty.

D. Scan all warranties into a single organized electronic PDF file as follows:
1. Organize the PDF file into an orderly sequence based on the table of contents of the Specifications.
2. Provide a typed Table of Contents for the entire file at the front of the document.
3. Provide bookmarks and links to each individual PDF to enable quick navigation through the PDF document.

E. Submit electronically, the warranty submittal for review by the PE and CPM.

F. Correct any deficiencies or omissions and resubmit as necessary.

3.5. WARRANTY NOTIFICATION, RESPONSE, EXECUTION AND FOLLOW-UP

A. Warranty Notification:
1. The City of Madison uses an email notification system for all warranty related issues. The GC will be required to provide, and keep current during the warranty period, a minimum of two (2) email addresses and phone numbers of current employees to receive email notifications and provide response regarding Work associated with these construction documents.
    a. In the event a Warranty Issue is deemed by the City of Madison to be an emergency, the GC shall first receive a phone call with a follow-up email from the CPM.

B. Warranty Response:
1. The GC shall upon notification by the City of Madison provide warranty response as follows:
    a. Critical Systems or equipment: Where damage to equipment and other building components, or injury to personnel is probable provide immediate emergency shut-down information and an on-site response team as soon as possible but in no case shall on-site response exceed 24 hours.
    b. For non-critical responses where damage or injury is unlikely provide on-site response no later than the next business day.

c. Where Technical Assistance support is part of the written warranty provide all assistance necessary via phone, text, or internet systems as indicated by the warranty. If issues cannot be resolved provide on-site response no later than the next business day.

d. If the request cannot be supported in sufficient time as outlined above the Owner (or Owner Representative) reserves the right to contact other contractors or service companies having similar capability to expedite the repair or replacement and shall invoice all associated costs to the Owner back to the GC.

C. Warranty Execution:

1. The GC shall provide all repairs or replacements as necessary to restore broken or damaged Work to the original level of acceptance as intended by the Contract Documents.
   a. Provide all materials, equipment, products, and labor necessary to complete the repair or replacement associated with the Warranty Issue.
   b. Provide all cleaning services as may be required before, during, and after the repair or replacement as per Specification 01 74 13 Progress Cleaning.
   c. Provide any protection necessary for existing construction as per Specification 01 76 00 Protecting Installed Construction
   d. Provide new letters of warranty when required.

D. Warranty Follow-up:

1. Logged Warranty Issues:
   a. The GC shall provide complete documented responses of all logged Warranty Issues. Responses shall provide a description of work completed, by who, inclusive dates, and photos of completed or repaired work.
      i. Provide call back response if work is not acceptable.
   b. The City Project Manager shall review the submitted response documentation and do a field inspection if necessary.
      i. If work is not acceptable, contact GC to review details and expectations of the repair as needed.
      ii. If work is acceptable close the Warranty Issue.
2. Warranty Reviews:
   a. The GC shall be responsible for scheduling on-site review with all of the following:
      i. City Project Manager, and other City staff as needed
      ii. Owner and Owner Tenant Representative
      iii. Plumbing, Heating, Electrical Sub-contractors
      iv. Other Sub-contractors that may be responsible for open Warranty issues
   b. Reviews shall be scheduled at 6 months, and 11 months after the effective date of the warranty. The review meetings shall:
      i. Review the status of all open Warranty Issues, determine course of action and estimated date of completion.
      ii. As appropriate, provide shut-down, start-up, testing, and training of off-season equipment as required by the contract documents.
      iii. The 11th month review shall review all open Warranty Issues, final plan for resolution, and all Warranty Issues where a new letter of warranty may have been issued.

END OF SECTION

SECTION 01 78 39
AS-BUILT DRAWINGS

PART 1 – GENERAL

1.1. SUMMARY

A. This specification is intended to provide clear guidelines and identify the responsibilities of all contractors as they pertain to City of Madison contract procedures regarding the accurate recording of the Work associated with the execution of this contract. This shall include but not be limited to work that will be hidden, concealed, or buried.

B. Each contractor shall be responsible for maintaining an accurate record of all installations, locations, and changes to the contract documents during the execution of this contract as it may relate to their specific division or trade.

C. The General Contractor (GC) shall be responsible for ensuring all contractors provide as-built record information to the Master As-Built Document Set as described in this specification.

1.2. RELATED SPECIFICAITONS

A. 01 26 13 Request for Information
B. 01 31 23 Construction Bulletin
C. 01 26 63 Change Orders
D. 01 29 76 Progress Payment Procedures
E. 01 33 23 Submittals
F. 01 77 00 Closeout Procedures
G. Other Divisions and Specifications that may address more specifically the requirements for field recording the installation of all items associated with the execution of this contract by Division or Trade.

1.3. RELATED DOCUMENTS

A. Other related documents shall include but not be limited to the following:
1. Bidding documents including drawings, specifications, and addenda.
2. Required regulatory documents of conditional approval.
3. Field orders, verbal or written by inspectors having regulatory jurisdiction.
4. Shop drawings and installation drawings.

1.4. PERFORMANCE REQUIREMENTS

A. The GC shall be responsible for maintaining the “Master As-Built Document Set” at all times during the execution of this contract. This document set shall include all of the following:
1. Master As-Built Plan Set
2. Master As-Built Specification Set
3. Other Document Sets

B. The GC shall designate one person of the GC staff to be responsible for maintaining the Master As-Built Document Set. This shall include, posting updates, revisions, deletions and the monitoring of all contractors posting as-built information as described in this specification.

C. All contractors shall use this specification as a general guideline regarding the requirements for documenting their completed Work. Contractors shall explicitly follow additional specification requirements within their own Division of Trade as it may apply to this specification.

1.5. QUALITY ASSURANCE

A. The GC shall be responsible for all of the following:
   a. Spot checking all sub-contractors field documents to insure daily information is being recorded as work progresses.
   b. Discuss as-built recording to the plan set at weekly job meetings with all sub-contractors on site.
   c. Schedule time with sub-contractors in the job trailer for recording as-built information to the plan set.
   d. Insure that all sub-contractors are providing clear and accurate information to the plan set in a neat and organized manner.
   e. Insure sub-contractors who have completed work have finalized recording all as-built information to the plan set before releasing them from the project site.

B. The Project Engineer, the City Project Manager, and other design team staff will perform random checks of the Master As-Built Document Set during the execution of this contract to ensure as-built information is being recorded in a timely fashion as the Work progresses. An updated and current Master As-Built Document Set is a stipulation for approval of the progress payment.

PART 2 – PRODUCTS

2.1. OFFICE SUPPLIES

A. The GC shall provide a sufficient supply of office products at all times for all contractors to use in recording as-built information into the plan set. This shall include but not be limited to the following:
   a. Red ink pens, medium point. Pens that bleed through paper, markers, and felt tips will not be accepted.
   b. The use of highlighters is acceptable. Assign colors to various trades for consistency in recording information.
   c. Straight edges of various lengths for drawing dimension, extension and other lines.
   d. Civil and Architectural scales
   e. Clear transparent, non-yellowing, single sided tape.
   f. Correction tape or correction fluid for correcting small errors.

PART 3 - EXECUTION

3.1. FIELD DOCUMENT AS-BUILTS

A. The GC and all Sub-contractors shall be responsible for keeping their own field set of as-built documents including plans, specifications and published changes.

B. Field sets shall be kept dry and in good condition at all times.

C. No Work shall be buried, covered, or hidden, by any additional Work, regardless of Contractor or Trade, until locations of all materials and equipment has been properly documented as described below.

D. All contractors shall be required to record the following as-built information:
   a. Notes on the daily installation of materials and equipment.
   b. Sketches, corrections, and markups indicating final location, positioning, and arrangement of materials and equipment such as pipes, conduits, valves, cleanouts, pull boxes and other such items. Note all final locations on plan sheets, indicate dimension off identifiable building features. Riser diagrams need only be corrected for significant changes in locations, routing or configuration.
      i. The use of photographs in lieu of hand drawn sketches is acceptable.
      ii. Photos shall be taken according to Specification 01 32 33 Photographic Documentation
      iii. Print photo and markup with dimensions or notes as necessary.
   c. Identify by the use of existing plan symbology and notes the size, type, quantity, and use as applicable of materials such as pipes, valves, conduits, etc.
   d. Note whether horizontal runs are below slab or above ceiling, include dimensions above or below finished floor elevation.

E. All contractors shall be responsible for transferring the information from their field set of documents to the Master As-Built Plan Set kept in the GC job trailer. See Section 3.3.D. below for the proper procedure.

F. All contractors shall update the GC Master Plan Set as often as necessary, but not less than once per work week.

3.2. SITE SURVEY AS-BUILT

A. The Land Surveyor Sub-Contractor shall provide digital as-built information including but not be limited to the following:
   a. For underground buried utility laterals and services of all types locate all of the following that may apply:
      i. Connection points at all mains
      ii. Storm discharge points to open air
      iii. All corners and bends regardless of angle, large radius sweeps shall have multiple point locations sufficient to define the sweep.
      iv. All vertical drops
      v. All wells
      vi. Private buried utilities such as buried electrical cables, irrigation systems, etc.
      v. Other information that may need to be located in the future by the owner prior to digging
   b. Record all surface features including but not limited to the following:
      i. Building corners, pavement edges, and other permanent structural features.
      ii. All surface covers for inlets, catch basins, cleanouts, access structures, curb stops and other such devices.
      iii. Other permanent surface features such as hydrants, lamp posts, and other permanent site amenities.
   c. The following data shall be recorded while locating items in sub-sections 3.2.a and 3.2.b above:
      i. Flow lines at both ends of pipes
      ii. Pipe sizes and material types
      iii. Rim elevations for all covers
      iv. Sump elevations and invert elevations of all structures
      v. Spot elevations for all pads, driveways, walks, stoops, and floors

B. The Surveyor shall provide the final digital as-built on a media and in a format specified in Specification 00 31 21 Survey Information to the GC for turn in to the Project Engineer and the Civil Engineer.

C. The Surveyor shall provide two printed as-built site plans to the GC for inclusion in the Master As-Built Plan Set as follows:
   1. One sheet to show all features (but not contour information) with text neatly organized for each item identified.
   2. One sheet showing contours, contour labels, and features from item 1 above, but with no additional text.

3.3. MASTER AS-BUILT DOCUMENT SET

A. The GC shall be responsible for maintaining the Master As-Built Document Set in the job trailer at all times.
   1. The Master As-Built Plan Set (Plan Set) shall begin with one complete bid set of drawings and any additional sheets that were supplied by published addenda during the bidding process. The cover sheet shall be titled as the “Master As-Built Plan Set” in large bold red letters approximately 2” in height and shall not be used for any other purpose.
      a. The Plan Set shall be kept dry, legible, and in good condition at all times.
      b. The Plan Set shall be kept up to date with new revisions within two (2) working days of supplemental drawings being issued. Revisions shall be posted as follows:
         i. Insert new, revised sheets into the plan set. Void old sheets but do not remove them from the plan set. Indicate date received and what document (RFI, CB, CO, etc) caused the change.
         ii. Insert new, revised individual details into the plan set. Void old details, tape new details over the old details with a “tape hinge” to allow them to be viewed. Indicate date received and what document (RFI, CB, CO, etc) caused the change.
         iii. Add new details in appropriate white space on relevant sheets. If no space is available use the back side of the previous sheet or insert a new sheet. Indicate date received and what document (RFI, CB, CO, etc) caused the change.
      c. The Plan Set shall be available at anytime for easy reference during progress meetings and for emergency location information of new work already completed.
   2. The Master As-Built Specification Set (Spec Set) shall begin with one complete bid set of specifications and any additional specifications that were supplied by published addenda during the bidding process. The Spec Set shall be provided in three “D” ring type binders of sufficient thickness to accommodate the specification set. Multiple binders are allowed as necessary. Label the front cover and binding edge with

"Master As-Built Specifications" in bold red letters. Provide other information as necessary to distinguish the contents of multi-volume sets.

a. The Spec Set shall be kept dry, legible, and in good condition at all times.
b. The Spec Set shall be kept up to date with new revisions within two (2) working days of supplemental drawings being issued.
c. The Spec Set shall be available at anytime for easy reference during progress meetings.

