RFB NO. 317012

CONSTRUCTION DOCUMENTS
PROJECT MANUAL

DANE COUNTY DEPARTMENT OF PUBLIC WORKS,
HIGHWAY AND TRANSPORTATION

PUBLIC WORKS ENGINEERINGDIVISION
1919 ALLIANT ENERGY CENTER WAY
MADISON, WISCONSIN 53713

REQUEST FOR BIDS NO. 317012
DAY RESOURCE CENTER REMODELING
615 E. WASHINGTON AVE
MADISON, WISCONSIN

Due Date / Time: **TUESDAY, MARCH 28, 2017 / 2:00 P.M.**

Location: **PUBLIC WORKS OFFICE**

Performance / Payment Bond: **100% OF CONTRACT AMOUNT**

Bid Deposit: **5% OF BID AMOUNT**

FOR INFORMATION ON THIS REQUEST FOR BIDS, PLEASE CONTACT:

ROB NEBEL, PUBLIC WORKS DIRECTOR – PROJECT MANAGER @
608/267-0119 or J. ERIC URTES, AIA,- PROJECT MANAGER @ 608/266-4798

E-MAILS: nebel@countyofdane.com and urtes.eric@countyofdane.com

FAX NO.: 608/267-1533

TABLE OF CONTENTS FOR RFB NO. 317012

DIVISION 08 - OPENINGS

08 11 13 Hollow Metal Doors and Frames
08 14 16 Flush Wood Doors
08 31 13 Access Doors and Frames
08 33 00 Coiling Doors and Grilles
08 41 00 Aluminum-Framed Entrances and Storefronts
08 71 00 Door Hardware
08 80 00 Glazing

DIVISION 09 - FINISHES

09 29 00 Gypsum Board
09 51 00 Acoustical Ceilings
09 65 00 Resilient Flooring
09 67 16 Epoxy Flooring
09 84 13 Acoustical Treatment
09 90 00 Painting

DIVISION 10 - SPECIALTIES

10 14 00 Information Specialties
10 22 26 Operable Panel Partitions
10 28 00 Toilet and Bath Accessories
10 41 16 Emergency Access Key Boxes
10 44 13 Fire Extinguishers and Cabinets
10 51 13 Lockers
10 67 00 Steel Shelving

DIVISION 11 – EQUIPMENT

11 42 16 Food Preparation Surfaces

DIVISION 21 - FIRE SUPPRESSION

210500 Common Work Results for Fire Suppression
210529 Hangers and Supports for Fire Suppression Piping and Equipment
211313 Wet-Pipe Sprinkler Systems

DIVISION 22 - PLUMBING

220500 Common Work Results for Plumbing
220514 Plumbing Specialties
220515 Piping Specialties
220523 General Duty Valves for Plumbing Piping
220529 Hangers and Supports for Plumbing Piping and Equipment
220700 Plumbing Insulation
221100 Facility Water Distrubution
221300 Sanitary Waste and Vent
222000 Natural Gas Fuel System
223000 Plumbing Equipment
224200 Commercial Plumbing Fixtures

DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING (HVAC)

23 05 00 Common Work Results for HVAC
23 05 13 Common Motor Requirements for HVAC Equipment
23 05 14 Variable Frequency Drives
23 05 15 Piping Specialties
23 05 23 General Duty Valves for HVAC
23 05 29 Hangers and Supports for HVAC Piping and Equipment

23 05 93 Testing, Adjusting and Balancing for HVAC
23 07 00 HVAC Insulation
23 09 14 Electric Instrumentation and Control Devices for HVAC
23 09 24 Direct Digital Control System for HVAC
23 09 25 Integrated Automation System for HVAC
23 09 93 Sequence of Operations for HVAC Controls
23 11 00 Facility Fuel Piping
23 21 13 Hydronic Piping
23 21 23 Hydronic Pumps
23 25 00 HVAC Water Treatment
23 31 00 HVAC Ducts
23 33 00 Air Duct Accessories
23 34 00 HVAC Fans
23 36 00 Air Terminal Units
23 37 13 Diffusers, Registers and Grilles
23 52 00 Heating Boilers
23 74 00 Packaged Roof Top Heating – Cooling Units
23 82 00 Heating Terminal Units

DIVISION 25 – INTEGRATED AUTOMATION
25 00 00 Integrated Access Control Systems (IACS)

DIVISION 26 - ELECTRICAL
26 05 00 General Electrical Requirements
26 05 11 Basic Materials and Methods
26 09 23 Occupancy Sensor Lighting Control System
26 43 13 Transient Voltage Surge Supression
26 51 13 Lighting

DIVISION 27 - COMMUNICATIONS
27 10 00 Telecommunications Distribution System
27 41 13 Architecturally Integrated Audio-Visual Equipment
27 52 23 Help Call System

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY
28 13 00 Access Control and Intrusion Detection
28 23 00 Video Surveillance System
28 31 00 Fire Alarm System

DIVISION 32 - EXTERIOR IMPROVEMENTS
32 31 16 Welded Wire Fences and Gates
32 93 00 Plants

DRAWINGS
Plot drawings on 24” x 36” (ARCH D)

GENERAL	
G100	COVER SHEET, INDEX OF DRAWINGS AND SYMBOLS & ABBREVIATIONS
CIVIL	
C100	SITE PLAN AND GRADING PLAN
C200	UTILITY PLAN
LANDSCAPE	
L100	LANDSCAPE PLAN
DEMOLITION	
D200	DEMOLITION FLOOR PLANS
ARCHITECTURAL	
A100	EXTERIOR ELEVATIONS
A200	FLOOR PLANS
A203	ROOF PLAN AND DETAILS
A300	REFLECTED CEILING PLANS
A500	CASEWORK SECTIONS
A600	EXTERIOR DETAILS
A700	DOOR SCHEDULE AND DETAILS
A701	PARTITION TYPES
A800	INTERIOR ELEVATIONS
A900	FINISH PLANS
STRUCTURAL	
S101	STRUCTURAL PLANS AND DETAILS
S102	STRUCTURAL DETAILS
PLUMBING	
PD101	PLUMBING DEMOLITION, SYMBOLS, ABBREVIATIONS AND SHEET INDEX
P100	UNDERFLOOR PLUMBING PLAN AND DETAILS
P101	FIRST AND SECOND PLUMBING FLOOR PLANS
P200	WASTE AND VENT DIAGRAM
P201	DOMESTIC WATER AND FUEL GAS DIAGRAMS
FIRE PROTECTION	
FP100	FIRST AND SECOND FIRE PROTECTION FLOOR PLANS

HVAC

M100	FIRST AND SECOND FLOOR HVAC - DEMOLITION PLANS
M101	FIRST AND SECOND FLOOR HVAC PLANS - NEW WORK
M102	FIRST AND SECOND FLOOR HVAC PIPING PLANS - NEW WORK
M103	ROOF PLAN HVAC DEMOLITION AND NEW WORK
M104	HVAC DETAILS
M105	HVAC SCHEDULES

ELECTRICAL

E000	SYMBOLS, ABBREVIATIONS, RISER DIAGRAM AND SHEET LIST
E001	SITE PLAN - ELECTRICAL
E100	FIRST AND SECOND FLOOR PLANS - ELECTRICAL DEMOLITION
E200	FIRST AND SECOND FLOOR PLANS - POWER AND SYSTEMS
E300	FIRST AND SECOND FLOOR PLANS - LIGHTING
E400	A/V RISER DIAGRAMS AND NOTES
E500	ELECTRICAL DETAILS
E600	ELECTRICAL SCHEDULES
E601	ELECTRICAL SCHEDULES

AUDIO VISUAL

AVS-2.1	AV DESIGN LAYOUT DEVICE MAP
AVS-3.1	AV DESIGN LAYOUT POWER-CONDIUT-PLATES
AVS-4.1	AV DESIGN LAYOUT FIRST FLOOR AV SCHEME

LEGAL NOTICE

INVITATION TO BID

Dane County Public Works, Highway & Transportation Dept., 1919 Alliant Energy Center Way, Madison, WI 53713, will receive sealed Bids until:

2:00 P.M., TUESDAY, MARCH 28, 2017

REQUEST FOR BIDS NO. 317012

DAY RESOURCE CENTER REMODELING

615 E. WASHINGTON AVE

MADISON, WISCONSIN

Dane County is inviting Bids for construction services, for the remodeling of the former Chamber of Commerce building to create a Day Resource Center for Dane County. Work includes the renovation of the approximately 12,800 SF two-story building and site improvements. Only firms with capabilities, experience & expertise with similar projects should obtain this Request for Bids document & submit Bids.

Request for Bids document may be obtained after **2:00 p.m. on March 9, 2017** by downloading it from countyofdane.com/pwbids. Please contact Rob Nebel, Project Manager, at 608/267-0119, nebel@countyofdane.com or Eric Urtes, AIA, Project Manager at 608/266-4798 urtes.eric@countyofdane.com or our office at 608/266-4018, for any questions or additional information.

All Bidders must be a registered vendor with Dane County & pay an annual registration fee & must be pre-qualified as a Best Value Contractor before award of Contract. Complete Vendor Registration Form at danepurchasing.com/Account/Login? or obtain one by calling 608/266-4131. Complete Pre-qualification Application for Contractors at countyofdane.com/pwht/BVC_Application.aspx or obtain one by calling 608/266-4029.

A pre-bid facility tour will be held Monday, March 20, 2017 at 1:00 p.m. at the Main Street Entrance of the Day Resource Center, 615 E. Washington Avenue. Access the parking lot from Main Street. Bidders are strongly encouraged to attend this tour.

PUBLISH: MARCH 7 & 14, 2017 - WISCONSIN STATE JOURNAL

MARCH 7 & 14, 2017 - THE DAILY REPORTER

DANE COUNTY DEPARTMENT of PUBLIC WORKS, HIGHWAY and TRANSPORTATION

County Executive
Joseph T. Parisi

1919 Alliant Energy Center Way ◆ Madison, Wisconsin 53713
Phone: (608) 266-4018 ◆ FAX: (608) 267-1533

Commissioner / Director
Gerald J. Mandli

BEST VALUE CONTRACTING APPLICATION

CONTRACTORS / LICENSURE APPLICANTS

The Dane County Department of Public Works requires all contractors to be pre-qualified as a best value contractor with the County prior to being awarded a contract. In addition, the County pre-qualifies potential contractors and sub-contractors who wish to work on County contracts. Subcontractors must become pre-qualified ten (10) days prior to commencing work under any Dane County Public Works Contract. Potential subcontractors are urged to become pre-qualified as early as possible. This document shall be completed, properly executed, along with the necessary attachments and additional information that the County requires for the protection and welfare of the public in the performance of a County contract.

Contractors or subcontractors of any tier who attain pre-qualification status will retain that status for a period of two (2) years from the date of qualification. Contractors shall notify the Dane County Department of Public Works, Highway & Transportation within fifteen (15) days of any changes to its business or operations that are relevant to the pre-qualification application. Failure to do so could result in suspension, revocation of the contractor's pre-qualification, debarment from County contracts for up to three (3) years and / or other sanctions available under the law.

No contracts will be awarded for construction work performed on Dane County projects unless the contractor is currently approved as a Wisconsin Trade Trainer or has applied for approval as an Apprenticeship Trade Trainer to the Wisconsin Department of Workforce Development and agrees to an acceptable apprenticeship program. If you are not currently approved as a Wisconsin Trade Trainer, or have not applied for approval as an Apprenticeship Trade Trainer, please contact the Department of Workforce Development - Bureau of Apprenticeship Standards at 608/266-3133 or visit their web site at: dwd.wisconsin.gov/apprenticeship/.

EXEMPTIONS

- Contractors who employ less than five (5) apprenticeable trade workers are not required to pre-qualify.
- Contractors performing work that does not apply to an apprenticeable trade, as outlined in Appendix A.
- The contractor / subcontractor provides sufficient documentation to demonstrate one or more of the following:
    - apprentices are not available in a specific geographic area;
    - the applicable apprenticeship program is unsuitable or unavailable; or
    - there is a documented depression of the local construction market which prevents compliance.