3. Other Document Sets may be kept at the GCs option in three "D" ring type binders of sufficient thickness to accommodate the documentation. Other documentation sets may include but not be limited to RFIs, CBs, COs, etc.

C. The Land Surveyor Sub-Contractor shall be required to use digital surveying for all exterior site surveying, and provide deliverable digital as-builts as specified in Specification 00 31 21 Survey Information. As soon as practical the surveyor shall provide the GC with a preliminary copy of installed buried utilities for inclusion with the plan set in the job trailer. The surveyor shall provide final digital as builts as per section 3.2 above.

D. All contractors shall be responsible for updating the Plan Set from their field sets at least once per work week. Updates shall include but not be limited to the following procedures:

a. All updates shall be done only in red ink. Place a "cloud" around small areas of correction to call attention to the change.
b. Whenever possible place general work notes, field sketches, supplemental details, photos, and other such information on the reverse side of the preceding sheet. Installation notes including dates shall be kept neatly organized in chronological order as necessary.
c. Accurately locate items on the plan set as follows:
   i. For items that are located as dimensioned provide a check mark or circle indicating the dimension was verified.
   ii. For items that are within 5 feet of the location indicated on the plans leave as shown and:
      - Provide correct dimensions to existing dimension strings or,
      - Accurately locate with new dimension strings
   iii. For items that are more than 5 feet from the location indicated on the plans
      - Accurately draw the items in the new location as installed and,
      - Accurately locate with new dimension strings and,
      - Note that the existing location is void.
d. Include dimensioned locations for items that will be buried, concealed, or hidden in the ground, under floors, in walls or above ceilings.
   i. Dimensions shall be pulled from identifiable building features, not from centers of columns or other buried features.
   ii. When necessary pull more dimensions as needed from opposing directions to properly locate single items.

3.4. AS-BUILT REVIEW AND ACCEPTANCE

A. The GC shall provide the Master As-Built Plan Set to the Project Engineer (PE), the City Project Manager (CPM), and other design team staff for content review prior to the Progress Payment Milestone indicated in Specification 01 29 76 Progress Payment Procedures. The submitted plan set shall include the digital survey information produced under Section 3.2 above.

1. If the plan set is not approved:
   a. The PE and CPM shall only be required to generalize deficiencies by trade there shall be no requirement or expectation to generate a "punch list" of required corrections.
   b. The GC and Sub-contractors as necessary shall be responsible for inspecting the installation and correcting the drawings as needed.
   c. The GC shall re-submit the plan set for review.
2. If the plan set is approved the PE shall take possession of the plan set to be used in providing the owner with digital CAD record drawings. Upon completion of transferring the information to CAD the PE shall provide the Owner with CAD record drawings, record PDFs, and the Master As-Built Plan Set.

3.5. CHANGES AFTER ACCEPTANCE

A. No Contractor shall be responsible for making changes to the As-Built record documents after acceptance by the PE and CPM except when necessitated by changes resulting from any Work made by the Contractor as part of his/her guarantee.

END OF SECTION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guide lines related to providing well documented and complete Operation and Maintenance (O&M) Data related to general facility use, equipment, systems, finishes, and materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as needed.

B. Operation and Maintenance Data shall apply to both of the following categories except where specific requirements are noted under their separate titles as follows:

1. Operation and Maintenance Data: Generally shall mean the owner manual that provides information on start-up, shut-down, operation, troubleshooting, maintenance, parts, and other such documentation as it pertains to all equipment and systems installed under the Work.
2. Use and Care instructions: Where applicable use and care instructions shall also be considered O&M for such things as flooring, tile, partitions, and other such finishes and trim related items, installed under the Work.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 77 00 Closeout Procedures
C. Section 01 78 36 Warranties
D. Section 01 79 00 Demonstration and Training
E. Other Divisions and Specifications that may address more specifically the requirements for O&M Data.

1.3. QUALITY ASSURANCE

A. All O&M Data shall meet the requirements identified in Section 1.4 below.

B. All contractors shall provide O&M Data for each piece of equipment, system, or finish installed during the installation of the Work. O&M Data shall be provided to the General Contractor (GC) for verification and submittal.

C. The GC shall be responsible for receiving all required O&M Data files from all contractors for verifying that all files submitted meet the requirements in Section 1.4 below.

1.4. O&M DATA REQUIREMENTS

A. O&M Data shall be provided in digital PDF format as follows:

1. PDF files shall be complete first generation consumer useable editions of PDF documents as provided by any of the following:
   a. Product manufacturer
   b. Supplier of product
   c. Product manufacturer internet site
2. Acceptable PDF files shall have the following functionality:
   a. Word searchable
   b. Key areas are bookmarked
   c. Table of Contents and/or Index linked to content is preferred whenever possible.

3. Scanned printed material, with word searchable capabilities, saved as a PDF, is not acceptable and will be rejected without further review.

B. O&M Data shall include but not be limited to the following manufacturers' published information as appropriate for the equipment, system, material, or finish:
1. Installation instructions
2. Parts lists, assembly diagrams, explosion diagrams
3. Wiring diagrams
4. Start-up, shut-down, troubleshooting and other related operation procedures
5. Lubrication, testing, parts replacement, and other such maintenance procedures
6. General use, care, and cleaning instructions
7. Special precautions and safety requirements
8. A list of certified equipment vendors, service companies, parts suppliers including company name, address, and phone number
9. A list of the recommended spare parts to have on hand at all times
10. A list by type of all recommended lubes, oils, packing material, and other maintenance supplies
11. Copies of final test reports, balance reports, and other related documentation
12. Warranty information for equipment and systems

1.5. O&M DATA SUBMITTALS

A. O&M Data shall be prepared as identified in this specification and shall be submitted for review as per the schedule identified in Specification Section 01 29 76, Progress Payment Procedures.

B. O&M Data Draft submittals will be reviewed for content, procedure, and compliance only. A general critique with recommendations for improvement will be made but re-submittals will not be required.

C. O&M Data Final submittals will be reviewed for content, procedure, and compliance. Re-submittals will be required until such time as each submittal is accepted.

NOTE: Acceptance of O&M Data Final submittals is required to be complete prior to scheduling and conducting owner related training and construction closeout.

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. O&M DATA PREPARATION - GENERAL

A. All contractors shall prepare O&M Data for draft and final submission as follows:
1. Obtain digital PDF files for each piece of equipment, system, material or finish as described in Sections 1.4.A.1 and 1.4.A.2 above.
2. Verify that all information as described in Section 1.4.B above is included with the PDF file. Obtain missing information as necessary for a complete submittal.

B. Rename each individual PDF file as follows.
1. Do not use special characters such as #, %, &, /, etc. These characters are reserved by the Project Management Web Site software the City of Madison uses; however the under-score (or under-bar) '_' is an allowed character.
2. Use the following format and examples for renaming your file:
a. Format: ***Equipment name_What_MADISON METRO TRANSIT SATELLITE FACILITY - CONTROLS UPGRADE_CONTRACT NUMBER 9136_Year***
i. *Equipment Name* represents the name of any equipment, system, material or finish as designated in the Contract Documents.
ii. *What* represents what the file is about
iii. *MADISON METRO TRANSIT SATELLITE FACILITY - CONTROLS UPGRADE* represents the title of the project or contract. A shortened version of the title may be identified by the City Project Manager to be used by all contractors.
iv. *CONTRACT NUMBER 9136* is the specific identification number the Work was bid under and appears on the plan set title sheet and in each sheet title block
v. *Year* represents the year the contract will be closed out
b. Examples of file names
i. AHU 2_Operation Manual_Fire Admin_1234_2015
ii. CPT 2_Use and Care_MPD West_9876_2011

C. All contractors shall submit the completed digital PDF files to the GC in sufficient time for the GC to meet the O&M Data submission deadlines as described in Specification Section 01 29 76, Progress Payment Procedures.

D. O&M Data shall be submitted and reviewed as described in sections 3.2 and 3.3 below.

3.2. O&M DATA DRAFT SUBMITTAL

A. All contractors shall prepare and submit the following for an O&M Data Draft review submittal:
   1. Prepare three (3) complete O&M Data file samples as described in section 3.1 above.
   2. Review all specifications within his/her Division of Work and prepare a complete O&M Data checklist listing all equipment, systems, materials, or finishes. Checklist shall be in tabular form similar to the example below and shall indicate the title (and plan identifier when applicable) of the O&M Data, the associated specification, and a column to verify the item has been turned in and completed.

B. The GC shall be required to review all contractors' samples and checklists for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
   1. When acceptable to the GC, he/she shall electronically submit each O&M Data draft submittal file to the CPM.

C. The Project Engineer, City Project Manager, Consulting Staffs and Owner Representatives shall review the O&M Data draft submittals and checklist within fifteen 15 working days as follows:
   1. Provide general critique comments by Division on O&M Data samples submitted. Critique is intended to provide all contractors with information on strengths and weaknesses of their submittals.
      a. Re-submittal of the O&M Data samples will not be required.
   2. Review in detail the O&M Data Checklist for completeness. Provide comments as needed.
      a. Re-submittal of the O&M Checklist will be required until accepted.

Title	Specification	Completed
Overhead Door Operator	08 36 00	
Air Handling Unit (AHU-3)	23 00 00	
Water Heater (WH-1)	22 30 00	

3.3. O&M DATA FINAL SUBMITTAL

A. All contractors shall prepare and submit the following for an O&M Data Final review submittal:
   1. Prepare complete O&M Data files as described in Section 3.1 above according to their approved checklist as described in Section 3.2 above.
   2. Submit completed checklist and all final O&M Data files to the GC for final submittal review.

B. The GC shall be required to spot check all contractors' submittals for completeness against their checklists and for compliance with this specification and shall return any to the originating contractor that are insufficient for re-submittal.
   1. When acceptable to the GC, he/she shall electronically submit each O&M Data final submittal file to the CPM.

C. The Project Engineer, City Project Manager, Consulting Staffs and Owner Representatives shall review the O&M Data final submittals and checklist within fifteen (15) working days as follows:
   1. Review the files submitted against the checklist and request any missing files through the GC.
   2. Review in detail all of the O&M Data files for completeness.
      a. Submittals shall be accepted or rejected as individual PDF files.
      b. Contractors shall re-submit entire O&M submittal if any portion is rejected or incomplete.

3.4. CONSTRUCTION CLOSEOUT

A. All contractors shall review Specification 01 77 00, Closeout Procedures and Specification 01 79 00 Demonstration and Training.
   1. Acceptance of all final O&M Data submittals is required prior to scheduling Demonstration and Training Sessions.
   2. Completion of all Demonstration and Training Sessions is required to receive the Substantial Compliance for Occupancy Certificate, and to begin Construction Closeout procedures.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 – GENERAL

1.1. SUMMARY

A. The purpose of this specification is to provide clear responsibilities and guidelines related to providing Demonstration and Training (D&T) Sessions related to general facility use, equipment, systems, finishes, and materials to City of Madison Staff (Owner, Owner Representatives, Maintenance, and Custodial Personnel) as needed.

B. All D&T shall be coordinated through the General Contractor (GC), Project Engineer (PE) and City Project Manager (CPM), and will be based on or customized to the needs of City of Madison Staff being trained. New equipment and systems may have complete D&T sessions as described in this specification while equipment or systems staff is familiar with may have sessions more focused on maintenance only.