SEC.	PROOF OF RESPONSIBILITY	CHECK IF APPLICABLE
1	Does your firm possesses all technical qualifications and resources, including equipment, personnel and financial resources, necessary to perform the work required for any project or obtain the same through the use of responsible, pre-qualified subcontractors?	Yes: ☐ No: ☐
2	Will your firm possess all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, which are necessary for the type of work to be performed including, but not limited to, those for any type of trade work or specialty work?	Yes: ☐ No: ☐
3	Will your firm meet all bonding requirements as required by applicable law or contract specifications?	Yes: ☐ No: ☐
4	Will your firm meet all insurance requirements as required by applicable law or specifications, including general liability insurance, workers compensation insurance and unemployment insurance requirements?	Yes: ☐ No: ☐
5	Will your firm maintain a substance abuse policy for employees hired for public works contracts that comply with Wis. Stats. Sec. 103.503?	Yes: ☐ No: ☐
6	Does your firm acknowledge that it must pay all craft employees on public works projects the wage rates and benefits required under Section 66.0903 of the Wisconsin Statutes?	Yes: ☐ No: ☐
7	Will your firm fully abide by the equal opportunity and affirmative action requirements of all applicable laws, including County ordinances?	Yes: ☐ No: ☐
8	In the past three (3) years, has your firm had control or has another corporation, partnership or other business entity operating in the construction industry controlled it? If so, please attach a statement explaining the nature of the firm relationship?	Yes: ☐ No: ☐ If Yes, attach details.
9	In the past three (3) years, has your firm had any type of business, contracting or trade license, certification or registration revoked or suspended?	Yes: ☐ No: ☐ If Yes, attach details.
10	In the past three (3) years, has your firm been debarred by any federal, state or local government agency?	Yes: ☐ No: ☐ If Yes, attach details.
11	In the past three (3) years, has your firm defaulted or failed to complete any contract?	Yes: ☐ No: ☐ If Yes, attach details.
12	In the past three (3) years, has your firm committed a willful violation of federal, state or local government safety laws as determined by a final decision of a court or government agency authority.	Yes: ☐ No: ☐ If Yes, attach details.
13	In the past three (3) years, has your firm been in violation of any law relating to your contracting business where the penalty for such violation resulted in the imposition of a penalty greater than $10,000?	Yes: ☐ No: ☐ If Yes, attach details.
14	Is your firm Executive Order 108 precertified with the State of Wisconsin?	Yes: No: ☐
15	Is your firm an active Wisconsin Trade Trainer as determined by the Wisconsin Bureau of Apprenticeship Standards?	Yes: ☐ No: ☐
16	Is your firm exempt from being pre-qualified with Dane County?	Yes: ☐ No: ☐ If Yes, attach reason for exemption.
17	Does your firm acknowledge that in doing work under any County Public Works Contract, it will be required to use as subcontractors only those contractors that are also pre-qualified with the County or become so ten days prior to commencing work?	Yes: ☐ No: ☐
18	Contractor has been in business less than one year?	Yes: ☐ No: ☐
19	Is your firm a first time Contractor requesting a one time exemption, but, intend to comply on all future contracts and are taking steps typical of a “good faith” effort?	Yes: ☐ No: ☐
20	Not applicable. My firm does not intend to work on Best Value Contracts. Note: Best Value Contracting is required to bid on most Public Works Contracts (if unclear, please call Jan Neitzel Knox 608-266-4029).	Yes: ☐ No: ☐

SIGNATURE SECTION

Your firm's Officer, or the individual who would sign a bid and / or contract documents must sign this document.

I do hereby certify that all statements herein contained are true and correct to the best of my knowledge:

Signature _____ Date _____

Printed or Typed Name and Title _____

NAME AND ADDRESS OF CONTRACTOR	
Name of Firm:	
Address:	
City, State, Zip:	
Telephone Number:	
Fax Number:	
E-mail Address:	

REMEMBER!

Return all to forms and attachments, or questions to:

JAN NEITZEL KNOX
EMAIL: NEITZEL-KNOX@COUNTYOFDANE.COM
OFFICE: (608)266-4029, FAX: (608)267-1533

DANE COUNTY DEPARTMENT OF PUBLIC WORKS,
HGHWAY & TRANSPORTATION
1919 ALLIANT ENERGY CENTER WAY
MADISON, WI 53713

APPENDIX A

APPRENTICEABLE TRADES

Bricklayer
Carpenter
Cement Mason (Concrete Finisher)
Cement Mason (Heavy Highway)
Construction Craft Laborer
Data Communications Installer
Electrician
Elevator Mechanic / Technician
Environmental Systems Technician / HVAC Service Technician / HVAC Install & Service
Glazier
Heavy Equipment Operator / Operating Engineer
Insulation Worker (Heat & Frost)
Iron Worker (Assembler, Metal Buildings)
Painter / Decorator
Plasterer
Plumber
Roofer / Waterproofer
Sheet Metal Worker
Sprinkler Fitter
Steamfitter (Service & Refrigeration)
Taper & Finisher
Telecommunications (Voice, Data & Video) Installer / Technician
Tile Setter

INSTRUCTIONS TO BIDDERS

TABLE OF CONTENTS

1. GENERAL

A. Before submitting Bid, bidder shall thoroughly examine all Construction Documents. Successful Bidder shall be required to provide all the Work that is shown on Drawings, set forth in Specifications, or reasonably implied as necessary to complete Contract for this project.

B. Bidder shall visit site to become acquainted with adjacent areas, means of approach to site, conditions of actual site and facilities for delivering, storing, placing, and handling of materials and equipment.

C. Pre-bid meeting is scheduled on Monday March 20, 2017 at 1:00 p.m. starting at the Main Street Entrance of the Day Resource Center, 615 E. Washington Avenue. Access the parking lot from Main Street.. Attendance by all bidders is optional, however bidders and sub-contractors are strongly encouraged to attend.

D. Failure to visit site or failure to examine any and all Construction Documents will in no way relieve successful Bidder from necessity of furnishing any necessary materials or equipment, or performing any work, that may be required to complete the Work in accordance with Drawings and Specifications. Neglect of above requirements will not be accepted as reason for delay in the Work or additional compensation.

2. DRAWINGS AND SPECIFICATIONS

A. Drawings and Specifications that form part of this Contract, as stated in Article 1 of General Conditions of Contact are enumerated in Document Index of these Construction Documents.

B. Complete sets of Drawings and Specifications for all trades will be available to all Bidders, irrespective of category of work to be bid on, in order that all Bidders may be familiar with work of other trades as they affect their bid.

3. INTERPRETATION

A. No verbal explanation or instructions will be given in regard to meaning of Drawings or Specifications before Bid Due Date. Bidders shall bring inadequacies, omissions or conflicts to Owner or Architect / Engineer's attention at least ten (10) calendar days before Bid Due Date. Prompt clarification will be available to all bidders by Addendum.

B. Failure to so request clarification or interpretation of Drawings and Specifications will not relieve successful Bidder of responsibility. Signing of Contract will be considered as implicitly denoting that Contractor has thorough understanding of scope of the Work and comprehension of Construction Documents.

C. Owner or Architect / Engineer will not be responsible for verbal instructions.

4. QUALIFICATIONS OF BIDDER (CONTRACTOR AND SUBCONTRACTOR)

A. Before award of Contract can be approved, Owner shall be satisfied that Bidder involved meets following requirements:

1. Has completed at least one (1) project of at least fifty percent (50%) of size or value of Division of work being bid and type of work completed is similar to that being bid. If greater magnitude of experience is deemed necessary, other than size or value of work, such requirements will be described in appropriate section of Specifications.

2. Maintains permanent place of business.

3. Can be bonded for terms of proposed Contract.

4. Has record of satisfactorily completing past projects and supplies list of no more than three (3) most recent, similar projects, with architect or engineer's and owner's names, addresses and telephone numbers for each project. Submit to Public Works Project Engineer with Bid. Criteria which will be considered in determining satisfactory completion of projects by bidder will include:

    a. Completed contracts in accordance with drawings and specifications.
    b. Diligently pursued execution of work and completed contracts according to established time schedule unless Owner grants extensions.
    c. Fulfilled guarantee requirements of construction documents.
    d. Is not presently on ineligible list maintained by County's Department of Administration for noncompliance with equal employment opportunities and affirmative action requirements.
    e. Authorized to conduct business in Wisconsin. By submitting Bid, bidder warrants that it has: complied with all necessary requirements to do business in State of Wisconsin; that persons executing contract on its behalf are authorized to do so; and, if corporation, that name and address of bidder's registered agent are as set forth in Contract. Bidder shall notify Owner immediately, in writing, of any change in its

registered agent, their address, and bidder's legal status. For partnership, term "registered agent" shall mean general partner.

B. County's Public Works Project Engineer will make such investigations as are deemed necessary to determine ability of bidder to perform the Work, and bidder shall furnish to County's Public Works Project Engineer or designee all such information and data for this purpose as County's Public Works Project Engineer may request. Owner reserves right to reject Bid if evidence submitted by, or investigation of, bidder fails to satisfy Owner that bidder is responsible and qualified to carry out obligations of Contract and to complete the Work contemplated therein.

5. BID GUARANTEE

A. Bank certified check, cashier's check or Bid Bond, payable to County in amount not less than five percent (5%) of maximum bid, shall accompany each Bid as guarantee that if Bid is accepted, Bidder will execute and return proposed Contract and Performance and Payment Bonds within ten (10) business days after being notified of acceptance of Bid. Company issuing bonds must be licensed to do business in Wisconsin.

B. Any bid, which is not accompanied by bid guarantee, will be considered "No Bid" and will not be read at Bid Due Date.

C. If successful Bidder so delivers Contract, Certificate of Insurance, and Performance and Payment Bonds, check will be returned to Bidder. In case Bidder fails to deliver such Contract, insurance, and bond, amount of bid guarantee will be forfeited to County as liquidated damages.

D. All checks tendered as bid guarantee, except those of three (3) lowest qualified, responsible bidders, will be returned to their makers within three (3) business days after Bid Due Date. All such retained checks will be returned immediately upon signing of Contract and Performance and Payment Bonds by successful Bidder.

6. WITHDRAWAL OF BIDS

A. Bids may be withdrawn by written request received from bidder or authorized representative thereof prior to time fixed for Bid Due Date, without prejudice to right of bidder to file new Bid. Withdrawn Bids will be returned unopened. Negligence on part of bidder in preparing their Bid confers no right for withdrawal of Bid after it has been opened.

B. No Bid may be withdrawn for period of sixty (60) calendar days after Bid Due Date.

C. If Bid contains error, omission or mistake, bidder may limit liability to amount of bidder's guarantee by giving written Notice of Intent not to execute Contract to Owner within seventy-two (72) hours of Bid Due Date.

7. CONTRACT FORM

A. Sample copy of contract that successful Bidder will be required to enter into is included in these Construction Documents and bidders are required to familiarize themselves with all conditions contained therein.

8. CONTRACT INTERESTS BY COUNTY PUBLIC OFFICIALS

A. In accordance with Wisconsin Statute 946.13, county official may not bid for or enter into any contract involving receipts or disbursements of more than $15,000.00 in a year, in which they have private pecuniary interest, direct or indirect if at same time they are authorized to take official action with respect to making of this Contract. Any contract entered into in violation of this Statute is void and County incurs no liability thereon. This subsection does not affect application and enforcement of Wisconsin Statute 946.13 by state prosecutors in criminal courts of this state.

9. EMERGING SMALL BUSINESS PROVISIONS

A. **Emerging Small Business Definition.** For purposes of this provision, ESB is defined as:

1. Independent business concern that has been in business minimum of one year;

2. Business located in State of Wisconsin;

3. Business comprised of less than twenty-five (25) employees;

4. Business must not have gross sales in excess of three million dollars ($3,000,000.00) over past three years; and

5. Business does not have history of failing to complete projects.

B. **Emerging Small Business (ESB) Involvement.** Bidder shall make good faith effort to award minimum of ten percent (10%) of the Work to ESBs. Bidder shall submit report to Dane County Contract Compliance Officer within ten (10) business days of Bid Due Date demonstrating such efforts. Good faith efforts means significant contact with ESBs for purposes of soliciting bids from them. Failure to make or demonstrate good faith efforts will be grounds for disqualification.

C. **Emerging Small Business Report.** Emerging Small Business Enterprise Report is to be submitted by Bidder in separate envelope marked “Emerging Small Business Report”. This report is due by 2:00 p.m. following specified ten (10) business days after Bid Due Date. Bidder who fails to submit Emerging Small Business Report shall be deemed not responsive.

D. **ESB Goal.** Goal of this project is ten percent (10%) ESB participation. ESB utilizations are shown as percentage of total Bid. If Bidder meets or exceeds specified goal, Bidder is only required to submit Form A - Certification, and Form B - Involvement. Goal shall be met if Bidder qualifies as ESB.

E. **Report Contents.** Following award of Contract, Bidder shall submit copies of executed contracts for all Emerging Small Businesses. Emerging Small Business Report shall consist of these:

1. Form A - Certification;

2. Form B - Involvement;

3. Form C - Contacts;

4. Form D - Certification Statement (if appropriate); and

5. Supportive documentation (i.e., copies of correspondence, telephone logs, copies of advertisements).

F. ESB Listing. Bidders may solicit bids from this ESB listing: pdf.countyofdane.com/commissions/2013-2015_Targeted_Business_Directory.pdf.