1.2. RELATED SPECIFICATIONS

A. Section 01 29 76 Progress Payment Procedures
B. Section 01 78 23 Operation and Maintenance Data
C. Section 01 78 36 Warranties
D. Section 01 78 39 As-Built Drawings
E. Other Divisions and Specifications that may address more specifically the requirements for D&T sessions related to the installation of all items and equipment installed under the execution of the Work.

1.3. QUALITY ASSURANCE

A. All contractors shall have the responsibility of preparing for and conducting D&T sessions as determined by this and other Division or Trade related specifications, Owner Operation and Maintenance Manuals, and other such documentation related to the Work.

B. The GC shall have responsibility for:

1. Ensuring that all contractors required to conduct a D&T session have successfully completed all of the following:
    a. Turned in all required documentation for review and documentation has been approved/accepted prior to scheduling D&T sessions.
    b. Other required documentation as needed is available and ready for use during the D&T session.
    c. All systems have been started, tested, and running as per appropriate specification and/or manufacturers recommendations prior to scheduling D&T sessions.
    d. All contractors are sufficiently prepared for their D&T session
    e. Documents the D&T session including date, time, contractor and company name, attendees and other information regarding the session
2. Organizing the coordination and scheduling of all D&T sessions between all contractors and the appropriate representatives of the Owner. These representatives may include any of the following depending on the Work of the Contract:
    a. Owner – end users
    b. Facility Maintenance personnel
        i. Facility general operation procedures including custodial services
        ii. Electrical

iii. Mechanical
iv. Plumbing
v. Site
c. Information Technology (IT) Department
d. Traffic Engineering – Radio Shop
e. Architects, Engineers and Facility Management staff as project completion overview

PART 2 – PRODUCTS – THIS SECTION NOT USED

PART 3 - EXECUTION

3.1. GENERAL REQUIREMENTS

A. The GC shall develop a specific D&T plan to be scheduled and conducted as described below but no sooner than the meeting discussed in 3.2.A.2 below.

C. The GC shall not schedule D&T sessions to preclude required personnel from attending multiple sessions.

3.2. COORDINATING AND SCHEDULING THE TRAINING

A. The GC, PE, and CPM, shall review all Training and Demonstration requirements during two (2) special meetings.
1. The first meeting shall be held at the 50% Contract Total Payment. During this meeting the following shall be discussed:
a. Preliminary schedule of training dates to be completed prior to beginning construction closeout.
b. List of documentation and items that need to be completed and available before and during the training session.
c. Who (Owner, Maintenance, etc) will be attending what training session(s).
2. The second meeting shall be held at the 80% Contract Total Payment. This meeting shall review due outs that have not yet been completed for the 90% Contract Total Payment and the requirements necessary for Construction Closeout. All Demonstration and Training sessions shall be completed prior to receiving the 90% progress payment and beginning Construction Closeout Procedures (see Specification 01 77 00).
a. This does not include any requirement associated with off season equipment preparation and/or demonstration and Training Sessions.

B. All of the Construction Work shall be operationally ready prior to conducting training as follows:
1. All contractors shall have their As-Built Drawing Records available for reviewing locations of system components during training.
2. All final and approved Operations and Maintenance Data shall be completed no less than two (2) full weeks prior to the scheduled training.
3. All systems shall have been started, functionally tested, balanced, and fully operational, and all piping and equipment labeling complete at least two (2) days prior to the scheduled training.
a. Seasonal equipment shall not be trained out of season. Contractors having seasonal equipment shall work with the GC and CPM for coordinating additional training sessions as appropriate for seasonal equipment.

C. Correction list items that prevent a piece of equipment or system from being fully operational for training shall be corrected prior to conducting the training.

3.3. TRAINING OBJECTIVES

A. For each piece of equipment or system installed train on the following objectives/topics as applicable:
1. System design, concept, and capabilities
2. Review of related contractor as-built drawings
3. Facility walkthrough to identify key components of the system
4. System operation and programming including weekly, monthly, annual test procedures
5. System maintenance requirements
6. System troubleshooting procedures
7. Testing, inspection, and reporting requirements associated with any regulatory requirements
8. Identification of any correction list items still outstanding
9. Review of system documentation including the following:
a. Operation and maintenance data
b. Warranties
c. Valve charts, tags, and pipe identification markers

B. For each piece of specialty equipment train on the following objectives/topics as applicable:

1. Manufacturers operations instructions
2. Manufacturers use and care instructions
3. Manufacturers maintenance and troubleshooting instructions
4. System operation and programming including weekly, monthly, annual test procedures
5. Identification of any correction list items still outstanding
6. Review of system documentation including the following:
    a. Operation and maintenance data
    b. Warranties

C. End User Orientation
1. Facility walkthrough
2. Security and emergency features
3. General facility operation procedures

D. Facility General Use and Custodial Services – if requested
1. Facility walkthrough
2. Security and emergency features
3. General facility operation procedures
4. Care and maintenance of specialty items, finishes, etc as requested
5. Attic stock inventory and material designations

3.4. DEMONSTRATION AND TRAINING PROGRAM PREPARATION

A. Each contractor having a responsibility for providing D&T sessions shall meet with the GC, CPM, and other City Staff as needed to review the extent of the Training Objectives in section 3.3 above needed for each piece of equipment, system, finish, etc. This meeting shall occur no less than four (4) weeks prior to the anticipated training session.

B. The contractor shall use the information from item 3.4.A above to prepare a formal training program for each piece of equipment or system based on the Training Objectives in 3.3 above.
1. The formal training program shall include the following information:
    a. Session title
    b. List of systems, equipment, use, care, etc to be covered during the session
    c. Provide the following for each systems, equipment, use, care, etc to be covered during the session
        i. Name and affiliation of each instructor to be used. As needed and discretion of the Owner the GC to require attendance by the installing technician, installing Contractor and the appropriate trade or manufacturer's representative.
        ii. Qualifications of each instructor to be used. Practical building operation expertise as well as in-depth knowledge of all modes of operation of the specific piece of equipment as installed in this project is required by the training personnel. If Owner determines training was not adequate, the training shall be repeated until acceptable to Owner.
        iii. A checklist of all documentation and system/equipment requirements necessary to complete a successful training session and the current status of each
        iv. Any additional documents, training aids, video or other items to be used to complete the training
        v. Any special requirements or needs associated with item iv above to complete the training
    d. The intended audience for the training
    e. The approximate duration of each objective or topic to be covered
2. Submit the completed training program to the GC for review and approval by the PE and CPM.

C. The PE and CPM shall work with staff as necessary to ensure all points of anticipated training needs have been met. The PE and CPM will approve the program as submitted or recommend changes for re-submittal as necessary.

3.5. CONDUCTING A DEMONSTRATION AND TRAINING SESSION

A. All contractors shall conduct their required D&T Sessions as follows:
1. Begin with a classroom session
    a. Provide a sign in sheet indicating all training to be conducted, instructors, etc.
    b. Provide an overview of the training to be conducted including the approximate schedule.
2. Conduct a general walk-through of the site.
    a. Point out locations of various equipment, valves, charts, and other related items.
    b. Use the Division or Trade As-Built record drawings to indicate locations of hidden or buried items.
3. Provide a demonstration of general equipment/system operation including using the O&M manual.

a. Startup and shutdown procedures.
b. Normal operational levels as depicted by any gauges, software, etc.
c. Indicate warning devices, signs etc. and demonstrate emergency shut-down procedures.

4. Provide a demonstration of all owner level maintenance using the O&M manual.
   a. Indicate frequency of maintenance.
   b. Provide and review all spare parts, special tools, and special materials.
5. Provide and review all spare parts, special tools, special materials, or attic stock as applicable.
6. While conducting D&T sessions:
   a. Allow hands on training whenever practical.
   b. Answer questions promptly
   c. Repeat demonstrations and procedures as necessary.

B. Within two (2) working days of completing the D&T session the contractor responsible for the session shall turn-in any documentation generated including the sign in roster to the GC.

C. The GC shall turn over all training documentation to the PE and CPM upon completion of D&T sessions.

D. Re-schedule any training that has been determined to be inadequate or inappropriate for any reason including but not limited to any of the following;
   1. Unqualified instructor
   2. System installation incomplete or untested to the specifications
   3. Equipment failure during demonstration
   4. Un-expected cancellation

3.6. CLOSEOUT PROCEDURE

A. Prior to receiving the 90% Progress payment the GC shall:
   1. Verify with the PE and CPM that each Demonstration and Training Session was conducted properly and according to the submitted plan.
   2. Any required “Off Season” equipment testing, balancing, and Demonstration and Training Sessions have been tentatively scheduled with the GC, necessary sub-contractors, instructors and Owner/Owner Representatives as necessary.

END OF SECTION

SECTION 23 09 00 INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Related Sections include the following:

a.

1. Section 23 09 24 "Direct Digital Control System for HVAC" for requirements that relate to this Section.
2. Section 23 09 93 "Sequence of Operations for HVAC Controls" for requirements that relate to this Section.

C. Furnish and install all labor, materials, equipment, electronic interfaces and actuation devices, apparatus, software, services, permits and supervision, and all permanent and temporary facilities necessary to provide complete and proper working Direct Digital Control system as indicated on the drawings, called for in the specifications or required by job conditions. Drawings are diagrammatic only. Provide any equipment and labor not specifically referred to herein or on the drawings that are required to meet the functional intent, such as repeaters, routers, bridges, and gateways.

1.3 SYSTEM DESCRIPTION

A. System is to use direct digital control with electric actuation for air handling units; direct digital control with electric actuation for room temperature and terminal airflow control.

1.4 DEFINITIONS

A. BAS: Building Automation System.
B. DDC: Direct digital control.
C. I/O: Input/output.
D. LAN: Local Area Network.
E. RTD: Resistance temperature detector.

1.5 SYSTEM PERFORMANCE

A. Comply with the following performance requirements:

1. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:

a. Water Temperature: Plus or minus 1 deg F.
b. Water Flow: Plus or minus 5 percent of full scale.
c. Water Pressure: Plus or minus 2 percent of full scale.
d. Space Temperature: Plus or minus 1 deg F.
e. Ducted Air Temperature: Plus or minus 1 deg F.
f. Outside Air Temperature: Plus or minus 2 deg F.
g. Temperature Differential: Plus or minus 0.25 deg F.
h. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
i. Airflow (Terminal): Plus or minus 10 percent of full scale.
j. Air Pressure (Space): Plus or minus 0.01-inch wg.
k. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
l. Carbon Monoxide: Plus or minus 5 percent of reading.
m. Nitrogen Dioxide: Plus or minus 5 percent of reading.
n. Electrical: Plus or minus 5 percent of reading.

B. Communications protocol:
1. BACnet protocol per the latest version of ASHRAE Standard 135 and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.

C. Engineering units: English.

D. Provide at least 10% spare I/O connections on each controller.

E. Components shall operate within 32 deg F to 122 deg F and 5-85% relative humidity, non-condensing.

1.6 SEQUENCE OF OPERATION

A. Refer to Section 23 09 24 "Direct Digital Control System for HVAC" for requirements that relate to this Section.

1.7 ACTION SUBMITTALS

A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
2. Schematic flow diagrams for each system showing fans, pumps, coils, dampers, valves, and control devices.
3. Wiring Diagrams: Power, signal, and control wiring. Differentiate between factory and field installed wiring.
4. Wire Tabulation List: wire ID, "to" and "from", and wire color.
5. Details of control panel faces, including controls, instruments, and labeling.
6. Schedule of dampers including size, leakage, and flow characteristics.
7. Schedule of valves including flow characteristics.

C. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.

D. Samples for Verification: For each color required, of each type of thermostat or sensor cover.

1.8 INFORMATIONAL SUBMITTALS

A. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.