G. **ESB Certification.** All contractors, subcontractors and suppliers seeking ESB certification must complete and submit Emerging Small Business Report to Dane County Contract Compliance Program.

H. **Certification Statement.** If ESB firm has not been certified by County as ESB prior to submittal of this Bid, ESB Report cannot be used to fulfill ESB goal for this project unless firm provides "Form D - Certification Statement". Certification statement must be completed and signed by ESB firm.

I. **Questions.** Questions concerning Emerging Small Business provisions shall be directed to:

Dane County Contract Compliance Officer
City-County Building, Room 421
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703
608/266-5623

J. **Substituting ESBs.** In event of any significant changes in subcontract arrangements or if need arises to substitute ESBs, Bidder shall report such proposed changes to Contract Compliance Officer to making any official changes and request authorization to substitute ESB firm. Bidder further agrees to make every possible effort to replace ESB firm with another qualified ESB firm.

K. **Good Faith Efforts.** Good faith efforts can be demonstrated by meeting all of these obligations:

1. Selecting portions of the Work to be performed by ESBs in order to increase likelihood of meeting ESB goal including, where appropriate, breaking down Contract into smaller units to facilitate ESB participation.

2. Advertising in general circulation, trade associations and women / minority focus media concerning subcontracting opportunities.

3. Providing written notices to reasonable number of specific ESBs that their interest in Contract was being solicited in sufficient time to allow ESBs to participate effectively.

4. Following up on initial solicitations of interest by contacting ESBs within five (5) business days prior to Bid Due Date to determine with certainty whether ESB were interested, to allow ESBs to prepare bids.

5. Providing interested ESB with adequate information about Drawings, Specifications and requirements of Contract.

6. Using services of available minority, women and small business organizations and other organizations that provide assistance in recruitment of MBEs / WBEs / ESBs.

7. Negotiating in good faith with interested ESBs, not rejecting ESBs as unqualified without sound reason based on thorough investigation of their capabilities.

8. Submitting required project reports and accompanying documents to County's Contract Compliance Officer within twenty-four (24) hours after Bid Due Date.

L. **Appeals Disqualification of Bid.** Bidder who is disqualified may appeal to Public Works & Transportation Committee and Equal Opportunity Commission.

10. METHOD OF AWARD - RESERVATIONS

A. Following will be basis of award of Contract, providing cost does not exceed amount of funds then estimated by County as available to finance Contract(s):

1. Lowest dollar amount submitted by qualified responsible bidder on Base Bid for all work comprising project, combined with such additive Owner accepted alternates.

2. Owner reserves right to reject all bids or any bid, to waive any informality in any bid, and to accept any bid that will best serve interests of County.

3. Unit Prices and Informational Bids will not be considered in establishing low bidder.

11. SECURITY FOR PERFORMANCE AND PAYMENTS

A. Simultaneous with delivery of signed Contract, Bidder shall be required to furnish Performance and Payment Bonds as specified in Article 29 of General Conditions of Contract, "Contract Security". Surety Company shall be licensed to do business in Wisconsin. Performance and Payment Bonds must be dated same date or subsequent to date of Contract. Performance and Payment Bonds must emulate information in Sample Performance and Payment Bonds in Construction Documents.

B. Provide certified copy of power of attorney from Surety Company showing that agent who signs Bond has power of attorney to sign for Surety Company. Secretary or Assistant Secretary of company must sign this certification, not attorney-in-fact. Certification must bear same or later date as Bond. Power of Attorney must emulate model power of attorney information detailed in Sample Performance and Payment Bonds.

C. If Bidder is partnership or joint venture, State certified list, providing names of individuals constituting partnership or joint venture must be furnished. Contract itself may be signed by one partner of partnership, or one partner of each firm comprising joint venture, but Performance and Payment Bonds must be signed by all partners.

D. If Bidder is a corporation, it is necessary that current certified copy of resolution or other official act of directors of corporation be submitted showing that person who signs Contract is authorized to sign contracts for corporation. It is also necessary that corporate seal be affixed to resolution, contract, and performance and payment bonds. If your corporation has no seal, it is required that above documents include statement or notation to effect that corporation has no seal.

12. TAXES

A. Wisconsin Statute 77.54 (9m) allows building materials that become part of local unit government facilities to be exempt from sales & use tax. Vendors & materials suppliers may not charge Bidders sales & use tax on these purchases. This does not include highways,

streets or roads. Any other Sales, Consumer, Use & other similar taxes or fees required by law shall be included in Bid.

B. In accordance with Wisconsin Statute 71.80(16)(a),successful nonresident bidder, whether incorporated or not, and not otherwise regularly engaged in business in this state, shall file surety bond with State of Wisconsin Department of Revenue payable to Department of Revenue, to guarantee payment of income taxes, required unemployment compensation contributions, sales and use taxes and income taxes withheld from wages of employees, together with any penalties and interest thereon. Amount of bond shall be three percent (3%) of Contract or subcontract price on all contracts of $50,000 or more.

13. SUBMISSION OF BIDS

A. All Bids shall be submitted on standard Bid Form bound herein and only Bids that are made on this Bid Form will be considered. Entire Bid Form and other supporting documents, if any, shall be removed or copied from Construction Documents, filled out, and submitted in manner specified hereinafter. Submit completed Bid Bond with Bid as well.

B. No bids for any subdivision or any sub-classification of this Work, except as indicated, will be accepted. Any conditional Bid, amendment to Bid Form or appended item thereto, or inclusion of any correspondence, written or printed matter, or details of any nature other than that specifically called for, which would alter any essential provision of Construction Documents, or require consideration of unsolicited material or data in determining award of Contract, will disqualify Bid. Telecommunication alterations to Bid will not be accepted.

C. Bidders must submit single Bid for all the Work.

D. Bid amounts shall be inserted in words and in figures in spaces provided on Bid Form; in case of conflict, written word amounts will govern.

E. Addenda issued after Bid Letting shall become part of Construction Documents. Bidders shall acknowledge receipt of such addenda in appropriate space provided on Bid Form. Bid may be rejected if receipt of any particular addendum applicable to award of Contract has not been acknowledged on Bid Form.

F. Bids shall be signed, placed in envelope, sealed and delivered before due time to place designated in Invitation to Bid, and identified with project name, bid number, location, category of work being bid upon, Bid Due Date, name and address of bidder.

G. Bidder shall be responsible for sealed Bid being delivered to place designated for Bid Due Date on or before date and time specified. Bids received after time of closing will be rejected and returned to bidder unopened.

H. Bid will be considered invalid and will be rejected if bidder has not signed it.

I. Faxed or emailed Bids will not be accepted.

J. Bidder’s organization shall submit completed with Bid, Fair Labor Practices Certification form, included in these Construction Documents.

14. SUBCONTRACTOR LISTING

A. Bidders shall be required to submit list of major subcontractors for General Construction, Plumbing, HVAC, and Electrical work proposed for this project to include committed prices for each subcontractor. List shall be placed in separate sealed envelope that must be clearly identified as "Major Subcontractor List", for named project and name of Bidder submitting it. County must receive envelope no later than date by which successful Bidder is required to submit his or her signed Contract, as established in Construction Documents.

15. ALTERNATE BIDS

A. No Alternate Bids are requested with the Bid Form included in the initial RFB, but if a new Bid Form is issued as an Addendum that includes Bid Alternates then the Bidder shall carefully read requests for Alternate Bids, and thoroughly examine Drawings and Specifications to determine extent various changes and conditions will affect Bid.

B. Space is provided in Bid Form for requested Alternate Bids. Failure to submit bid for any requested Alternate Bids may result in rejection of entire Bid.

C. Bidder shall state amount to be added / subtracted to Base Bid for providing alternates, including all incidentals, omissions, additions, and adjustments as may be necessary or required by such changes. If there is no difference in price, Bidder shall state, "No Change".

D. Descriptions of requested Alternate Bids are as set forth in Construction Documents.

16. INFORMATIONAL BIDS

A. No Informational Bids are requested with the Bid Form included in the initial RFB, but if a new Bid Form is issued as an Informational Bid then the Bidder shall state amount that is included in Base Bid for all equipment, materials and labor required to complete the Work described. Informational bids are amounts requested for accounting purposes and for allocation of funds only. It is not intended to omit any of the Work described or related items from this project.

B. Description of requested Informational Bids, if any, is as set forth in Construction Documents.

17. UNIT PRICES

A. Provide unit prices if requested on Bid Form. Unit prices will include all costs for materials, labor, insurance, taxes, overhead and profit necessary to perform specified work. Estimated quantities are approximate only. Payment will be based upon actual quantities placed, provided or installed. Failure to provide requested unit prices may result in rejection of entire Bid.

B. Owner reserves right to accept or reject any unit prices as given in Bid.

C. Bidder shall refer to Bid Form and applicable specification section to determine basis of unit measure and detailed information related to each unit price item requested.

18. COMMENCEMENT AND COMPLETION

A. Successful Bidder shall commence work when schedule and weather permit, but no later than stated in Bid Form. Contractor shall pursue the Work regularly and continuously at reasonable rate to insure completion of the Work within time stated in Bid.

B. Should it be found impossible to complete the Work on or before time specified for completion, written request may be submitted for extension of time setting forth reasons believed to justify granting of such request. Refer to Article 20 of General Conditions of Contract, titled "Time for Completion".

19. WORK BY OWNER

A. Abatement of light fixtures Type G and Type H provided by Dane County, installed and wired by electrical contractor, refer to sheet E600.

20. SPECIAL HAZARDS COVERAGE

A. Not Applicable.

FORM A

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CERTIFICATION

In accordance with General Conditions of Contract, submit this Emerging Small Business Report within ten (10) days after Bid Due Date.

PROJECT NAME: _____

_____

BID NO.: _____ BID DUE DATE: _____

BIDDER INFORMATION

COMPANY NAME: _____

ADDRESS: _____

_____

TELEPHONE NO.: _____

CONTACT PERSON: _____

EMAIL ADDRESS: _____

FORM B

DANE COUNTY
(Copy this Form as necessary to provide complete information)
EMERGING SMALL BUSINESS REPORT - INVOLVEMENT

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

Indicate percentage of financial commitment to this ESB: _____% Amount: $_____

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

Indicate percentage of financial commitment to this ESB: _____% Amount: $_____

FORM C

DANE COUNTY
(Copy this Form as necessary to provide complete information)
EMERGING SMALL BUSINESS REPORT - CONTACTS

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

	ESB FIRM NAME CONTACTED	DATE	PERSON CONTACTED	DID ESB BID?	ACC-EPT BID?	REASON FOR REJECTION
1)						
2)						
3)						
4)						
5)						
6)						
7)						
8)						

FORM D

DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CERTIFICATION STATEMENT

I, _____ , _____ of
Name Title

_____ certify to best of my knowledge and
Company

belief that this business meets Emerging Small Business definition as indicated in Article 9 and that information contained in this Emerging Small Business Report is true and correct.

_____ _____
Bidder's Signature Date

Name of Bidding Firm: _____

BID FORM

BID NO. 317012
PROJECT: DAY RESOURCE CENTER REMODELING

TO: DANE COUNTY DEPARTMENT OF PUBLIC WORKS, HIGHWAY & TRANSPORTATION PROJECT MANAGER
1919 ALLIANT ENERGY CENTER WAY
MADISON, WISCONSIN 53713

NOTE: WISCONSIN STATUTE 77.54 (9M) ALLOWS FOR NO SALES & USE TAX ON THE PURCHASE OF MATERIALS FOR COUNTY PUBLIC WORKS PROJECTS.

BASE BID - LUMP SUM:

Dane County is inviting Bids for construction services, for the remodeling of the former Chamber of Commerce building to create a Day Resource Center for Dane County. Work includes the renovation of the approximately 12,800 SF two-story building and site improvements. The undersigned, having examined the site where the Work is to be executed and having become familiar with local conditions affecting the cost of the Work and having carefully examined the Drawings and Specifications, all other Construction Documents and Addenda thereto prepared by Dane County Department of Public Works, Highway & Transportation hereby agrees to provide all labor, materials, equipment and services necessary for the complete and satisfactory execution of the entire Work, as specified in the Construction Documents, for the Base Bid stipulated sum of:

_____ and _____ /100 Dollars
Written Price

$_____
Numeric Price

LUMP SUM ALLOWANCE:

Provide a lump sum allowance to be included in the Base Bid of twenty thousand dollars ($20,000.00). This allowance will be used for building identification signage including installation and design in coordination with the County, design team and City of Madison staff. Owner will provide the awarded general contractor with building signage and project requirements.

Twenty Thousand - and 00 /100 Dollars
Written Price

$20,000.00
Numeric Price

UNIT PRICING:
Add unit price for including the following items. All pricing to include rough-in, cabling and commissioning.

- Security Camera: add or delete one Camera per section 28 23 00 $_____
- Card Reader: add or delete one Proximity Card Reader per section 28 13 00: $_____
- Help Call System: State unit cost to add or delete one Cornell E-104-1WP per section 26 52 23: $_____
- First Floor Flat Panel Display Assemblies: cost to add or delete one AV-121 and one AV-122 per section 27 41 13: $_____

_____ and _____/100 Dollars
Written Price

$_____
Numeric Price

Receipt of the following addenda and inclusion of their provisions in this Bid is hereby acknowledged:

Addendum No(s). _____ through _____

Dated _____

Dane County Department of Public Works, Highway & Transportation must have this project completed by September 15, 2017. Assuming this Work can be started by April 21, 2017, what dates can you commence and complete this job?

Commencement Date: _____ Completion Date: _____
(final, not substantial)

I hereby certify that all statements herein are made on behalf of:

_____
(Name of Corporation, Partnership or Person submitting Bid)

Select one of the following:
1. A corporation organized and existing under the laws of the State of _____, or

2. A partnership consisting of _____, or

3. A person conducting business as _____;

Of the City, Village, or Town of _____ of the State of _____.

I have examined and carefully prepared this Bid from the associated Construction Documents and have checked the same in detail before submitting this Bid; that I have full authority to make such statements and submit this Bid in (its) (their) (my) behalf; and that the said statements are true and correct. In signing this Bid, we also certify that we have not, either directly or indirectly, entered into any agreement or participated in any collusion or otherwise taken any action in restraint of free competition; that no attempt has been made to induce any other person or firm to submit or not to submit a Bid; that this Bid has been independently arrived at without collusion with any other bidder, competitor, or potential competitor; that this Bid has not been knowingly disclosed prior to the Bids Due Date to another bidder or competitor; that the above statement is accurate under penalty of perjury.

The undersigned further agrees to honor the Base Bid and the Alternate Bid(s) for sixty (60) calendar days from date of Award of Contract.

SIGNATURE: _____
(Bid is invalid without signature)

Print Name: _____ Date: _____

Title: _____

Address: _____

Telephone No.: _____ Fax No.: _____

Email Address: _____

Contact Person: _____

THIS PAGE IS FOR BIDDERS' REFERENCE AND NEED NOT BE SUBMITTED WITH BID FORM.

BID CHECK LIST:
These items **must** be included with Bid:
☐ Bid Form ☐ Bid Bond ☐ Fair Labor Practices Certification
☐ Project Experience / Reference Summary

BIDDERS SHOULD BE AWARE OF THE FOLLOWING:

DANE COUNTY VENDOR REGISTRATION PROGRAM

Any person bidding on any County contract must be registered with the Dane County Purchasing Division & pay an annual registration fee. A contract will not be awarded to an unregistered vendor. Obtain a *Vendor Registration Form* by calling 608/266-4131 or complete a new form or renewal online at:
www.danepurchasing.com/registration

DANE COUNTY BEST VALUE CONTRACTING PRE-QUALIFICATION

Contractors must be pre-qualified as a Best Value Contractor with the Dane County Public Works Engineering Division before the award of contract. Obtain a *Best Value Contracting Application* by calling 608/266-4018 or complete one online at:
www.countyofdane.com/pwht/BVC_Application.aspx

EQUAL BENEFITS REQUIREMENT

By submitting a Bid, the contractor acknowledges that a condition of this contract is to provide equal benefits as required by Dane County Code of Ordinances Chapter 25.016. Contractor shall provide equal benefits as required by that Ordinance to all required employees during the term of the contract. Equal Benefits Compliance Payment Certification shall be submitted with final pay request. For more information:
www.danepurchasing.com/partner_benefit.aspx

FAIR LABOR PRACTICES CERTIFICATION

The undersigned, for and on behalf of the BIDDER, APPLICANT or PROPOSER named herein, certifies as follows:

A. That he or she is an officer or duly authorized agent of the above-referenced BIDDER, APPLICANT or PROPOSER, which has a submitted a bid, application or proposal for a contract or agreement with the county of Dane.

B. That BIDDER, APPLICANT or PROPOSER has (check one):

_____ not been found by the National Labor Relations Board ("NLRB") or the Wisconsin Employment Relations Commission ("WERC") to have violated any statute or regulation regarding labor standards or relations in the seven years prior to the signature date of this Certification.

_____ been found by the National Labor Relations Board ("NLRB") or the Wisconsin Employment Relations Commission ("WERC") to have violated any statute or regulation regarding labor standards or relations in the seven years prior to the signature date of this Certification.

Officer or Authorized Agent Signature _____ Date _____

Printed or Typed Name and Title _____

Printed or Typed Business Name _____

NOTE: You can find information regarding the violations described above at: www.nlrb.gov and werc.wi.gov.

For reference, Dane County Ordinance 25.11(28)(a) is as follows:

(28) BIDDER RESPONSIBILITY. (a) Any bid, application or proposal for any contract with the county, including public works contracts regulated under chapter 40, shall include a certification indicating whether the bidder has been found by the National Labor Relations Board (NLRB) or the Wisconsin Employment Relations Committee (WERC) to have violated any statute or regulation regarding labor standards or relations within the last seven years. The purchasing manager shall investigate any such finding and make a recommendation to the committee, which shall determine whether the conduct resulting in the finding affects the bidder's responsibility to perform the contract.

If you indicated that the NLRB or WERC have found you to have such a violation, you must include copies of any relevant information regarding such violation with your proposal, bid or application.

Include this completed Certification with your bid, application or proposal.

*

COUNTY OF DANE

PUBLIC WORKS CONSTRUCTION CONTRACT

Contract No. _____ Bid No. 317012

Authority: 2016 RES -_____

THIS CONTRACT, made and entered into as of the date by which authorized representatives of both parties have affixed their signatures, by and between the County of Dane (hereafter referred to as "COUNTY") and _____ (hereafter, "CONTRACTOR"), and

W I T N E S S E T H :

WHEREAS, COUNTY, whose address is c/o Assistant Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR Day Resource Center Remodeling, 615 E. Washington Avenue, Madison, Wisconsin (the Project"); and

WHEREAS, CONTRACTOR, whose address is _____ _____ is able and willing to construct the Project, in accordance with the Construction Documents;

NOW, THEREFORE, in consideration of the above premises and the mutual covenants of the parties hereinafter set forth, the receipt and sufficiency of which is acknowledged by each party for itself, COUNTY and CONTRACTOR do agree as follows:

1. CONTRACTOR agrees to construct, for the price of $_____ the Project and at the CONTRACTOR'S own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence labor, insurance, and other accessories and services necessary to complete the Project in accordance with the conditions and prices stated in the Bid Form, General Conditions of Contract, the drawings which include all maps, plats, plans, and other drawings and printed or written explanatory matter thereof, and the specifications therefore as prepared by Dorschner Associates, Inc.
(hereinafter referred to as "the Architect / Engineer"), and as enumerated in the Project Manual Table of Contents, all of which are made a part hereof and collectively evidence and constitute the Contract.

2. COUNTY agrees to pay the CONTRACTOR in current funds for the performance of the Contract subject to additions and deductions, as provided in the General Conditions of Contract, and to make payments on account thereof as provided in Article entitled, "Payments to Contractor" of the General Conditions of Contract.

3. During the term of this Contract, CONTRACTOR agrees to take affirmative action to ensure equal employment opportunities. The CONTRACTOR agrees in accordance with Wisconsin Statute 111.321 and Chapter 19 of the Dane County Code of Ordinances not to discriminate on the basis of age, race, ethnicity, religion, color, gender, disability, marital status, sexual orientation, national origin, cultural differences, ancestry, physical appearance, arrest record or

conviction record, military participation or membership in the national guard, state defense force or any other reserve component of the military forces of the United States, or political beliefs. Such equal opportunity shall include, but not be limited to, the following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation. CONTRACTOR agrees to post in conspicuous places, available to all employees and applicants for employment, notices setting forth the provisions of this paragraph.

4. CONTRACTOR shall file an Affirmative Action Plan with the Dane County Contract Compliance Officer in accord with Chapter 19 of the Dane County Code of Ordinances. CONTRACTOR must file such plan within fifteen (15) business days of the effective date of this Contract. During the term of this Contract CONTRACTOR shall also provide copies of all announcements of employment opportunities to COUNTY'S Contract Compliance Office, and shall report annually the number of persons, by race, ethnicity, gender, and disability status, which apply for employment and, similarly classified, the number hired and number rejected.

5. During the term of this Contract, all solicitations for employment placed on CONTRACTOR'S behalf shall include a statement to the effect that CONTRACTOR is an "Equal Opportunity Employer".

6. CONTRACTOR agrees to comply with provisions of Chapter 25.016 of the Dane County Code of Ordinances, which pertains to domestic partnership benefits.

7. CONTRACTOR agrees to furnish all information and reports required by COUNTY'S Contract Compliance Officer as the same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and the provisions of this Contract.

8. CONTRACTOR agrees that all persons employed by CONTRACTOR or any subcontractor shall be paid no less than the minimum wage established under Chapter 40, Subchapter II, Dane County Code of Ordinances. CONTRACTOR agrees to abide by and comply with the provisions of Chapter 40, Subchapter II of the Dane County Code of Ordinances, and said Subchapter is fully incorporated herein by reference.

9. This Contract is intended to be a Contract solely between the parties hereto and for their benefit only. No part of this Contract shall be construed to add to, supplement, amend, abridge or repeal existing rights, benefits or privileges of any third party or parties including, but not limited to, employees of either of the parties.

10. The entire agreement of the parties is contained herein and this Contract supersedes any and all oral agreements and negotiations between the parties relating to the subject matter hereof. The parties expressly agree that the express terms of this Contract shall not be amended in any fashion except in writing, executed by both parties.

11. CONTRACTOR must be pre-qualified as a Best Value Contractor with Dane County Public Works Engineering Division before award of Contract. Subcontractors must be pre-qualified ten (10) business days prior to commencing Work under this Contract.

IN WITNESS WHEREOF, COUNTY and CONTRACTOR, by their respective authorized agents, have caused this Contract and its Schedules to be executed, effective as of the date by which all parties hereto have affixed their respective signatures, as indicated below.

* * * * * * *

FOR CONTRACTOR:

Signature Date

Printed or Typed Name and Title

Signature Date

Printed or Typed Name and Title

NOTE: If CONTRACTOR is a corporation, Secretary should attest. In accordance with IRS Regulations, unincorporated entities are required to provide either their Social Security or Employer Number in order to receive payment for services rendered.

* * * * * * *

This Contract is not valid or effectual for any purpose until approved by the appropriate authority designated below, and no work is authorized until the CONTRACTOR has been given notice to proceed by COUNTY'S Assistant Public Works Director.

FOR COUNTY:

Joseph T. Parisi, County Executive Date

Scott McDonell, County Clerk Date

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

BOND AMOUNT:

PROJECT:
(Name, location or address, and Project number, if any)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of

(Witness)	*(Contractor as Principal)* *(Seal)*
	(Title)
(Witness)	*(Surety)* *(Seal)*
	(Title)

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

Init.
/

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	Name	Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)

CONSTRUCTION CONTRACT
Date:

Amount:

Description:
(Name and location)

BOND
Date:
(Not earlier than Construction Contract Date)

Amount:

Modifications to this Bond: ☐ None ☐ See Section 18

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:	Name	Name and Title:	

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

AIA Document A312–2010 combines two separate bonds, a Performance Bond and a Payment Bond, into one form. This is not a single combined Performance and Payment Bond.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address		Address	

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EQUAL BENEFITS COMPLIANCE PAYMENT CERTIFICATION FORM

PURPOSE

25.016(8) of the Dane County Ordinance requires that each contractor receiving payment for contracted services must certify that he or she has complied fully with the requirements of Chapter 25.016 "Equal Benefits Requirement" of the Dane County Ordinances. Such certification must be submitted prior to the final payment on the contract.

This form should be included with a copy of the final contract invoice forwarded to your contract representative at Dane County.

CERTIFICATION

I, _____ certify that
Printed or Typed Name and Title

_____
Printed or Typed Name of Contractor

has complied fully with the requirements of Chapter 25.016 of the Dane County Ordinances "Equal Benefits Requirements".

Signed _____

Date _____

For questions on this form, please contact Chuck Hicklin at 608-266-4109 or your contract representative at Dane County.