B. Qualification Data: For Installer.

C. Field quality-control test reports.

1.9 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 for Operation and Maintenance Data, include the following:

1. Maintenance instructions and lists of spare parts for each type of control device and compressed-air station.
2. Interconnection wiring diagrams with identified and numbered system components and devices.
3. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
4. Calibration records and list of set points.
5. Programming manuals.
6. Maintenance instructions.
7. Record documents (“as-builts”), including updated schematic diagrams, wiring diagrams, and control sequences.
8. Training documentation.
9. Contact information of service contractor and parts suppliers.

1.10 QUALITY ASSURANCE

A. Installing contractor must be a manufacturer's branch office or an authorized representative of a Direct Digital Control (DDC) equipment manufacturer that provides engineering and commissioning of the DDC equipment. Submit written confirmation of such authorization from the manufacturer. Indicate in letter of authorization that installing contractor has successfully completed all necessary training required for engineering, installation, and commissioning of equipment and systems and that such authorization has been in effect for a period of not less than three years. DDC equipment may or may not be required to be installed by this contractor as part of the project, but the intent of this quality assurance specification is to ensure that the installing contractor has the capabilities to engineer, install, and commission the field devices supplied under this section for temperature control.

b.

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 use.

C. Comply with ASHRAE 135 for DDC system components.

D. Comply with the following:

1. UL-916; Energy Management Systems.
2. UL-873; Temperature Indication and Regulating Equipment.
3. UL-864, Subcategories UUKL, UOXX, UDTZ; Fire Signaling and Smoke Control Systems.
4. FCC, Part 15, Subpart J, Class A Computing Devices.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

1.12 COORDINATION

A. Coordinate location of thermostats, gas sensors, and other exposed control sensors with plans and room details before installation.

B. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.

C. Coordinate interface of DDC controllers with "Addressable Fire- Alarm System". Interface of mechanical equipment shutdown shall be interfaced with the fire alarm system upon detection.

1.13 WARRANTY

A. Provide warranty on all parts and labor for one year starting at the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Refer to Section 23 09 24 "Direct Digital Control System for HVAC" for requirements that relate to this Section.

2.3 INTERFACE WITH DDC EQUIPMENT

A. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers. Systems which command multiple outputs over a single pair of wires, such as power line carrier systems, are not acceptable.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.
8. SPDT Output Relays: Indicate status with an LED.

B. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

C. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

D. Control Panels:
1. Provide panel enclosures for all DDC controllers and associated function modules. All controls to be in enclosures without exception. Panels will be approved provided all conduit is bonded and grounded.
2. Provide UL listed cabinets for use with line voltage devices.
3. NEMA Rating:

    a. Inside: NEMA-1.
    b. Outside: NEMA-3R or NEMA-4.

4. Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide as built wiring/piping diagram within enclosure. Provide raceways for wiring and poly within panel for neat appearance. Provide termination blocks for all wiring terminations. Label outside of panel with panel number corresponding to plan tags and as-built control drawings as well as building system(s) served.
5. Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.
6. For panels that have 120VAC power feeds provide a resettable circuit breaker. Provide label within the panel indicating circuit number of 120VAC serving panel
7. Provide a service shutdown toggle switch for each air handling unit system located inside the temperature control panel that will initiate a logical shutdown of the air handling unit system. Label the switch so it is clear which position is shut down and which is auto.

E. Interface with Other Systems: All hardware and software required to provide the specified interactions with other systems, such as fire alarm, security, and lighting systems.

2.4 ELECTRONIC SENSORS AND TRANSMITTERS

B. General Requirements:

1. Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
2. For wall, immersion, or duct mounting as required.

    a. Architectural housing for office space mounting.
    b. Weatherproof/sunshield housing for outdoors.
    c. Thermowell housing for water applications.

        1) Non-corrosive fluids below 250 deg F: brass or stainless steel.
        2) Other applications: 300 series stainless steel.

d. Protective housing for duct mounting.
e. Water and dust tight stainless-steel housing for space sensors located in process areas.

3. The sensor/transducer shall be selected to withstand ambient conditions, including moisture or condensation and transient conditions for temperatures, pressures, etc.
4. Transducers may be supplied as an integral unit with the field sensor, or as part of the controller.
5. The sensor/transducer shall be appropriately selected to most closely match the expected sensing range.
6. Use a transmitter where the sensor is more than 100 feet from its associated controller, there is excessive electrical noise present, or the controller cannot accept direct sensor input, a 4-20mA type.
7. All temperature sensors shall be of the same manufacturer.
8. All pressure transmitters and transducers shall be of the same manufacturer.

C. RTDs and Transmitters:

1. Manufacturers:

a. BEC Controls Corporation.
b. MAMAC Systems, Inc.
c. RDF Corporation.

2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft.
5. Averaging Elements in Ducts: 18 inches long, rigid use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Color: White.
e. Orientation: Vertical.

8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Pressure Transmitters/Transducers:

1. Manufacturers:

a. BEC Controls Corporation.
b. General Eastern Instruments.
c. MAMAC Systems, Inc.
d. ROTRONIC Instrument Corp.
e. TCS/Basys Controls.
f. Vaisala.

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.

a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA.
c. Building Static-Pressure Range: 0- to 0.25-inch wg.
d. Duct Static-Pressure Range: 0- to 5-inch wg.

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300- psig; linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.
7. Air Filters: Provide filters on all pressure probes in return or exhaust air systems.

E. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Concealed.
2. Set-Point Indication: Concealed.
3. Thermometer: Concealed.
4. Color: White
5. Orientation: Vertical.

F. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base.
3. Adjusting Key: As required for calibration and cover screws.

2.5 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.

B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.6 THERMOSTATS

A. Manufacturers:

1. Erie Controls.
2. Danfoss Inc.; Air-Conditioning and Refrigeration Div.
3. Heat-Timer Corporation.
4. Sauter Controls Corporation.
5. Tekmar Control Systems, Inc.
6. Theben AG - Lumilite Control Technology, Inc.

B. Combination Thermostat and Fan Switches: Line-voltage thermostat with push-button or lever-operated fan switch.

1. Label switches "FAN ON-OFF" or "FAN HIGH-LOW-OFF" or "FAN HIGH-MED-LOW-OFF" based on system operation.
2. Mount on single electric switch box.

C. Remote-Bulb Thermostats (Type T5): On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

D. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.

1. Bulb Length: Minimum 1 foot (3 m) for every square foot of coil surface.
2. Quantity: One thermostat for every 20 sq. ft. of coil surface.

E. Thermostat Accessories:

1. Cover: Manufacturer's standard locking covers.
2. Guards: Locking; heavy-duty, transparent plastic; mounted on separate base
3. Insulating Bases: For sensors located on exterior walls.

2.7 GAS DETECTION EQUIPMENT

A. Standalone Carbon Monoxide and Nitrogen Dioxide Detectors and Controllers

1. Available Manufacturers:

   a. B. W. Technologies.
   b. CEA Instruments, Inc.
   c. Honeywell International Inc.; Home & Building Control.
   d. INTEC Controls, Inc.
   e. MSA Canada Inc.
   f. TSI Incorporated.
   g. Vaisala.
   h. Vulcain Inc.
   i. Brasch Manufacturing Company.
   j. General Analysis Corporation.
   k. Macurco Inc.
   l. MDA Scientific
   m. Toxalert.

2. Controller:

   a. General: Microprocessor controlled, capable of performing the specified sequence of operation.
   b. Enclosure: Corrosion resistant.
   c. Operating Temperature Range: 32 to 104 deg F.
   d. Operating Relative Humidity Range: 15 to 90%, non-condensing.
   e. Input Power: 120V connection. 24V with transformer is acceptable.
   f. Outputs:

      1) Indicating Lights: For power and alarm.
      2) Audible Alarm: with manual silence switch.
      3) Ventilation Equipment Activation Relay: 120V, 5A at 240 VAC.
      4) Fault Alarm Relay: 24V, to signal building automation system.
      5) Activate ventilation equipment when power to controller fails.

   g. Accessories:

      1) Calibration kit.
      2) Splash Protection: Corrosion-resistant splash guard with transparent cover to see indicating lights, or NEMA rating 3R or higher.

3. Sensors:

   a. General: Electrochemical, factory calibrated.
   b. Accuracy: +5%.
   c. Minimum Life: 2 years
   d. Repeatability: +10% at calibration point.

4. Alternates:
   a. A separate controller with remote transmitters is permitted.
   b. Combination carbon dioxide / nitrogen dioxide sensors or transmitters are permitted.

B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F; with 2 factory-calibrated alarm levels at 35 and 200 ppm in a heavy-gauge aluminum NEMA 1 enclosure.

C. Nitrogen Dioxide Detection System: packaged system with microcontroller, sensor(s), control relays and contacts in a heavy-gauge aluminum NEMA 1 enclosure.

1. Detection Resolution: Plus or minus 0.1 ppm.
2. Ambient Temperature Range: Minus 4 to plus 113 deg F (minus 20 to 45 deg C).
3. Ambient Humidity Range: 10 to 95 percent relative humidity.
4. Low alert level adjustable in increments of 0.1 ppm.
5. Indicator lights for power, relay status, and alarm condition.
6. Protected against static discharge, excessive electrical noise, and tested in accordance with ANSI/UL 1244.
7. Output relays providing a normally closed set of contacts for the alert states and the alarm states, which will automatically operate ventilation equipment on power loss to the sensor.
8. If a large area must be monitored with multiple sensors, a controller system with remote sensors may be used.

D. Accessories:

1. Calibration kit.
2. Splash Protection: Corrosion-resistant splash guard with transparent cover to see indicating lights, or NEMA rating 3R or higher.

2.8 FLOW MEASURING STATION

A. Fan inlet piezometers:

1. Where fan inlet piezometers are provided by makeup air manufacturer, these shall be used by the control contractor for air flow measurement. The air velocity transducers shall be provided under this Section and sized as described below.
2. 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.

2.9 ACTUATORS

A. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque. Stroke time for 90-degree rotation 90 seconds or less for major equipment and 6 minutes or less for terminal equipment. Provide position feedback potentiometers connected to controller for closed loop control on major equipment analog control loops. Provide pilot positioners.

1. Manufacturers:

a. Belimo Aircontrols (USA), Inc.

2. Valves: Size for torque required for valve close off at maximum pump differential pressure. Provide operators and pilot positioners with linkages and brackets for mounting on control valve. Design mounting and/or support to provide no more than 5% hysteresis in either direction.
3. Dampers: Size for running torque calculated as follows:

   a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
   b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
   c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft of damper.
   d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
   e. Dampers with 2- to 3-Inch wg. of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
   f. Dampers with 3- to 4-Inch wg. of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.

4. Coupling: V-bolt and V-shaped, toothed cradle.
5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on non-spring-return actuators.
7. Power Requirements (Two-Position Spring Return): 24-V ac.
8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
10. Temperature Rating: 40 to 104 deg F.
11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
12. Run Time: 12 seconds open, 5 seconds closed.
13. Provide external adjustable stops on damper actuators.

2.10 CONTROL VALVES

A. Manufacturer: Basis-of-Design Product: The design is based on the following:

1. Belimo Air Controls (USA), Inc.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Honeywell
2. Siemens
3. Johnson Controls, Inc.

C. Hydronic system control valves shall have the following characteristics:

1. NPS 2 and Smaller:
   a. Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
   b. Characterized Ball Valves: The following manufacturers are acceptable: Belimo, Air Controls (USA), and Johnson Controls. Forged brass or bronze body, stainless steel shaft and ball, reinforced Teflon or PTFE ball seals, double O-ring stem seals, characterized disk, maximum of ANSI Class IV (0.01%) leakage, suitable for use on water systems at 150 psig and 212° F. Minimum size for ball valves shall be 0.4 Cv.