GENERAL CONDITIONS OF CONTRACT

TABLE OF CONTENTS

1. CONSTRUCTION DOCUMENTS

A. Construction Documents, listed in Table of Contents of this Specification volume shall form part of this Contract and provisions of Construction Documents shall be as binding upon parties as if they were fully set forth in Contract itself.

B. These shall also be considered as part of Construction Documents: Addenda, including additions and modifications incorporated in such addenda before execution of Contract; requests for information; construction bulletins; change orders; and written interpretations by Architect / Engineer or Public Works Project Manager that are made after execution of Contract.

C. Construction Documents are complementary, and what is required by one shall be as binding as if required by all. Intent of Construction Documents is to include all labor, materials and equipment necessary for proper execution of the Work.

2. DEFINITIONS

A. These terms as used in this Contract are respectively defined as follows:
   1. All uses of term "County" in Construction Documents shall mean Dane County.
   2. All uses of term "Department" in Construction Documents shall mean Department of Public Works, Highway & Transportation, which is a unit of Dane County government. Department is County agency overseeing Contract with Contractor.
   3. Public Works Project Manager is appointed by and responsible to Department. Public Works Project Manager has authority to act on behalf of Department and will sign change orders, payment requests and other administrative matters related to projects.
   4. Public Works Project Manager is responsible for supervision, administration and management of field operations involved in construction phase of this Work.
   5. Term "Work" includes all labor, equipment and materials necessary to produce project required by Construction Documents.
   6. Term "Substantial Completion" is date when project or specified area of project is certified by Architect / Engineer that construction is sufficiently completed, in accordance with Construction Documents, and as modified by any subsequent changes agreed to by parties, so that County may occupy project or specified area of project for use for which it was intended subject to permit approval for occupancy.
   7. Contractor is person, firm, or corporation with whom County makes Contract. Though multiple contracts may be involved, Construction Documents treat them throughout as if each were of singular number.

3. ADDITIONAL INSTRUCTIONS AND DRAWINGS

A. Contractor may be furnished additional instructions and detail drawings as necessary to carry out the Work included in Contract. Additional drawings and instructions thus supplied to Contractor will coordinate with Construction Documents and will be so prepared that they can be reasonably interpreted as part thereof. Contractor shall carry out the Work in accordance with additional detail drawings and instructions.

4. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

A. Unless otherwise specified, Contractor shall submit three (3) copies of all Shop Drawings for each submission, until receiving final approval. After final approval, provide five (5) additional copies for distribution and such other copies as may be required.

B. Contractor shall submit, on an on-going basis and as directed, Product Data such as brochures that shall contain catalog cuts and specifications of all furnished mechanical and electrical equipment. After Architect / Engineer's approval, one (1) copy shall remain in Architect / Engineer's file, one (1) kept at Department's office and one (1) kept at job site by Contractor for reference purposes.

C. Samples shall consist of physical examples furnished by Contractor in sufficient size and quantity to illustrate materials, equipment or workmanship, and to establish standards to compare the Work.
   1. Submit Samples in sufficient quantity (minimum of two (2)) to permit Architect / Engineer to make all necessary tests and of adequate size showing quality, type, color range, finish, and texture. Label each Sample stating material, type, color, thickness, size, project name, and Contractor's name.
   2. Submit transmittal letter requesting approval, and prepay transportation charges to Architect / Engineer's office on samples forwarded.
   3. Materials installed shall match approved Samples.

D. Contractor shall review Shop Drawings and place their dated stamp thereon to evidence their review and approval and shall submit with reasonable promptness and in orderly sequence to cause no delay in the Work or in work of any other contractor. At time of submission, Contractor shall inform Architect / Engineer in writing of any deviation in Shop Drawings or Samples from requirements of Construction Documents. Architect / Engineer will not consider partial lists.

E. Architect / Engineer will review and approve or reject Shop Drawings with reasonable promptness to cause no delay. Architect / Engineer's approval shall not relieve Contractor from responsibility for errors or omissions in Shop Drawings.

F. Contractor shall not commence any work requiring Shop Drawing, Product Data or Sample submission until Architect / Engineer has approved submission. All such work shall be in accordance with approved Shop Drawings, Product Data and Samples.

G. Contractor shall keep on site of the Work, approved or conformed copy of Shop Drawings and shall at all time give Department access thereto.

H. By stamping and submitting Shop Drawings, Product Data and Samples, Contractor thereby represents that he or she has or will determine and verify all field measurements, field construction criteria, materials, catalog numbers, and similar data and that he or she has checked and coordinated each Shop Drawing, Product Data and Sample with requirements of the Work and of Construction Documents. Architect / Engineer shall return without examination, Shop Drawings, Product Data and Samples not so noted.

I. All Shop Drawings from any one Contractor should be numbered consecutively and on cover sheet shall bear name and location of project, name of Contractor, date of submittal and date of each correction or revision and associated Specification section and page number.

5. CUTTING AND PATCHING

A. Contractor shall be responsible for all cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

B. Contractor shall not damage or endanger portion of the Work or fully or partially completed construction of County or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. Contractor shall not cut or otherwise alter such construction by County or separate contractor except with written consent of County and of such separate contractor; such consent shall not be unreasonably withheld. Contractor shall not withhold unreasonably from County or separate contractor, Contractor's consent to cutting or otherwise altering the Work.

6. CLEANING UP

A. Contractor shall keep premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under Contract. Contractor shall remove from and about the Work waste materials, rubbish, Contractor's tools, construction equipment, machinery, and surplus materials at completion of the Work. Contractor shall maintain streets and sidewalks around the Work site in clean condition. Contractor shall remove all spillage and prevent tracking of spillage arising from performance of the Work, into, out of, and within the Work site. Contractor shall establish regular maintenance program of sweeping, vacuuming and / or hosing to minimize accumulation of dirt and dust upon such areas.

B. If Contractor fails to clean up as directed in Construction Documents, County may do so and shall charge Contractor cost thereof.

C. Contractor shall be responsible for broken windows and glass, and at completion of the Work shall replace such damaged or broken windows and glass. After replacing damaged or broken windows and glass, Contractor shall remove all labels, wash and polish both sides of all windows and glass.

D. In addition to general cleaning (sweeping, vacuuming and / or hosing, as is appropriate to work surface), Contractor shall perform following final cleaning for all trades at completion of the Work:
   1. Remove temporary protections;
   2. Remove marks, stains, fingerprints and other soil or dirt from painted, decorated and finished woodwork and wall surfaces;
   3. Remove spots, plaster, soil and paint from ceramic tile, marble and other finished materials, and wash or wipe clean;
   4. Clean fixtures, cabinet work and equipment, removing stains, paint, dirt and dust, and leave same in undamaged, new condition;
   5. Clean aluminum in accordance with recommendations of manufacturer; and
   6. Clean resilient floors thoroughly with well-rinsed mop containing only enough moisture to clean off any surface dirt or dust and buff dry by machine to bring surfaces to sheen.

7. USE OF SITE

A. Contractor shall provide County and Architect / Engineer access to the Work under all circumstances.

B. Contractor shall confine operations at site to areas permitted by County, law, ordinance, permits and Construction Documents and shall not unreasonably encumber site with materials

or equipment. Contractor shall assure free, convenient, unencumbered, direct and safe access to all properties adjacent to the Work for County, its employees, invitees and guests.

8. MATERIALS AND WORKMANSHIP

A. Contractor shall perform all work and furnish all supplies and materials, machinery, equipment, facilities and means, necessary to complete the Work required by this Contract, within time specified, in accordance with provisions of Construction Documents.

B. All equipment and materials incorporated in the Work covered by this Contract are to be new; use recycled and / or recovered materials to extent that such use is technically and economically feasible. Recovered materials are products recovered from solid waste in form identical to original form for use that is same as, or similar to original use. Recycled materials are products manufactured from solid waste.

C. If requested, Contractor shall furnish satisfactory evidence as to kind and quality of construction materials proposed or used. Contractor shall furnish to Architect / Engineer, for approval, manufacturer name and model, performance capacities and other pertinent information of machinery, mechanical, electrical or other types of equipment, which Contractor plans to install.

D. If not otherwise provided, materials and labor called for in this Contract shall be provided and performed in accordance with established practice and standards recognized by Architects, Engineers, Department, and construction industry.

E. Reference to "Standard" specifications of any association or manufacturer, or codes of County authorities, intends most recent printed edition or catalog in effect on date that corresponds with date of Construction Documents.

F. Whenever reference is made in Specifications that work shall be "performed", "applied", in accordance with "manufacturer's directions or instructions", Contractor to whom those instructions are directed shall furnish three (3) printed copies of such instructions to Architect / Engineer before execution of the Work.

9. CONTRACTOR'S TITLE TO MATERIALS

A. Contractor or any subcontractor shall not purchase materials or supplies for the Work subject to any chattel mortgage or under conditional sale contract or other agreement by which seller retains interest. Contractor warrants that all materials and supplies used in the Work are free from all liens, claims or encumbrances and Contractor has good title to them.

10. "OR EQUAL" CLAUSE

A. Whenever equipment or materials are identified on Drawings or in Specifications by reference to manufacturer's or vendor's name, trade name, catalog number, and other identifying information, it is intended to establish standards; and any equipment or material of other manufacturers and vendors which will perform adequately duties imposed by general design will be considered equally accepted provided equipment or material so proposed is, in opinion of Architect / Engineer, of equal substance and function. Architect / Engineer and Department shall provide written approval before Contractor may purchase or install it.

B. Equipment or materials of manufacturers, other than those named, may be used only upon following conditions:
   1. That, in opinion of Architect / Engineer and Department, proposed material or equipment item is fully equal or superior (in design, materials, construction, workmanship, performance, finish, etc.) to named item. No compromise in quality level, however small, is acceptable.
   2. That, in substituting materials or equipment, Contractor assumes responsibility for any changes in system or for modifications required in adjacent or related work to accommodate such substitution despite Architect / Engineer's and Department's approval, and all costs growing out of approval of "or equal" items shall be responsibility of Contractor. No extra costs resulting from such approval shall become responsibility of Department, Architect / Engineer or any other separate Contractor.
   3. It shall be understood that use of materials or equipment other than those specified, or approved equal by Architect / Engineer and Department, shall constitute violation of Contract, and that Architect / Engineer and Department shall have right to require removal of such materials or equipment and their replacement with specified materials or equipment at Contractor's expense.
   4. Product and manufacturer named first in Specifications or on information shown on Drawings is basis of selection of manufactured items and equipment, particularly mechanical equipment. In using other than first named products or manufacturers, including those specified as additionally approved or acceptable, Contractor assumes responsibility for any changes in system and for modifications in any work required to accommodate them. Architect / Engineer's approval of such additionally acceptable products or manufacturers, either in Specifications or in Addendum, does not relieve Contractor from obligation to coordinate such optional products with other Contractors, whose work may be affected by them, and to pay all additional costs resulting from their inclusion into the Work. Contractor's liability shall include payment of Architect / Engineer's fees for any additional services made necessary by or directly connected to such product changes. No extra costs resulting from such changes shall become responsibility of Department, Architect / Engineer or any other separate Contractor.

C. No request for approval of "or equal" materials will be entertained except from Contractor. Identify any request for substitution as substitution on Contractor's letter of transmittal and give reasons for substitution. Department may in its sole discretion allow substitutions of materials.

11. PATENTS AND ROYALTIES

A. If Contractor uses any design, device or material covered by letters, patent or copyright, it is mutually agreed and understood, that, without exception, contract prices shall include all royalties or costs arising from use of such design, device or materials, in any way involved in the Work.

B. Contractor shall indemnify and save harmless County from any and all claims for infringement by reason of use of such patent or copyright in connection with the Work agreed to be performed under this Contract, and shall indemnify County for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during prosecution of the Work or after completion of the Work.

12. SURVEYS, PERMITS, REGULATIONS AND TAXES

A. Department will furnish to Contractor all site, topography and property surveys necessary for execution of the Work.

B. Contractor shall procure all permits, licenses and approvals necessary for execution of this Contract.

C. Contractor shall give all notices and comply with all State of Wisconsin, Federal and local laws, codes, rules and regulations relating to performance of the Work, protection of adjacent property, and maintenance of passageways, guard fences or other protective facilities.

D. Contractor shall pay all Sales, Consumer, Use and other similar taxes required by law.

E. Contractor shall promptly notify Architect / Engineer of any variances of Drawings or Specifications with that of any State of Wisconsin, federal or local law, code, rule or regulation. Upon such notification, Architect / Engineer will require correction of variance to comply with applicable law, code, rule or regulation at no additional cost to Contractor.