      1) Pressure Rating for NPS 1 and Smaller: Nominal 600 psi.
      2) Pressure Rating for NPS 1-1/2 through NPS 2: Nominal 400 psi.
      3) Close-off Pressure: 200 psig.
      4) Process Temperature Range: Zero to 250 deg F.
      5) Control Port Leakage: 0%
      6) Body and Tail Piece: Cast bronze ASTM B61, ASTM B62, ASTM B584, or forged brass with nickel plating.
      7) End Connections: Threaded (NPT) ends.
      8) Ball: stainless steel.
      9) Stem and Stem Extension:
      10) Material to match ball.
      11) Blowout-proof design.
      12) Ball Seats: Reinforced PTFE.
      13) Stem Seal: Reinforced PTFE packing ring with a threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if an equivalent cycle endurance can be demonstrated by testing.
      14) Flow Characteristic: Equal percentage.

2. NPS 2-1/2 and Larger: Class 125 iron, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

   a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
   b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:

   a. Two Position: Line size.
   b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
   c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.

1. Body Style: Wafer or Lug.
2. Disc Type: Nickel-plated ductile iron or Elastomer-coated ductile iron.
3. Sizing: 1-psig maximum pressure drop at design flow rate.
4. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

E. Terminal Unit Control Valves: Pressure Independent Characterized Control valve (PICCV), bronze body, bronze trim, two or three ports ball valve as indicated, replaceable plugs and seats, and union and threaded ends.

1. PICCV equal to Belimo Zone Tight ball valve (PIQCV)
2. Combination of differential pressure regulator and 2-way valve.
3. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
4. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Performance:

    a. Pressure Rating: 360 psig.
    b. Close-off pressure of 200 psig.
    c. Process Temperature Range: Between 36 deg F to 212 deg F.
    d. Range: 100 to 1.

7. Integral Pressure Regulator: Located upstream of ball to regulate pressure, to maintain a constant pressure differential while operating within a pressure differential range of 5 to 50 psig.
8. Body: Forged brass, nickel plated, and with threaded ends.
9. Ball: Stainless steel.
10. Stem and Stem Extension: Stainless steel, blowout-proof design.
11. Ball Seats: Reinforced PTFE.
12. Stem Seal: Reinforced PTFE packing ring stem seal with threaded packing ring follower to retain the packing ring under design pressure with the linkage removed. Alternative means, such as EPDM O-rings, are acceptable if equivalent cycle endurance can be achieved.

F. All valves unless specifically noted on the plans or indicated below shall be globe style or Characterized Ball valves.

2.11 CONTROL DAMPERS

A. Manufacturer: Basis-of-Design Product: The design is based on the following:

1. TAMCO 7000 (T. A. Morrison & Co. Inc.).

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance Inc.
2. Don Park Inc.; Autodamp Div.
3. United Enertech Corp.
4. Vent Products Company, Inc.

C. Dampers: AMCA-rated, parallel or opposed-blade design; 0.108-inch-minimum thick, galvanized-steel or 0.125-inch-minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch-thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.

1. Secure blades to 1/2-inch-diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze or nylon blade bearings, blade- linkage hardware of zinc-plated steel and brass, ends sealed against spring- stainless-steel blade bearings, and thrust bearings at each end of every blade.
2. Operating Temperature Range: From minus 40 to plus 200 deg F.
3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
4. Edge Seals, Ultra-Low Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg. when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

D. High-Performance Control Dampers: AMCA-rated for Tamco Dampers

1. Ultra-Low Leakage Damper (Class 1A).
2. Frame: extruded-aluminum, 0.125-inch-minimum thick; frames with holes for duct mounting.
3. Blades: minimum 0.064-inch-thick aluminum with maximum blade width of 8 inches and length of 48 inches, with end caps.
4. Secure blades to 1/2-inch-diameter, zinc-plated axles using zinc-plated hardware, with Celcon inner bearing fixed to an aluminum hexagon blade pin rotating within a polycarbonate outer bearing inserted in the damper frame, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
5. Operating Temperature Range: From minus 40 to plus 200 deg F
6. Edge Seals: Use inflatable blade edging or replaceable silicone rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 1.7 cfm per sq. ft. of damper area, at differential pressure of 1-inch wg. when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.12 ELECTRICAL POWER DEVICES

A. Transformers:

1. Transformer shall be sized for the total connected load, plus an additional 25 percent of connected load.
2. Transformer shall be at least 100 VA.
3. Transformer shall have both primary and secondary fuses.
4. Transformer Construction:

    a. Ferroresonant, dry type, convection cooled, 600V class. Transformer windings of Class H (220 deg C) insulated copper.
    b. Use a Class H installation system throughout with operating temperatures not to exceed 150-deg C over a 40-deg C ambient temperature.
    c. Configure transformer primary for multi-input voltage. Include input terminals for source conductors and ground.
    d. Manufacture transformer core using M-6 grade, grain-oriented, stress-relieved transformer steel.
    e. Configure transformer secondary in a 240/120-V split with a 208-V tap or straight 120 V, depending on power output size.
    f. Electrically isolate the transformer secondary windings from the primary windings. Bond neutral conductor to cabinet enclosure and output neutral terminal.
    g. Include interface terminals for output power hot, neutral and ground conductors.
    h. Label leads, wires and terminals to correspond with circuit wiring diagram.
    i. Vacuum impregnate transformer with epoxy resin.

B. DC Power Supply:

1. Plug-in style suitable for mating with a standard eight-pin octal socket. Include the power supply with a mating mounting socket.
2. Enclose circuitry in a housing.
3. Include both line and load regulation to ensure a stable output. To protect both the power supply and the load, power supply shall have an automatic current limiting circuit.
4. Performance:

    a. Output voltage nominally 25-V dc within 5 percent.
    b. Output current up to 100 mA.
    c. Input voltage nominally 120-V ac, 60 Hz.
    d. Load regulation within 0.5 percent from zero- to 100-mA load.
    e. Line regulation within 0.5 percent at a 100-mA load for a 10 percent line change.
    f. Stability within 0.1 percent of rated volts for 24 hours after a 20-minute warmup.

2.13 LOW-VOLTAGE CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

2.14 ANALOG ELECTRONIC INSTRUMENT INDICATORS

A. Panel mount type and at least 2" square.

B. Output: analog needle type or digital with ½" high LED or backlit LCD displays.

C. Marked in appropriate units (Degrees, PSI, %RH, GPM, CFM, etc.) and with appropriate range of values.

D. Minimum accuracy of 1% of scale range.

E. Digital units shall be scaled to show 3 digits plus 1 decimal point.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that conditioned power supply is available to control units and operator workstation.

B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.

3.2 SYSTEM DESIGN

A. General Criteria:

1. Size all control devices to properly supply and/or operate and control the apparatus served.
2. Provide control devices suitable for the environment in which they will operate:

    a. All devices shall be constructed to withstand system temperatures and pressures.
    b. Devices used in outdoor ambient conditions shall be constructed to withstand those conditions or shall be suitably weather protected.
    c. Devices in corrosive environments shall be constructed of materials to withstand the effects of that environment.

B. Control Dampers:

1. General:

a. Unless otherwise indicated, use opposed blade for modulating control dampers and use parallel blade dampers for two position (open/close) dampers and for mixing applications.
b. All blade linkage hardware shall have a corrosion resistant finish and be readily accessible for maintenance.
c. Damper construction material shall be the same as the connecting duct material. Exception: Aluminum damper may be used in a galvanized duct system.
d. Maximum single damper size shall be 48"x48". If total width or height exceeds maximum, use multiple dampers.
e. Locate actuators outside of the air stream, unless otherwise indicated.

2. Sizing/selection criteria:

a. Two position dampers shall be sized as close as possible to duct size but in no case is the damper to be less than duct area.
b. When damper is part of an intake louver assembly, damper shall be same nominal size as louver unless specified otherwise on drawings.
c. All dampers used for mixing of airstreams shall be sized for 1800 to 2000 feet per minute velocity.

3. All control dampers furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Control Contractor in locations shown on plans or where required to provide specified sequence of control
4. Damper end switches, where required, shall be independently mounted to the damper drive shaft or auxiliary shaft attached to a damper drive blade. End switches shall be adjusted to prove the damper the position opposite the fail position of the damper actuator unless the control sequence requires a different position to be proven to accomplish the specified control sequence.
5. Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted.
6. Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

C. Control Valves:

1. All temperature control valves furnished by the control manufacturer are to be installed by the Mechanical Contractor under the coordinating control and supervision of the Control Contractor in locations shown on plans or where required to provide specified sequence of control.
2. Sizing/selection criteria:

a. Valves with pressure drop greater than 50% of upstream pressure shall have sound reduction trim.
b. Water Service:

1) Characteristic: equal percentage for two-way valves; linear for three-way valves.
2) Select control valves based on pressure drop calculations based on C_v values at 100% stroke.
3) Heating: globe type, selected for a minimum of 25% of equipment sub circuit pressure drop but no more than maximum available pump head allowing 2 psi pressure drop for balancing valve.

D. Air Temperature Sensors:

1. Ducts with cross-sectional area less than 3 square feet: single point type.
2. Ducts with cross-sectional area more than 3 square feet: RTD type.
3. Mixed air: averaging type

3.3 INSTALLATION

A. Install software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation.

B. Connect and configure equipment and software to achieve sequence of operation specified.

1. Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Align with light switches and humidistats. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

C. Verify location of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
2. Meet ADA requirements.
3. Locate temperature sensors away from direct sunlight, diffuser air streams, and heat sources.
4. Install thermostats and temperature sensors mounted on outside walls on insulated subbases. Subbase to provide a minimum of one-half inch of insulation.
5. Install devices with visible readouts where the display can be easily read.

D. Install guards on thermostats in the following locations:

1. Entrances.
2. Public areas.
3. Where indicated.
4. Provide guards on thermostats and sensors in entrance hallways, other public areas, or in locations where thermostat is subject to physical damage.

E. Install automatic dampers according to Section 23 33 00 "Air Duct Accessories."

F. Gas Detection Equipment: Provide sensors in locations and install per manufacturers requirements to provide full area coverage.

G. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

H. Install labels and nameplates to identify control components. Coordinate with owner.

I. Install hydronic instrument wells, valves, and other accessories as needed.

J. Provide power wiring to each component requiring power, such as control panels. Use circuits dedicated for controls. For equipment on emergency power, use emergency power circuits for their controllers.

K. Mount all control devices in accessible locations.

L. Interposing Relays:

1. Provide interposing relays necessary for interfacing to low voltage outputs with 120 VAC or line voltage motor control.

    a. Use Type C horsepower rated interposing relays for motors and electric heaters.
    b. Use Type K interposing relays for other general-purpose use.

M. Well-Mounted Sensors:

1. Install thermal conducting compound.
2. In pipe 2½ inches and smaller: install at elbow with tee fitting with well pointed upstream. Minimum 2” tee size.
3. In pipe 3 inches and larger: install the element in the flow.

N. Low Limit Thermostats (Freezestats):

1. Install low limit controls where indicated on the drawings or as specified. Unless otherwise indicated, install sensing element on the downstream side of heating coils.
2. Mount units using flanges and element holders. Provide duct collars or bushings where sensing capillary passes through sheet metal housings or ductwork; seal this penetration to eliminate air leakage. Mount the units in an accessible location as to allow for resetting after low limit trips while still meeting manufacturer's installation requirements for proper function.
3. Distribute (serpentine) sensing element horizontally across the coil to cover every square foot of coil; on larger coils this may require more than one instrument. Install controls at accessible location with mounting brackets and element duct collars where required.

O. Air Flow Stations:

1. Install airflow stations in accordance with manufacturer's recommendations.

P. Temperature Control Panels:

1. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. All control panel openings shall be plugged. Conduits and other penetrations on the top of the cabinets shall be sealed on the exterior of the cabinet with silicone caulk to resist water penetration. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
2. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings

Q. Current Status Switches:

1. Provide for each fan or pump specified or shown on point list. Set threshold adjustment to indicate belt or coupling loss. Readjust threshold for proper operation after final balancing is completed. Use the variable frequency drive (VFD) integrated relay output for motor status, if provided on the VFD, in lieu of a discrete current switch.

3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

A. Install raceways, boxes, and cabinets according to Section 26 05 33 "Raceways and Boxes for Electrical Systems."

1. Metal Conduit:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFC Cable Systems; a part of Atkore International.
    b. Allied Tube & Conduit; a part of Atkore International.
    c. Electri-Flex Company.
    d. Republic Conduit.
    e. Southwire Company.
    f. Thomas & Betts Corporation; A Member of the ABB Group.
    g. Western Tube and Conduit Corporation.
    h. Wheatland Tube Company
3. EMT: Comply with ANSI C80.3 and UL 797.

B. Metal Fittings:

1. Comply with NEMA FB 1 and UL 514B.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Fittings, General: Listed and labeled for type of conduit, location, and use.
4. Fittings for EMT:

    a. Material: Steel.
    b. Type: Setscrew.

5. Expansion Fittings: Steel to match conduit type, complying with type XJ for steel, rated for environmental conditions, where installed, and including flexible external bonding jumper.
6. Joint Compound for FMC Approved, as defined in NFPA, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

C. Install building wire and cable according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

D. Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded

E. Install signal and communication cable for communications horizontal cabling.

1. All cabling to be installed in EMT raceway, unless otherwise noted.
2. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
3. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
4. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
5. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
6. Route wires parallel or perpendicular to the building structural elements.
7. Do not route wires across telephone equipment areas.
8. In enclosures, install wiring in plastic track.
9. In controllers, wrap and secure all wiring.
10. Install wires at least 3 inches away from hot surfaces, such as steam and hot water pipes.

F. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.

G. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

H. Where the sensor voltage exceeds the controller’s allowed input voltage, modify the circuit with resistor(s) so that the input voltage to the controller is as high as practical and below the controller’s limit.

I. Provide transient voltage surge protection according to Division 26.

J. For equipment powered by standby emergency power, provide power to the equipment’s controller from a standby power panel.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.

    a. Use manufacturer's linearity curve to linearize the signal from each sensor.

3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated. Factory calibration does not replace field calibration.
4. Control System Inputs and Outputs:

    a. Check analog inputs at 0, 50, and 100 percent of span.
    b. Check analog outputs using milliampere meter at 0, 50, and 100 percent output.
    c. Check digital inputs using jumper wire.
    d. Check digital outputs using ohmmeter to test for contact making or breaking.
    e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:

    a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
    b. Manually operate flow switches to verify that they make or break contact.

6. Pressure:
    a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
    b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.

7. Temperature:

    a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
    b. Calibrate temperature switches to make or break contacts.

8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 01 for Demonstration and Training."

1. The first training session, minimum 8 hours, shall take place just prior to Substantial Completion. Training shall include system operation, maintenance procedures, and operating the system software. Submit O&M manuals at least one week prior to training session.
2. A follow-up training session, minimum 4 hours, shall take place approximately six months after Substantial Completion to assist troubleshooting answer questions.
3. A second follow-up training session, minimum 4 hours, shall take place approximately twelve months after Substantial Completion (just before the end of the warrantee period) to assist troubleshooting answer questions.

END OF SECTION 23 09 00

SECTION 23 09 24
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 SCOPE

A. The work associated with this section will be bid as part of the Division 23 scope of work.

B. Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a completely coordinated building Direct Digital Control (DDC) system. This system interfaced with Instrumentation and Controls for HVAC (Section 23 09 00) utilizing Direct Digital Control signals to operate actuated control devices will meet, in every respect, all operational and quality standards specified herein, a fully coordinated modification and extension via standard Web browser-IP address DDC of the City of Madison's Automation System.

C. The system shall be modular in nature, and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, ASCs, and operator devices.

D. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

1.2 RELATED WORK

A. Section 23 09 00 "Instrumentation and Controls for HVAC."

B. Division 23 HVAC equipment provided to be controlled or monitored.

1.3 REFERENCE

A. Applicable provisions of Division 1 govern work under this section.

1.4 REFERENCE STANDARDS

A. FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference.

1.5 WORK INCLUDED

A. Section 23 09 00 work includes furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, pneumatic tubing, sensor mounting, etc., that is covered in that section.

B. Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators are also covered in Section 23 09 00.

1.6 DESCRIPTION

A. The DDC control work associated with this section shall be bid as part of the Temperature Control Contract scope of the Work.

B. The Building Automation System (BAS) shall be based on a hierarchical architecture incorporating the Niagara N4 Framework™. All Building Management Functions shall be operable from the existing Honeywell workstations.

C. The BAS shall consist of the following:

1. N4 Supervisor Lon Web Connection.
2. Building Operator's N4 Supervisor Web Station.
3. WEBs-N4™ - Direct Digital Control Panels.
4. WEBs-N4™ 800 - Master Controls
5. Spyder Controllers Standalone Application Specific Controllers (ACSs).
6. LonWorks Network Wiring
7. City of Madison Lan/Wan Integration

1.7 OPEN COMMUNICATION

A. Industry standard Open Communication Protocols shall be provided as specified in the applicable communication sections.

B. LonWorks® compliance:

1. The fully integrated Honeywell WEBs-N4™ System shall be operable on the LonWorks® bus. General Purpose Controllers, Unitary Controllers, and PC- based centrals shall be able to operate and communicate on the 2-wire LonWorks® bus without the need of using gateways or drivers.
2. The Systems Integrator shall after all hardware (devices/nodes and wiring) has been installed provide all necessary device installation, device configuration, device diagnostics, network variable binding and systems diagnostics.
3. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each network controller shall communicate to LonMark™/LonTalk™ (IDC) and/or BACnet™ (IBC) controllers.

1.8 QUALITY ASSURANCE

A. Manufacturers:

1. Control Works Inc.

Marquis Harding
E-mail: mharding@controlworks-bas.com
P.O. 7066
Madison, WI
53706 608-347-
6108

B. Installer Qualifications:

1. A firm specializing and experienced in DDC control system installation with a local service office within 60 miles of Madison and experience with similar installations for no less than five (5) years. All work to be done by qualified mechanics in the direct employ of this manufacturer.
2. All engineering and commissioning work shall be done by qualified personnel in the direct employ of this manufacturer, or of an Authorized Representative of that manufacturer that provides engineering and commissioning of the manufacturers control equipment.
3. 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 (3) years.

C. Response Time:

1. During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.

D. Authorized Controls Integrator:

1. The control contractor shall be a Honeywell ACI – Authorized Integrator.

E. Electrical Standards:

1. Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.
2. DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment being provided is in compliance with FCC rules governing the control of interference caused by Digital Electronic Equipment to Radio Communications (Part 15, Subpart J, Class-A).

1.9 SUBMITTALS

A. Include the following information:

1. Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Indicate which piece of mechanical equipment is associated with each controller and what area within the building is being served by that equipment. For terminal unit control, provide a room schedule that lists mechanical equipment tag, room number of space served, address of DDC controller, and any other pertinent information required for service.

1.10 PRODUCT DATA

A. Submit manufacturer's specifications for each control device furnished, including installation instructions and startup instructions. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked. Annotated software program documentation shall be submitted for system sequences, along with descriptive narratives of the sequence of operation of the entire system involved. Shop drawings shall also contain complete software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Submit wiring diagram for each electrical control device along with other details required to demonstrate that the system has been coordinated and will function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

B. All control devices in public areas shall be selected by Owner from one of the manufacturer's standard colors.

C. 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 owner

1.11 MAINTENANCE DATA

A. Submit maintenance data and spare parts lists for each control device. Include this data in maintenance manual.

1.12 RECORD DRAWINGS

A. Prior to request for final payment provide complete composite record drawings to incorporate the DDC and Electric fieldwork. Provide application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Copies of the record drawings shall be provided in addition to the documents on compact disk. All record drawings shall also be installed into the BAS server in a dedicated directory. Accurate Section 23 09 00 record drawings to be supplied by the Section 23 09 00 Contractor with the accuracy of these drawings being the responsibility of the 23 09 00 contractor. In the event that changes are required to the 23 09 00 supplied record drawings after they have been compiled by the 23 09 24 contractor, it shall be the 23 09 00 contractors responsibility to provide updated composite record drawings incorporating the 23 09 24 record drawings.

B. All software addressing for device communication shall be noted for all devices provided under this section and the communication addressing required for devices provided by others that are integrated into the direct digital control system provided under this section. Coordinate with the supplier of the equipment specified to be interfaced through digital communications for communication addressing. Provide circuit number of 120VAC panel power circuit(s) feeding each control panel on record drawings. Label circuit number(s) inside the panel served.

C. Provide complete composite record drawings to incorporate the DDC and Electric fieldwork.

1.13 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1.14 MATERIAL DELIVERY AND STORAGE

A. Provide factory-shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

PART 2 - PRODUCTS

2.1 NETWORKING/COMMUNICATIONS

A. The design of the BAS shall be networked. Inherent in the system's design shall be the ability to expand or modify the network either via a local network or a standard Web browser. A combination of the two networking schemes.

B. City to provide network connections for the network Honeywell JACE 800 controllers.

C. Local Network:

1. Building DDC Panel Support:

a. The Digital Panel shall directly oversee a local network such that communications may be executed directly to and between ASCs. The Digital Panel version shall be referred to as the "Digital Panel(s)" throughout this document.

D. Data Access:

1. All operator devices either network resident or a standard Web browser, shall have the ability to access all point status and application data on the network.
2. Access to system data shall not be restricted by the hardware configuration of the BAS.
3. All operators shall have the ability to collect data for any property of any object and store this data for future use.
4. The data collection shall be performed by log objects, resident in the controller that shall have, at a minimum, the following configurable properties:

a. Designating the log as interval or deviation.
b. For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.
c. 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.
d. 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.
e. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

E. All log data shall be stored in a relational database in the controller and the data shall be accessed from a server (if the system is so configured) or a standard Web browser. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

F. 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.

G. All operators shall have the ability to archive its log data either locally (to itself), or remotely to a server or other controllers 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.

H. 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.

I. 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:

    a. Peak demand, with date and time stamp.
    b. 24-hour demand log.
    c. Accumulated KWH and therms for day.
    d. Sunday through Saturday KWH and therm usage.
    e. Demand KW annual history for past 12 periods.
    f. KWH and therm annual history for past periods.

J. 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.

K. The event totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.

L. Global Data Sharing: global Data Sharing or Global point broadcasting shall allow point data to be shared between ASCs, when it would be inefficient or impractical to locate multiple sensors.

M. General Network Design: Network design shall include the following provisions:

N. Data transfer rates for alarm reporting and quick point status from multiple ASCs. The minimum baud rate shall be 9600 baud.

O. Support of any combination of ASCs. A minimum of 100 ASCs shall be supported on a single local network. The bus shall be addressable for up to 255 ASCs.

P. Detection of single or multiple failures of the ASCs or the network media.

Q. Error detection, correction, and retransmission to guarantee data integrity.

R. Commonly available, multiple sourced, networking components shall be used.

S. Use of an industry standard protocol, such as Optomux, and IEEE RS-485 communications interface.

T. The HVAC BAS provided under this section of the specifications shall consist of a distributed Client-Server, Local Area Network (LAN) based system, a dedicated local area network, routers, switchers, network nodes, direct digital control system and software to provide interoperability with the server software. The system is to be furnished and installed in its entirety by this supplier.