F. Work under this Contract shall comply with all applicable State of Wisconsin, Federal and local laws, codes and regulations.

G. Contractor shall pay charges for water, sewer and other utility connections made by municipalities where required by Specifications.

13. CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE

A. Contractor shall provide and pay for all materials, labor, tools, equipment, transportation and superintendence necessary to execute, complete and deliver the Work within specified time. Contractor agrees to secure at their own expense all personnel necessary to carry out the Work. Such personnel shall not be deemed County employees nor shall they have or be deemed to have any direct contractual relationship with County.

B. Performance of any work necessary after regular working hours, on Sundays or Legal Holidays shall be without additional expense to County. Performance of any work at site at other than normal working hours must be coordinated with Public Works Project Manager.

C. Contractor shall furnish, erect, maintain and remove such temporary works as may be required.

D. Contractor shall observe, comply with, and be subject to all terms, conditions, requirements and limitations of Construction Documents.

E. At the Work site, Contractor shall give personal superintendence to the Work or shall employ construction superintendent or foreman, experienced in character of work covered by Contract, who shall have full authority to act for Contractor. Understand that such superintendent or foreman shall be acceptable to Architect / Engineer and Department.

F. Remove from project or take other corrective action upon notice from Architect / Engineer or Department for Contractor's employees whose work is considered by Architect / Engineer or Department to be unsatisfactory, careless, incompetent, unskilled or otherwise objectionable.

G. Contractor and subcontractors shall be required to conform to Labor Laws of State of Wisconsin and various acts amendatory and supplementary thereto and to other laws, ordinances and legal requirements applicable to the Work.

H. Presence and observation of the Work by Architect / Engineer or Public Works Project Manager shall not relieve Contractor of any obligations.

14. WEATHER CONDITIONS

A. In event of temporary suspension of work, or during inclement weather, or whenever Architect / Engineer shall direct, Contractor shall, and shall cause subcontractors to protect carefully all work and materials against damage or injury from weather. If, in opinion of Architect / Engineer or Department, any work or materials that have been damaged or injured due to failure on part of Contractor or any subcontractors so to protect the Work, such materials shall be removed and replaced at expense of Contractor.

15. PROTECTION OF WORK AND PROPERTY

A. Contractor shall at all times safely guard County's property from injury or loss in connection with this Contract. Contractor shall at all times safely guard and protect the Work, and adjacent property, from damage. Contractor shall replace or make good any such damage, loss or injury unless such is caused directly by errors contained in Contract, or by County, or County's duly authorized representative.

B. Contractor may act diligently, without previous instructions from Architect / Engineer and / or Department, in emergency that threatens loss or injury of property, or safety of life. Contractor shall notify Architect / Engineer and / or Department immediately thereafter. Promptly submit any claim for compensation by Contractor due to such extra work to Architect / Engineer and / or Department for approval as provided for in Article 18 herein.

16. INSPECTION AND TESTING OF MATERIALS

A. Authorized representatives and agents of County government shall have access at all times to the Work wherever it is in preparation or progress and Contractor shall provide facilities for such access and for inspection.

B. Should it be considered necessary or advisable at any time before final acceptance of the Work to make examination of work already completed, by removing or tearing out same, Contractor shall upon request, promptly furnish all necessary facilities, labor and materials. If such work is found to be defective in any aspect, due to fault of Contractor or subcontractors thereof, Contractor shall assume all expenses of such examination and of satisfactory reconstruction. Contractor will be reimbursed for such examination and replacement in accordance with Article 18 - A.3., of these General Conditions of Contract if such work is found to meet requirements of Contract.

C. If Specifications, Architect / Engineer's, or Public Works Project Manager's instructions require any work to be specially tested or approved, Contractor shall give Architect / Engineer and Public Works Project Manager timely notice of its readiness for testing or inspection. Test all materials and equipment requiring testing in accordance with accepted or specified standards, as applicable. Architect / Engineer shall recommend laboratory or inspection agency and Department will select and pay for all initial laboratory inspection services. Should retesting be required, due to failure of initial testing, cost of such retesting shall be borne by Contractor.

D. Cost of any testing performed by manufacturers or Contractor for substantiating acceptability of proposed substitution of materials and equipment, or necessary conformance testing in

conjunction with manufacturing processes or factory assemblage, shall be borne by Contractor or manufacturer responsible.

17. REPORTS, RECORDS AND DATA

A. Contractor shall submit to Architect / Engineer and Public Works Project Manager such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, invoices, records and other data as either may request concerning work performed or to be performed under this Contract.

18. CHANGES IN THE WORK

A. Make no changes, except in cases of emergency, in the Work covered by approved Construction Documents without having prior written approval of Department. Charges or credits for the Work covered by approved change shall be determined by one of these methods:
   1. Unit bid prices previously approved.
   2. Agreed lump sum based on actual cost of:
      a) Labor, including foremen, and all fringe benefits that are associated with their wages.
      b) Materials entering permanently into the Work.
      c) Ownership or rental cost of construction tools and equipment during time of use on extra work.
      d) Power and consumable supplies for operation of power equipment.
      e) Workmen's Compensation Insurance, Contractor's Public Liability and Property Damage Insurance, and Comprehensive Automobile Liability Insurance.
      f) Social Security and old age and unemployment contributions.
      g) Add to cost under (2), fixed fee to be agreed upon, but not to exceed fifteen percent (15%) of actual cost of work performed with their own labor force. Fee shall be compensation to cover cost of supervision, overhead, bond, profit and any other general expense.
      h) On that portion of the Work under (2) done under subcontract, Contractor may include not over seven and one-half percent (7½%) for supervision, overhead, bond, profit and any other general expense.
      i) Department may require correct amount of costs with supporting vouchers; Contractor shall keep and present in such form as directed.
   3. Cost-plus work, with not-to-exceed dollar limit, based on actual cost of:
      a) Labor, including foremen, and all fringe benefits that are associated with their wages.
      b) Materials entering permanently into the Work.
      c) Ownership or rental cost of construction tools and equipment during time of use on extra work. Rental cost cannot exceed fifty percent (50%) replacement value of rented equipment.
      d) Power and consumable supplies for operation of power equipment.
      e) Workmen's Compensation Insurance, Contractor's Public Liability and Property Damage Insurance, and Comprehensive Automobile Liability Insurance.
      f) Social Security and old age and unemployment contributions.
      g) To cost under (3), there shall be added fixed fee to be agreed upon but not to exceed fifteen percent (15%) of actual cost of work performed with their own labor force. Fee shall be compensation to cover cost of supervision, overhead, bond, profit, and any other general expense.
      h) On that portion of the Work under (3) done under subcontract, Contractor may include not over seven and one-half percent (7½%) for supervision, overhead, bond, profit, and any other general expense.

i) Contractor shall keep and present, in such form as directed, correct amount of cost together with such supporting vouchers as may be required by Department.

B. If Contractor claims that by any instructions given by Architect / Engineer, Department, by drawings or otherwise, regarding performance of the Work or furnishing of material under Contract, involves extra cost, Contractor shall give Department written notice of cost thereof within two (2) weeks after receipt of such instructions and in any event before proceeding to execute work, unless delay in executing work would endanger life or property.

C. No claim for extra work or cost shall be allowed unless it was done in pursuance of written Change Order from Architect / Engineer and approved by Department, as previously mentioned, and claim presented with payment request submitted after changed or extra work is completed.

D. Negotiation of cost for change in the Work shall not be cause for Contractor to delay prosecution of the Work if Contractor has been authorized in writing by Public Works Project Manager to proceed.

19. EXTRAS

A. Without invalidating Contract, Department may order extra work or make changes by altering, adding to or deducting from the Work, contract sum being adjusted in accordance with Article 18 herein.

20. TIME FOR COMPLETION

A. Contractor agrees that the Work shall be prosecuted regularly and diligently and complete the Work as stated in Construction Documents and on the Bid Form.

21. CORRECTION OF WORK

A. All work, all materials whether incorporated in the Work or not, and all processes of manufacture shall at all times and places be subject to inspection of Architect / Engineer and Public Works Project Manager who shall be judge of quality and suitability of the Work, materials, and processes of manufacture for purposes for which they are used. Should they fail to meet Architect / Engineer's and Public Works Project Manager's approval they shall be reconstructed, made good, replaced or corrected, by Contractor at Contractor's expense. Immediately remove all rejected material from site.

B. If Contractor defaults or neglects to carry out the Work in accordance with Construction Documents or fails to perform any provision of Contract, Department may, after ten (10) business days' written notice to Contractor and without prejudice to any other remedy County may have, make good such deficiencies. In such case, appropriate Change Order shall be issued deducting from Contractor's payments then or thereafter, cost of correcting such deficiencies, including cost of Architect / Engineer's additional services made necessary by such default, neglect or failure.

22. SUBSURFACE CONDITIONS FOUND DIFFERENT

A. If Contractor encounters subsurface or latent conditions at site materially differing from those shown on Drawings or indicated in Specifications, Contractor shall immediately give notice to Architect / Engineer and Public Works Project Manager of such conditions before they are

disturbed. Architect / Engineer will thereupon promptly investigate conditions, and if Architect / Engineer finds that they materially differ from those shown on Drawings or indicated in Specifications, Architect / Engineer will at once make such changes as necessary, any increase or decrease of cost resulting from such changes to be adjusted in manner provided in above Article 18 entitled "Changes in the Work".

23. RIGHT OF DEPARTMENT TO TERMINATE CONTRACT

A. In event that any provisions of this Contract are violated by Contractor or by any subcontractors, County may serve written notice upon Contractor and Surety of its intention to terminate Contract, such notice to contain reasons for such intention to terminate Contract, and unless within ten (10) business days after serving of such notice upon Contractor, such violation or delay shall cease and satisfactory arrangement or correction be made, Contract shall, upon expiration of said ten (10) business days, cease and terminate.

B. In event of any such termination, County shall immediately serve notice thereof upon Surety and Contractor, and Surety shall have right to take over and perform Contract subject to County's approval; provided, however, that if Surety does not commence performance thereof within ten (10) business days from date of mailing to such Surety of notice of termination, County may take over the Work and prosecute same to completion by contract, or by force account, at expense of Contractor; Contractor and Surety shall be liable to County for any excess cost occasioned County thereby, and in such event County may take possession of and utilize in completing the Work, such materials and equipment as may be on the Work site and therefore necessary.

24. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

A. Contractor shall be responsible for Construction Schedule and coordination. Immediately after execution and delivery of Contract and before making first payment, Contractor shall notify all subcontractors to furnish all required information to develop Construction Schedule. Contractor and all subcontractors associated with the Work shall furnish following information from each Division of Specifications:
   1. List of construction activities;
   2. Start, finish and time required for completion of each activity;
   3. Sequential relationships between activities;
   4. Identify all long lead-time items, key events, meetings or activities such as required submittals, fabrication and delivery, procurement of materials, installation and testing;
   5. Weekly definition of extent of work and areas of activity for each trade or Subcontract; and
   6. Other information as determined by Public Works Project Manager.

B. In addition to above requested items, Contractor shall request delivery dates for all County-furnished equipment, materials or labor. This shall include any work handled by Department under separate contracts such as asbestos abatement, air and water balancing, etc. Indicate on Construction Schedule these associated delivery and installation dates.

C. Progress Reporting:
   1. Contractor shall update and publish Construction Schedule on monthly basis. Revisions to Schedule shall be by Contractor and made in same detail as original Schedule and accompanied by explanation of reasons for revision; and shall be subject to approval by Department.

2. Failure of Contractor to keep Schedule in updated format shall result in County hiring firm specializing in construction schedule development and deducting those costs associated with updating process from payments due Contractor.
3. Contractor shall submit show actual percentage of each activity completed, estimated future progress, and anticipated completion time.

D. Responsibility for timely completion requires:
1. Contractor and subcontractors understand that performance of each is interdependent upon performance of others.
2. Whenever it becomes apparent from current schedule, that phasing or progress completion dates will not be met, Contractor must take some or all following actions at no additional cost to County:
   a) Increase construction labor in such quantities and crafts as will eliminate backlog of work.
   b) Increase number of working hours per shift, shifts per working day, working days per week, amount of construction equipment, or any combination of foregoing to eliminate backlog of work.
   c) Reschedule work (yet remain in conformance with Drawings and Specifications).
3. Prior to proceeding with any of above actions, Contractor shall notify Public Works Project Manager.

E. Maintain current Construction Schedule at all times. Revise Construction Schedule in same detail as original and accompany with explanation of reasons for revision. Schedule shall be subject to approval by Architect / Engineer and Public Works Project Manager.