U. The HVAC BAS shall be modular in design and scaleable in implementation from an initial installation of a single server with minimum of two concurrent operator workstations to a system with up to 40 concurrent operator workstations, unlimited web browser access (using Internet Explorer) to system information for monitoring and control functions, and field controller network interfaces to permit expansion to 60,000 physical hardware points.

2.2 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 Chrome 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 BAS, 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 All operators/controllers, 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:

    a. Modify common application objects, such as schedules, calendars, and set points in a graphical manner.
    b. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator.
    c. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
    d. 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.
    e. View logs and charts.
    f. View and acknowledge alarms.
    g. Setup and execute SQL queries on log and archive information.

5. 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.
6. 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.

2.3 DIGITAL PANELS

A. General: Digital Panels shall be microprocessor-based, multi-tasking, multi-user, digital control processors.

B. Memory: Each Digital Panel shall have sufficient memory to support its own operating system and databases including:

1. Control Processes.
2. Energy Management Applications.
3. Alarm Management.
4. Trend Data.
5. Maintenance Support Applications.
6. Operator I/O.
7. Dial-Up Communications.
8. Manual Override Monitoring.

C. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.

D. Serial Communication Ports: Digital Panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as laptop computers, Personal Computers, and Video Display terminals.

E. Hardware Override Monitoring: Digital Panels shall monitor the status of al overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited.

F. Integrated On-Line Diagnostics: Each Digital Panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The Digital Panels shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each Digital Panel.

G. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.

H. Power fail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of the Digital Panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

I. Upon restoration of normal power, the Digital Panels shall automatically resume full operation without manual intervention.

2.4 SYSTEM SOFTWARE FEATURES

A. General:

1. All necessary software to form a complete operating system as described in this specification shall be provided.
2. The software programs specified in this section shall be provided as an integral part of the Digital Panel and shall not be dependent upon any higher level computer for execution.

B. Graphic Requirements: Provide color graphic backgrounds with operational information interface for the following systems:

1. Building 3901
    a. MAU-1
    b. EF-1
    c. MAU-2
    d. EF-2
    e. CO-1 through CO-8 and NO2-1 through NO2-8
    f. UH-1 through UH-8
    g. EWH-1 through EWH-3
    h. RTU-1 and ZD-1-1 through ZD-1-8
    i. RTU-2 and VAV 2-1 through VAV 2-3
    j. F-1
    k. EF-3 through EF-9
2. Building 3829
    a. MAU-1
    b. EF-1 through EF-4
    c. CO-1 through CO-4 and NO2-1 through NO2-4
    d. UH-1 through UH-9
    e. EWH-1 through EWH-3
    f. F-1 and ZD-1-1 through ZD-1-3 and BPD-1
    g. F-2 and ZD-2-1 through ZD-2-3 and BPD-2
    h. EF-5 through EF-9
    i. MS-1 and MS-2
3. Building Floor Plan graphic for temperature sensor information and terminal unit service designations.

C. Control Software Description:

1. 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.
2. Heavy Equipment Delays: 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.
3. Power fail 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.

D. Energy Management Applications: Digital Panels shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling.
2. Calendar Based Scheduling.
3. Holiday Scheduling.
4. Temporary Schedule Overrides.
5. Optimal Start.
6. Optimal Stop.
7. Demand Limiting.
8. Load Rolling.
9. Heating/Cooling Interlock.
10. Average/High/Low Signal Select and Reset.

E. All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the “Execution” portion of this specification.

F. Programming Capability: Digital Panels shall be able to execute configured processes defined by the user, to automatically perform calculations and control routines.

G. Process Inputs and Variables: It shall be possible to use any of the following in a custom 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,).

H. Process Triggers: Configured processes may be triggered based on any combination of the following:

1. Time of Day.
2. Calendar Date.
3. Other Processes.
4. Events (e.g., point alarms).

I. Data Access: A single process shall be able to incorporate measured or calculated data from any and all other ASCs.

1. In addition, a single process shall be able to issue commands to points in any and all other NCUs on ASCs local network.

J. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each Digital Panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the Digital Panel’s ability to report alarms be affected by either operator activity at the local I/O device, or communications with other ASCs on the network.

K. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.

L. Each Digital Panel shall be capable of storing a library of at least 100 Alarm Messages. Each message may be assignable to any number of points in the panel.

M. Auto-Dial Alarm Management: In dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.

a.

N. Trend Analysis: A data collection utility shall be provided to automatically sample, store and display system data.

O. 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 Digital Panel shall have a dedicated buffer for trend data, and shall be capable of storing 32 trend logs. Each trend log shall have up to 4 points trended at 268 data samples each. Data shall be stored at the Digital Panel.

P. Runtime Totalization: Digital Panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the “Execution” portion of this specification.

1. The Totalization routine shall have a sampling resolution of one minute.
2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.

Q. Event Totalization: Digital Panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.5 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

A. Each Digital Panel shall be able to extend its performance and capacity through the use of standalone Application Specific Controllers (ASCs).

B. Each ASC shall operate as a standalone controller capable of performing its specific control responsibilities independently of other controllers in the network. Each ASC shall be of microprocessor-based, multi-tasking, real-time digital control processor.

C. Each ASC shall have sufficient memory to support its own operating system and data bases including:

1. Control Processes.
2. Energy Management Applications.
3. Operator I/O (Portable Service Terminal).

D. The operator interface to any ASC point data or programs shall be through the Digital Panel or portable operator's terminal connected to any ASC on the network.

E. ASCs shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following:

1. Display temperatures.
2. Display status.
3. Display setpoints.
4. Display control parameters.
5. Override binary output control.
6. Override analog setpoints.
7. Modification of gain and offset constants.

F. Power fail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.

2.6 APPLICATION DESCRIPTIONS

A. Unitary Controllers:

B. Unitary Controllers shall support, but not be limited to, the following types of systems to address specific applications described in the “Execution” portion of this specification, and for future expansion:

1. Ductless Split Systems.
2. Generic Point Multiplexing.

C. Unitary Controllers shall support the following types of point inputs and outputs:

1. Economizer Switchover Inputs:

a. Drybulb.
b. Outdoor Air Enthalpy.
c. Differential Temperature.
d. Binary Input from a separate controller.

2. Economizer Outputs:

a. Integrated Analog with minimum position.
b. Binary Output to enable self-containe.
c. Economizer Actuator.

3. Heating and Cooling Outputs:

a. 1 to 3 Stages.
b. Analog Output with two-pipe logic.
c. Reversing valve logic for Heat Pumps.

4. Fan Output:

a. On/Off Logic Control.

D. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the “Execution” portion of this specification, and for future expansion:

1. Daily Schedules.
2. Comfort/Occupancy Mode.
3. Economy Mode:

    a. Standby Mode/Economizer Available.
    b. Unoccupied/Economizer Not Available.
    c. Shutdown.

4. Lighting Logic Interlock to Economy Mode.
5. Temporary Override Mode:

    a. Temporary Comfort Mode (Occupancy-Based Control)
    b. Boost (Occupant Warmer/Cooler Control)

E. MAU Controllers:

1. MAU Controllers shall support, but not be limited to the following configurations of systems to address current requirements as described in the “Execution” portion of this specification, and for future expansion:

    a. Make-up Air Units:

        1) 100% Single Path.
        2) Generic Point Multiplexing.

F. MAU Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.

G. MAU controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the “Execution” portion of this specification.

H. Continuous Zone Temperature Histories: Each MAU Controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

I. Alarm Management: Each MAU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

J. Each MAU Controller shall come with a hand-held Zone Terminal permanently mounted at the controller to allow interface with the controller. This device will allow the user to monitor or adjust set points and time scheduling within a specific zone.

2.7 OPERATOR INTERFACE

A. Basic Interface Description.

B. Command Entry/Menu Selection Process: Operator interface software shall minimize operator training through the use of English language prompting, English language point identification.

C. The operator interface shall have the option of using a mouse or similar pointing device for a “point and click" approach to facilities management. Users shall be able to start and stop equipment or change setpoints from graphical displays through the use of a mouse or similar pointing device.

D. Password Protection: Multiple-level password access protection shall be provided to allow the user/manager to limit control, display and database manipulation capabilities as he deems appropriate for each user, based upon an assigned password. Provide secure password access to all features, functions and data contained in the overall BAS.

E. Passwords shall be exactly the same for all operator devices.

F. A minimum of four (4) levels of access shall be supported:

1. Level 1 = Data Access and Display.
2. Level 2 = Level 1 + Operator Overrides and Commands.
3. Level 3 = Level 2 + Operator Management.
4. Level 4 = Level 3 + Database Generation and Modification.

G. A minimum of eight (8) passwords shall be supported at each Digital Panel.

H. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed at any operator device, shall be limited to only those items defined for the access level of the password used to log-on.

I. User-definable, automatic log-off timers of from 1 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices logged on.

J. Operator Commands: The operator interface shall allow the operator to perform commands including, but not limited to, the following:

1. Start-up or shutdown selected equipment.
2. Adjust setpoints.
3. Add/Modify/Delete time programming.
4. Enable/Disable process execution.
5. Lock/Unlock alarm reporting for each point.
6. Enable/Disable Totalization for each point.
7. Enable/Disable Trending.
8. Enter temporary override schedules.
9. Define Holiday Schedules.
10. Change time/date.
11. Enter/Modify analog alarm limits.
12. Enable/Disable demand limiting.
13. Enable/Disable duty cycle.
14. Enable/Disable average/high/low signal select and reset.

K. Logs and Summaries: Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following types of reports:

L. A general listing of all points in the network shall include, but not be limited to, the following:

1. Points currently in alarm.
2. Off-line points.
3. Points currently in override status.
4. Points in Weekly Schedules.
5. Holiday Programming.

M. Summaries shall be provide for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration of the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

N. System Configuration and Definition: All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

O. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:

1. Add/Delete/Modify Application Specific Controllers.
2. Add/Delete/Modify points of any type, and all associated point parameters, and tuning constants.
3. Add/Delete/Modify alarm reporting definition for each point.
4. Add/Delete/Modify energy management applications.
5. Add/Delete/Modify time- and calendar-based programming.
6. Add/Delete/Modify Totalization for every point.
7. Add/Delete/Modify Historical Data Trending for every point.
8. Add/Delete/Modify configured control processes.
9. Add/Delete/Modify dial-up telecommunication definition.
10. Add/Delete/Modify all operator passwords.
11. Add/Delete/Modify Alarm Messages.

P. Programming Description: Definition of operator device characteristics, ASCs, individual points, applications and control sequences shall be performed through fill-in-the-blank templates.

Q. System Definition/Control Sequence Documentation: All portions of system definition shall be self-documenting to provide hardcopy printouts of all configuration and application data.

R. Database Save/Restore/Back-Up: Back-up copies of all ASC and Digital Panel databases shall be stored in at least one personal computer or laptop. Users shall also have the ability to manually execute downloads of an ASC or Digital Panel data base.

S. Interface with City of Madison Central BAS System: Provide a standard Web browser with IP address for connection to existing City Central BAS System. Update graphics on City Central BAS System as required to allow central monitoring of this project control system.

T. Graphical User Interface Computer Hardware (Desktop):

1. Coordinate with Owner's Representative on interface with their computer hardware desktop. The exact location of the existing 2 network ports in or near mechanical room to be coordinated by Owner with this Contractor.

PART 3 - EXECUTION

3.1 GENERAL

A. This contractor shall provide all labor, materials, engineering, software permits, tools, check-out and certificates required to install a complete DDC automation system as herein specified. This system expansion shall be compatible with and interfaced to the existing computer driven automation center on campus, and shall operate through all the existing I/O devices, central processing unit (CPU), and digital communication trunks. This connection to the digital communications trunk shall be true bi-directional analog and digital communications.

B. Any and all points added with this project shall be properly interfaced into the existing City's existing central automation system via standard Web browser-IP address format and grouped for display purposes into the system such that all points associated with a new or existing DDC system can appear together on the CRT display or printed log. Assignment of points to a group shall not be restricted by hardware configuration of the points of direct digital control. It shall be possible to assign a point to appear in more than one system. An English descriptor and an alpha/numeric identifier shall identify each system.

C. This City's central automation system expansion as herein specified shall be fully integrated and completely installed by this section. It shall include all required computer CPU software and hardware. Include the engineering, installation, supervision, calibration, software programming, and checkout necessary for a fully operational system.

D. Mechanical drawings of the system and BAS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Engineer shall be furnished and installed without additional cost.

3.2 INSTALLATION

A. Install the control system in accordance with manufacturer's instructions.

B. All work and materials are to conform in every detail to the rules and requirements of the National Electrical Code and any applicable local codes, and present manufacturing standards. All wiring and cable installation shall conform with the wiring installation as specified in the installation section of Section 23 09 00. All material shall be UL approved.

b.

C. The addition of this specified system expansion shall in no way impair the future capabilities of any existing functions of the computer driven existing City central campus automation system. A system expansion with lessor capabilities will not be accepted. Further, this contractor will not put in jeopardy the normal, uninterruptable operation of the entire campus automation system the time it is interfaced through the completion of this project.

D. Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details on drawings.

E. Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by this contractor.

F. Control panels shall not be installed in concealed areas. All panels shall be accessible and serviceable which will provide minimal disruption to the building occupant or function. Consult with maintenance operation staff for recommended locations. Final location shall be decided by the Owner's Project Representative.

G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide printed plastic tags for instruments and controls inside cabinet and on engraved plastic nameplates cabinet face.

H. Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

I. Provide an input for a service shutdown toggle switch for each make-up air unit system provided inside the (Section 23 09 00) temperature control panel that will initiate a logical shutdown of the make-up air unit system.

J. All cables to the DDC panels in the DDC panel with sufficient spare cable (minimum of 5') to allow termination.

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. Schedule with the Commissioning Agent, CxP that allows in advance notice of 5 business days of the testing so that the CxP may witness as deemed necessary. Also notify the Owner's Representative, as required. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

c.

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 CxP, Engineer, and Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.4 DEMONSTRATION

A. The system manufacturer or his representative shall provide start-up and adjustment service for the control system.

B. The system manufacturer or his representative shall provide a minimum eight (24) hours of training for the Owner's personnel on the operation and maintenance of the packaged control system.

3.5 TRAINING

A. All training provided for personnel shall comply with the format, general content requirements and submission guidelines specified under Division 01.

B. Contractor to provide 24 hours of instruction training to the owner's designated personnel on the operation of the system 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 instructional training shall be in two sessions as follows:

1. Initial Instructional 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 Instructional Training: Two days (16 hours total) approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics such as data collection, event counting and answer questions.

D. Provide two follow-up visits for troubleshooting and instruction, one six months after substantial completion and the other at the end of the warranty period. Length of each visit to be not less than 2 hours or the time necessary to provide required information and complete troubleshooting and inspection activity for all controls installed under this section. Coordinate the visit with the City and provide an inspection report to the Owner's representative of any deficiencies found.

END OF SECTION 23 09 24

SECTION 23 09 93
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

B. Related Sections include the following:

1. Section 23 09 00 "Instrumentation and Control for HVAC" for control equipment and devices and for submittal requirements.

1.3 DEFINITIONS

A. DDC: Direct digital control.

B. BAS: Building Automation System

C. VAV: Variable air volume.

D. Inches w.g.: Inches of water gauge, or inches of water column.

1.4 GENERAL

A. A value in this specification followed by the word “adjustable” means the value can be changed manually through the DDC system by the Owner.

B. All duct mounted smoke detectors shall be provided and installed by this contractor. 120/1 electrical power to the detectors will be provided by the Electrical Contractor. ALL other required wiring to achieve a complete and fully functioning duct smoke detection system that is California code and NFPA standard compliant as well as acceptable to the local authority having jurisdiction. Wire all duct smoke detectors to a single remote alarm horn and trouble annunciator alarm wall mounted in a normally occupied area. Verify alarm horn and trouble annunciator location with Owner.

C. The DDC control systems shall be connected to the main fire suppression control panel. When this fire suppression system is activated, the fire suppression system shall shut down ALL equipment fan motors via the DDC temperature system. This contractor shall provide all materials and labor required for this control feature. The fire suppression system panel and its programming shall be by others.

D. All control points shall be exposed as BACnet objects and shall be viewable and editable over the internet from a remote location with a standard web browser.

E. For pushbutton switches mentioned in the sections below, provide the Owner with a sample of each type used for approval prior to installation.

F. When filter pressure monitoring and control is required for a unit, filter monitoring and control shall apply to all filter banks in the unit.

G. Setpoints:

1. All setpoints indicated in the control specification are to be adjustable. The setpoints shall be readily available to be modified in the mechanical system software system summary (either textual or graphic based) and under the same software level as hardware points. Some less used setpoints may be provided on a lower software level, if requested by the Owner for clarity. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on requirements of the building. The control contractor shall work with the balancing contractor and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use. Document all final setpoints on the as-built control drawings. Any questions regarding the intended operation of the HVAC equipment and control systems shall be referred to the HVAC design engineer through the appropriate construction communication process. The following setpoints should be used as initial setpoints unless otherwise specified in the individual control sequences or instructed by the user Agency. If the contractor fails to check with the user Owner for final setpoints, they shall adjust setpoints at no additional cost.

a. Occupied Space Terminal Unit Heating: 68 deg F
b. Occupied Space Terminal Unit Cooling: 75 deg F
c. Unoccupied Space Terminal Unit Heating: 60 deg F
d. Unoccupied Space Terminal Unit Cooling: 80 deg F

H. Anti-cycling:

1. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential setpoints shall be set at 2 deg F and non-temperature setpoints shall be set at 10% of the controlled range unless otherwise specified. Setpoints shall indicate at when the process should be turned on. Heating and cooling differentials shall be set for above setpoint and shall be used to turn the process off. For example, an economizer sequence called to switch at 68º F, would turn on at 68 deg F and off at 70 deg F since it is a cooling function. A heating lockout setpoint of 50º F would turn on heating control at 50 deg F and off at 52 deg F Non-temperature differentials shall be set above setpoint if the setpoint is indicating a minimum value or below setpoint if the setpoint is indicating a maximum value. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Unless otherwise specified in the individual control sequences, fans shall have a minimum runtime on timers of 15 minutes (adj.) and off timers of 5 minutes (adj.). Safeties shall override runtime timers.

I. Deadbands:

1. Provide deadbands for all DDC control loops to prevent constant hunting of output signals to controlled devices. Deadbands shall be set to provide adequate control around setpoint as follows unless otherwise specified in the individual control sequences:

   a. Temperature Control: ±0.5 deg F
   b. Humidity Control: NA
   c. Airflow Control: ±2% of total flow
   d. AHU Static Pressure Control: ±0.01 in. w.c.

J. Alarms:

1. Provide all alarmed points with adjustable time delays to prevent nuisance tripping under normal operation and on equipment start-up. For all commanded outputs that have status feedback, provide an alarm that shall indicate the commanded output is not in its commanded state. Provide alarms on all points as indicated on point charts. For existing campus automations systems, add/delete what is called on the point charts for after consultation with user Agency to provide consistent alarming throughout the automation system.
2. For devices that have form “C” contacts available for alarm monitoring, use closed contacts for the Normal condition and open contacts on Alarm condition. This shall provide a level of supervision by detecting a break in the wiring.

K. Equipment Start/Stop Failure States:

1. All start/stop points for equipment shall utilize normally open contacts unless called out specifically in the individual control sequences.

L. Variable Frequency Drive (VFD) Motor Run Status:

1. Use the VFD programmable relay dry contact output specified to be provided with the VFD under Section 23 05 14 to prove motor run status and detect belt loss or coupling break.

M. VFD Minimum Speed & Ramp Timers:

1. The VFD start-up technician shall work with the DDC Temperature Control Contractor determine the minimum speed required for the motor controlled by the VFD to provide cooling of the motor as installed to prevent heat related problems. This minimum speed shall be set in the VFD controller. The VFD start-up technician shall work with the DDC Temperature Control Contractor to set the acceleration and deceleration timers in the VFD controller at 30 seconds for motors less than 40 HP.

N. Current Switch Setup:

1. When current switches are used for proving fan status, they shall be set up so that they will detect belt or coupling loss by the reduction in current draw on loss of coupled load. The current switch set up shall be redone by the 23 09 00 contractor after the balancer is complete.

O. Damper Interlocks for Fans with ECM motors:

1. For fan systems with ECM motors and shutoff dampers specified with end switches, the damper interlock shall be hardwired in such a way that the damper shall open if the fan starter hand / off / auto switch is in the hand or in the auto position and being called to start. After the damper end switch has proven the damper open, a hardwire interlock from the end switch to the starter holding coil for the fan shall cause the fan to start.

P. Damper Interlocks for Fans with VFD's:

1. For fan systems with VFD's and shutoff dampers specified with end switches, the damper end switches shall be hardwire interlocked to the safety circuit(s) of the VFD to prevent the fan from starting until the damper is proven open. The damper end switch shall also be monitored by the DDC system.

Q. Fan Interlocking:

1. Provide interlocks between supply and return or exhaust fan systems as scheduled on the plans or called out in individual control sequences. If DDC controlled, interlocks shall be done through DDC start/stop points unless otherwise specified in individual control sequences. If not DDC controlled, interlocks shall be accomplished via hardwire interlocks between fan starters or VFD's.

R. Thermostats and Sensors:

1. All devices and equipment including terminal units, specified to be controlled in a control sequence by a thermostat or sensor, shall be provided with a thermostat or sensor, whether or not the device is indicated on the plans.

S. Watch Dog Timer:

1. Where the integrated system consists of programmable DDC controllers with BACnet objects mapped to an enterprise level Building Automation System (BAS) and it is shown that the BACnet objects do not indicate when they are offline on the enterprise level BAS when communication is lost between the two systems, software algorithms shall be provided to alarm when communication is lost. The integrated system shall program a binary data object that is toggled on and off at an adjustable rate (initially one minute) that shall be monitored by the enterprise level BAS which shall alarm if the toggling ceases.

T. Weekly Scheduling:

1. Provide scheduling of DDC terminal units based on occupancy. Work with the user Owner to determine scheduling and which zones should be included. Individual terminal units shall be able to receive temporary schedules that shall override the group schedules. Temporary override buttons at the zone sensor (where specified on point charts) shall override the scheduling to occupied. When 20 % or more terminal units are indexed to occupied, the associated air handling unit shall start if not already running.

U. DDC Controller Communication Bus Configuration:

1. The actively controlled primary mechanical equipment (VFDs, meters, gas detection, destratification fans etc.) DDC controllers shall be configured to be located on the same supervisory controller BACnet MSTP communication trunk unless the supervisory controller capacity prevents it. If this is the case, the primary mechanical equipment DDC controllers shall be separated onto supervisory controllers in such a way that the systems that need to share information for operation and interlocking shall reside on the same supervisory controllers. Other critical building systems that require communication between DDC controllers to operate shall be on the same BACnet MSTP communication trunk. Terminal unit controllers shall be located on a separate BACnet MSTP trunks if necessary to allow for primary equipment to reside on the same BACnet MSTP trunk. If the DDC controllers used for control of primary mechanical equipment and interlocks or point information is required for proper operation as described above do not use BACnet MSTP communication but use Ethernet communication, the DDC controllers shall be connected to the same Ethernet switch. If the controllers cannot be connected to the same switch, hardwired points between controllers shall be used to share information.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONTROLS

A. Refer to Mechanical drawings for Sequence of Operations for HVAC Controls.

END OF SECTION 23 09 93