25. PAYMENTS TO CONTRACTOR

A. Contractor shall provide:
1. Detailed estimate giving complete breakdown of contract price by Specification Division; and
2. Periodic itemized estimates of work done for purpose of making partial payments thereon.

B. Submit these estimates for approval first to Architect / Engineer, then to Public Works Project Manager. Costs employed in making up any of these schedules are for determining basis of partial payments and not considered as fixing basis for additions to or deductions from Contract price.

C. County will make partial payments to Contractor for value, proportionate to amount of Contract, of all labor and material incorporated in the Work during preceding calendar month upon receipt of Application and Certificate for Payment form from Architect / Engineer and approval of Department.

D. Contractor shall submit for approval first to Architect / Engineer, and then to Public Works Project Manager all Application and Certificate for Payment forms. If requested, Application and Certificate for Payment shall be supported by such additional evidence as may be required, showing Contractor's right to payment claimed.

E. Application and Certificate for Payment for preparatory work and materials delivered and suitably stored at site to be incorporated into the Work at some future period, will be given due consideration. Requesting payment for materials stored off site, may be rejected, however, if deemed essential for reasons of job progress, protection, or other sufficient cause, requests will be considered, conditional upon submission by Contractor of bills of sale,

photographs and such other procedures as will adequately protect County's interest such as storage in bonded warehouse with adequate coverage. If there is any error in payment, Contractor is obligated to notify Department immediately, but no longer than ten (10) business days from receipt of payment.

F. Payments by County will be due within forty-five (45) business days after receipt by Department of Application and Certificate for Payment.

G. County will retain five percent (5%) of each Application and Certificate for Payment until final completion and acceptance of all the Work covered by Contract. However, anytime after fifty percent (50%) of the Work has been furnished and installed at site, County will make remaining payments in full if Architect / Engineer and Public Works Project Manager find that progress of the Work corresponds with Construction Schedule. If Architect / Engineer and Public Works Project Manager find that progress of the Work does not correspond with Construction Schedule, County may retain up to ten percent (10%) of each Application and Certificate for Payment for the Work completed.

H. All material and work covered by partial payments made shall become sole property of County, but this provision shall not be construed as relieving Contractor from sole responsibility for care and protection of materials and work upon which payments have been made, or restoration of any damaged work, or as waiver of right of County to require fulfillment of all of terms of Contract.

I. County will make final payment within sixty (60) calendar days after final completion of the Work, and will constitute acceptance thereof. Submit Equal Benefits Compliance Payment Certification with final pay request. Payment may be denied if Certification is not included.

J. County may make payment in full, including retained percentages and less authorized deductions, upon completion and acceptance of each Division where price is stated separately in Contract.

K. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit to this Department, as requested and with final application for payment for work under said contract, affidavit(s) as required to prove that all debts and claims against this Work are paid in full or otherwise satisfied, and give final evidence of release of all liens against the Work and County. If Wisconsin Prevailing Wage Rate Determination is required for this Work, use "Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination" and "Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination" (if applicable). If Wisconsin Prevailing Wage Rate Determination is not required for this Work, use "Dane County, Wisconsin Contractor Wage Affidavit". Forms of such affidavits are included in Supplementary Conditions.

26. WITHHOLDING OF PAYMENTS

A. County, after having served written notice on said Contractor, may either pay directly any unpaid bills of which Department has written notice, or withhold from Contractor's unpaid compensation sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged; whereupon, payment to Contractor shall be resumed in accordance with terms of this Contract, but in no event shall these provisions be construed to impose any obligations upon County to either Contractor or Contractor's Surety.

B. In paying any unpaid bills of Contractor, County shall be deemed agent of Contractor, and any payment so made by County, shall be considered as payment made under Contract by County to Contractor and County shall not be liable to Contractor for any such payment made in good faith.

C. Contractor shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives from all claims growing out of lawful demands of subcontractors, laborers, workers, mechanics, material men, and furnishers of machinery and parts thereof, equipment, power tools, and all supplies, including commissary, incurred in performance of this Contract.

D. At Department's request, Contractor shall furnish satisfactory evidence that all obligations of nature designated above have been paid, discharged or waived.

27. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

A. Making of final payment shall constitute waiver of all claims by County except those arising from:
   1. Unsettled lien;
   2. Faulty or defective work appearing after substantial completion;
   3. Failure of the Work to comply with requirements of Construction Documents; or
   4. Terms of any special guarantees required by Construction Documents.

B. Acceptance of final payment shall constitute waiver of all claims by Contractor.

28. PAYMENTS BY CONTRACTOR

A. Contractor shall pay following not later than fifth (5^{th}) business day following each payment received from County:
   1. All transportation and utility services rendered;
   2. All materials, tools, and other expendable equipment that have been delivered at site of the Work to extent of ninety percent (90%) of cost thereof, and balance of cost thereof when said balance is paid to Contractor; and
   3. Each subcontractor, respective amount allowed Contractor because of work performed by subcontractor to extent of subcontractor's interest therein.

29. CONTRACT SECURITY

A. Contractor shall furnish Performance and Payment Bonds in amount at least equal to one hundred percent (100%) of Contract price as security for faithful performance of this Contract and payment of all persons performing labor on project under this Contract and furnishing materials in connection with this Contract.

B. Sample Performance and Payment Bonds that Contractor will be required to execute is bound into these Construction Documents. Before construction Contract is consummated, completed Performance and Payment Bonds must be approved by Department.

30. ASSIGNMENTS

A. Contractor shall not assign whole or any part of this Contract or any moneys due or to become due hereunder without written consent of Department. In case Contractor assigns all or any part of any moneys due or to become due under this Contract, instrument of

assignment shall contain clause substantially to effect that it is agreed that right of assignee in and to any moneys due or to become due to Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for performance of the Work called for in this Contract.

31. MUTUAL RESPONSIBILITY OF CONTRACTORS

A. If, through acts of neglect on part of Contractor or any subcontractor shall suffer loss or damage on the Work, Contractor agrees to settle with such subcontractor by agreement or arbitration if such other subcontractor will so settle. If such subcontractor shall assert any claim against County on account of any damage alleged to have been sustained, Department shall notify Contractor, who shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives against any such claim.

32. SEPARATE CONTRACTS

A. Department may award other contracts for the Work and all Contractors shall fully cooperate with each other and carefully adjust their work to that provided under other contracts as may be directed by Department. No Contractor shall commit or permit any act that will interfere with performance of the Work by any other Contractor.

B. Contractor shall coordinate the Work with those of other Contractors. Cooperation will be required in arrangement for storage of materials and in detailed execution of the Work. Contractor, including subcontractors, shall keep informed of progress and detail work of others and shall notify Architect / Engineer or Department immediately of lack of progress or defective workmanship on part of others. Failure of Contractor to keep informed of the Work progressing on site and failure to give notice of lack of progress or defective workmanship by others shall be construed as acceptance by Contractor of status of the Work as being satisfactory for proper coordination with Contractor's own work.

33. SUBCONTRACTS

A. Contractor may use services of specialty subcontractors on those parts of the Work that, under normal contracting practices, are performed by specialty subcontractors.

B. Contractor shall not award any work to any subcontractor without prior approval of Department. Qualifications of subcontractors shall be same as qualifications of Contractor. Request for subcontractor approval shall be submitted to Department fifteen (15) business days before start of subcontractor's work. If subcontractors are changed or added, Contractor shall notify Department in writing.

C. Contractor shall be as fully responsible to County for acts and omissions of subcontractors, and of persons either directly or indirectly employed by them, as Contractor is for acts and omissions of persons directly employed by Contractor.

D. Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind subcontractors to Contractor by terms of General Conditions of Contract and other Construction Documents insofar as applicable to work of subcontractors and to give Contractor same power as regards terminating any subcontract that Department may exercise over Contractor under any provision of Construction Documents.

E. Nothing contained in this Contract shall create any contractual relation between any subcontractor and County.

F. Contractor shall insert in all subcontracts, Articles 26, 33, 43 and 45, respectively entitled: "Withholding of Payments", "Subcontracts", "Affirmative Action Provision and Minority / Women / Disadvantaged Business Enterprises", and "Minimum Wages", and shall further require all subcontractors to incorporate physically these same Articles in all subcontracts.

34. PUBLIC WORKS PROJECT MANAGER'S AUTHORITY

A. Public Works Project Manager shall:
   1. Administer and ensure compliance with Construction Documents;
   2. Provide responsible on-site observations of construction and have authority to request work and to stop work whenever necessary to insure proper enforcement of Construction Documents;
   3. Convene and chair project meetings and foreman's coordination meetings when necessary to coordinate resolution of conflicts between Contractors, Architects, Engineers, Consultants, and Department; and
   4. Check and inspect material, equipment and installation procedures of all trades for proper workmanship and for compliance with Drawings, Specifications and Shop Drawings, permit no material on project site that is not satisfactory and reject work not in compliance with Construction Documents.

35. ARCHITECT / ENGINEER'S AUTHORITY

A. Architect / Engineer is retained by, and is responsible to Department acting for County.

B. Architect / Engineer shall determine amount, quality, acceptability, and fitness of several kinds of work and materials that are provided under this Contract and shall decide all questions that may arise in relation to said work and construction thereof.

C. Architect / Engineer shall decide meaning and intent of any portion of Specifications and of any Drawings where they may be found obscure or be in dispute.

D. Architect / Engineer shall provide responsible observation of construction. Architect / Engineer has authority to stop the Work whenever such stoppage may be necessary to insure proper execution of Construction Documents.

E. Architect / Engineer shall be interpreter of conditions of Construction Documents and judge of its performance.

F. Within reasonable time, Architect / Engineer shall make decisions on all matters relating to progress of the Work or interpretation of Construction Documents.

G. Architect / Engineer's decisions are subject to review by Public Works Project Manager.

36. STATED ALLOWANCES

A. Stated allowances enumerated in Instructions to Bidders shall cover net cost of materials or equipment, and all applicable taxes. Contractor's cost of delivery and unloading at site, handling costs on site, labor, installation costs, overhead, profit and any other incidental costs shall be included in Contractor's bid, but not as part of cash allowance.

B. Department will solicit at least two (2) bids on materials or equipment for which allowance is stated and select on basis of lowest qualified responsible bid. Contractor will then be instructed to purchase "Allowed Materials". If actual price for purchasing "Allowed Materials", including taxes, is more or less than "Cash Allowance", Contract price shall be adjusted accordingly. Adjustment in Contract price shall not contain any cost items excluded from cash allowance.

37. ESTIMATES OF QUANTITIES

A. Whenever estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of Construction Documents, they are given for use in comparing bids and right is especially reserved to increase or diminish them as they may be deemed reasonably necessary or desirable by Department to complete the Work included in this Contract, and cost for such increase or diminution shall be adjusted in manner provided for in General Conditions of Contract Article 18 entitled "Changes in the Work".

38. LANDS AND RIGHTS-OF-WAY

A. Prior to start of construction, County shall furnish all land and rights-of-way necessary for carrying out and completion of the Work to be performed under this Contract.

39. GENERAL GUARANTEE

A. Neither final certificate of payment nor any provision in Construction Documents nor partial or entire occupancy of premises by County shall constitute acceptance of work not done in accordance with Construction Documents or relieve Contractor of liability in respect to any expressed warranties or responsibility for faulty materials or workmanship.
   1. In no event shall making of any payment required by Contract constitute or be construed as waiver by County of any breach of covenants of Contract or waiver of any default of Contractor and making of any such payment by County while any such default or breach shall exist shall in no way impair or prejudice right of County with respect to recovery of damages or other remedy as result of such breach or default.

B. Contractor shall remedy and make good all defective workmanship and materials and pay for any damage to other work resulting there from, which appear within period of one (1) year from date of substantial completion, providing such defects are not clearly due to abuse or misuse by County. Department will give notice of observed defects with reasonable promptness.

C. Guarantee on work executed after certified date of substantial completion will begin on date when such work is inspected and approved by Architect / Engineer and Public Works Project Manager.

D. Where guarantees or warrantees are required in sections of Specifications for periods in excess of one (1) year, such longer terms shall apply; however, Contractor's Performance and Payment Bonds shall not apply to any guarantee or warranty period in excess of one (1) year.

40. CONFLICTING CONDITIONS

A. Any provision in any of Construction Documents which may be in conflict or inconsistent with any Articles in these General Conditions of Contract or Supplementary Conditions shall be void to extent of such conflict or inconsistency.

B. In case of ambiguity or conflict between Drawings and Specifications, Specifications shall govern.

C. Printed dimensions shall be followed in preference to measurements by scale. Large-scale drawings take precedence over small-scale drawings. Dimensions on Drawings and details are subject to field measurements of adjacent work.

41. NOTICE AND SERVICE THEREOF

A. Any notice to Contractor from Department relative to any part of this Contract shall be in writing and considered delivered and service thereof completed, when said notice is posted, by certified or registered mail, to Contractor at Contractor's last given address, or delivered in person to said Contractor, or Contractor's authorized representative on the Work.

42. PROTECTION OF LIVES AND HEALTH

A. In order to protect lives and health of Contractor's employees under Contract, Contractor shall comply with all pertinent provisions of Wisconsin Administrative Code, Rules of Department of Commerce, relating to Safety and Health.

B. Contractor alone shall be responsible for safety, efficiency and adequacy of Contractor's tools, equipment and methods, and for any damage that may result from their failure or their improper construction, maintenance or operation.

43. AFFIRMATIVE ACTION PROVISION AND MINORITY / WOMEN / DISADVANTAGED BUSINESS ENTERPRISES

A. Affirmative Action Provisions.
   1. During term of their Contract, Contractor agrees not to discriminate on basis of race, religion, color, sex, handicap, age, sexual preference, marital status, physical appearance, or national origin against any person, whether recipient of services (actual or potential), employee, or applicant for employment. Such equal opportunity shall include but not be limited to following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation or level of service(s). Contractor agrees to post in conspicuous places, these affirmative action standards so as to be visible to all employees, service recipients and applicants for this paragraph. Listing of prohibited bases for discrimination shall no be construed to amend in any fashion state or federal law setting forth additional bases and exceptions shall be permitted only to extent allowable in state or federal law.
   2. Contractor is subject to this Article only if Contractor has ten (10) or more employees and receives $10,000.00 or more in annual aggregate contracts with County. Contractor shall file and Affirmative Action Plan with Dane County Contract Compliance Officer in accord with Chapter 19 of Dane County Code of Ordinances. Such plan must be filed within fifteen (15) business days of effective date of this Contract and failure to do so by said date shall constitute ground for immediate termination of Contract by County. Contractor shall also, during term of this Contract, provide copies of all announcements

of employment opportunities to County's Contract Compliance Office, and shall report annually number of persons, by race, sex and handicap status, who apply for employment, and, similarly classified, number hired and number rejected.

3. Contact Dane County Contract Compliance Officer at Dane County Contract Compliance Office, 210 Martin Luther King, Jr. Blvd., Room 421, Madison, WI 53703, 608/266-4114.
4. In all solicitations for employment placed on Contractor's behalf during term of this Contract, Contractor shall include statement to affect Contractor is "Equal Opportunity Employer". Contractor agrees to furnish all information and reports required by County's Contract Compliance Officer as same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and provision of this Contract.

B. Minority / Women / Disadvantaged / Emerging Small Business Enterprises.
   1. Chapter 19.508 of Dane County Code of Ordinances is official policy of Dane County regarding utilization of, to fullest extent of, Minority Business Enterprises (MBEs), Women Business Enterprises (WBEs) Disadvantage Business Enterprises (DBEs) and Emerging Small Business Enterprises (ESBEs).
   2. Contractor may utilize MBEs / WBEs / DBEs / ESBEs as subcontractors or suppliers. List of subcontractors will be required of low bidder as stated in this Contract. List shall indicate which are MBEs / WBEs / DBEs / ESBEs and percentage of subcontract awarded, shown as percentage of total dollar amount of bid.

44. COMPLIANCE WITH FAIR LABOR STANDARDS

A. During term of this Contract, Contractor shall report to County Contract Compliance Officer, within ten (10) business days, any allegations to, or findings by National Labor Relations Board (NLRB) or Wisconsin Employment Relations Commission (WERC) that Contractor has violated statute or regulation regarding labor standards or relations. If investigation by Contract Compliance Officer results in final determination that matter adversely affects Contractor's responsibilities under this Contract, and which recommends termination, suspension or cancellation of this Contract, County may take such action.

B. Contractor may appeal any adverse finding by Contract Compliance Officer as set forth in Dane County Ordinance 25.015(11)(c) through (e).

C. Contractor shall post this statement in prominent place visible to employees: "As condition of receiving and maintaining contract with Dane County, this employer shall comply with federal, state and all other applicable laws prohibiting retaliation or union organizing."

45. DOMESTIC PARTNERSHIP BENEFITS

A. Contractor agrees to provide same economic benefits to all of its employees with domestic partners as it does to employees with spouses, or cash equivalent if such benefit cannot reasonably be provided. Contractor agrees to make available for County inspection Contractor's payroll records relating to employees providing services on or under this Contract or subcontract. If any payroll records of Contractor contain any false, misleading or fraudulent information, or if Contractor fails to comply with provisions of Chapter 25.016, Dane County Ordinances, contract compliance officer may withhold payments on Contract; terminate, cancel or suspend Contract in whole or in part; or, after due process hearing, deny Contractor right to participate in bidding on future County contracts for period of one year

after first violation is found and for period of three years after second or subsequent violation is found.

46. USE AND OCCUPANCY PRIOR TO ACCEPTANCE

A. Contractor agrees to use and occupancy of portion or unit of the Work before formal acceptance by Department, provided Department:
   1. Secures written consent of Contractor; except when in opinion of Public Works Project Manager, Contractor is chargeable with unwarranted delay in final cleanup of punch list items or other Contract requirements.
   2. Secures endorsement from insurance carrier and consent of Surety permitting occupancy of building or use of the Work during remaining period of construction, or, secures consent of Surety.
   3. Assumes all costs and maintenance of heat, electricity and water.
   4. Accepts all work completed within that portion or unit of the Work to be occupied, at time of occupancy.

47. MINIMUM WAGES

A. Contractor shall post, at appropriate conspicuous point on site of project, schedule showing all determined minimum wage rates for various classes of laborers and mechanics to be engaged in the Work under this Contract and all deductions, if any, required by law to be made from unpaid wages actually earned by laborers and mechanics so engaged.

B. Supplementary Conditions section in Construction Documents lists wage determinations required by State Law.

C. If, after award of Contract, it becomes necessary to employ any person in trade or occupation not classified in wage determinations, such person shall be paid at not less than such rate as shall be determined by Wisconsin Department of Workforce Development. Such approved minimum rate shall be retroactive to time of initial employment of such person in such trade or occupation. Contractor shall notify Department of Contractor's intention to employ persons in trades or occupations not so classified in sufficient time for Department to obtain approved rates for such trades or occupations.

D. Specified wage rates are minimum rates only, and Department will not consider any claims for additional compensation made by Contractor because of payment by Contractor of any wage rate in excess of applicable rate contained in this Contract. Contractor shall adjust any disputes in regard to payment of wages in excess of those specified in this Contract.

E. Submit required affidavit(s) to Department of Public Works, Highway & Transportation, as requested and with final application for payment for work under said contract. Affidavit(s) shall clearly indicate name, trade or occupation, and paid wages of every laborer, worker or mechanic employed by Contractor and all subcontractors during billing period including accurate record of number of hours worked by each employee and actual wages paid as stipulated in Wisconsin Statue 66.0903. If Wisconsin Prevailing Wage Rate Determination is required for this Work, use "Prime Contractor Affidavit of Compliance with Prevailing Wage Rate Determination" and "Agent or Subcontractor Affidavit of Compliance with Prevailing Wage Rate Determination" (if applicable). If Wisconsin Prevailing Wage Rate Determination is not required for this Work, use "Dane County, Wisconsin Contractor Wage Affidavit". Forms of such affidavits are included in Supplementary Conditions.

48. CLAIMS

A. No claim may be made until Department's Assistant Public Works Director has reviewed Architect / Engineer's decision as provided for in Article 35 of General Conditions of Contract. If any claim remains unresolved after such review by Department's Assistant Public Works Director the claim may be filed under Wisconsin Statute 893.80. Work shall progress during period of any dispute or claim. Unless specifically agreed between parties, venue will be in Dane County, Wisconsin.

49. ANTITRUST AGREEMENT

A. Contractor and County recognize that in actual economic practice, overcharges resulting from antitrust violations are in fact usually borne by County. Therefore, Contractor hereby assigns to County any and all claims for such overcharges as to goods and materials purchased in connection with this Contract, except as to overcharges which result from antitrust violations commencing after price is established under this Contract and any change order thereto.

50. INSURANCE

A. Contractor Carried Insurance:
   1. Contractor shall not commence work under this Contract until Contractor has obtained all insurance required under this Article and has provided evidence of such insurance to Risk Manager, 425 City-County Building, 210 Martin Luther King Jr. Blvd., Madison, WI 53703. Contractor shall not allow any subcontractor to commence work until insurance required of subcontractor has been so obtained and approved. Company providing insurance must be licensed to do business in Wisconsin.
   2. Worker's Compensation Insurance:
      a) Contractor shall procure and shall maintain during life of this Contract, Worker's Compensation Insurance as required by statute for all of Contractor's employees engaged in work at site of project under this Contract and, in case of any such work sublet, Contractor shall require subcontractor similarly to provide Worker's Compensation Insurance for all of latter's employees to be engaged in such work unless such employees are covered by protection afforded by Contractor's Worker's Compensation Insurance.
      b) If any claim of employees engaged in hazardous work on project under this Contract is not protected under Worker's Compensation Statute, Contractor shall provide and shall cause each subcontractor to provide adequate Employer's Liability Insurance for protection of such of Contractor's employees as are not otherwise protected.
   3. Contractor's Public Liability and Property Damage Insurance:
      a) Contractor shall procure and maintain during life of this Contract, Contractor's Public Liability Insurance and Contractor's Property Damage Insurance in amount not less than $1,000,000 bodily injury, including accidental death, to any one person, and subject to same limit for each person, in amount not less than $1,000,000 on account of one accident, and Contractor's Property Damage Insurance in amount not less then $1,000,000 or combined single limit of at least $1,000,000 with excess coverage over and above general liability in amount not less than $5,000,000. Contractor shall add "Dane County" as additional insured for each project.
      b) Contractor's Public Liability and Property Damage Insurance shall include Products, Completed Operation, and Contractual Liability under Insurance Contract. "Contractor shall in all instances save, defend, indemnify and hold harmless County and Architect / Engineer against all claims, demands, liabilities, damages or any other costs which may accrue in prosecution of the Work and that Contractor will save, defend, indemnify and hold harmless County and Architect / Engineer from all

damages caused by or as result of Contractor's operations" and each shall be listed as additional insured on Contractor's and sub-contractors' insurance policies.

c) Obligations of Contractor under Article 50.A.2.b) shall not extend to liability of Architect / Engineer, agents or employees thereof, arising out of:
   1) Preparation or approval of maps, drawings, opinions, reports, surveys, change orders, designs or specifications; or
   2) Giving of or failure to give directions or instructions by Architect / Engineer, agents or employees thereof provided such giving or failure to give is primary cause of injury or damage.

d) Contractor shall procure and shall maintain during life of this Contract, Comprehensive Automobile Liability Insurance covering owned, non-owned and hired automobiles for limits of not less than $1,000,000 each accident single limit, bodily injury and property damage combined with excess coverage over and above general liability in amount not less than $5,000,000.

e) Contractor shall either:
   1) Require each subcontractor to procure and to maintain during life of subcontract, subcontractor's Public Liability Property Damage Insurance, and Comprehensive Automobile Liability Insurance of type and in same amount specified in preceding paragraphs; or
   2) Insure activities of subcontractors in Contractor's own policy.

4. Scope of Insurance and Special Hazards: Insurance required under Article 50.A.2 & 50.A.3. hereof shall provide adequate protection for Contractor and subcontractors, respectively, against damage claims which may arise from operations under this Contract, whether such operation be by insured or by anyone directly or indirectly employed by insured and also against any of special hazards which may be encountered in performance of this Contract as enumerated in Supplementary Conditions.
5. Proof of Carriage of Insurance: Contractor shall furnish Risk Manager with certificates showing type, amount, class of operations covered, effective dates, dates of expiration of policies and "Dane County" listed as additional insured. Such certificates shall also contain (substantially) following statement: "Insurance covered by this certificate will not be canceled or materially altered, except after ten (10) business days written notice has been received by Risk Manager."

B. Builder's Risk:
   1. County shall provide Builder's Risk insurance coverage for its insurable interests in construction or renovation projects with completed value of $500,000 or less. Therefore, if project completed value is more than $500,000, Contractor shall obtain and maintain in force, at its own expense, Builder's Risk Insurance on all risks for amount equal to full completed value of covered structure or replacement value of alterations or additions. Any deductible shall not exceed $25,000 for each loss. Policy shall include occupancy clause and list Dane County as loss payee.

C. Indemnification / Hold Harmless:
   1. Contractor shall indemnify, hold harmless and defend Dane County, its boards, commissions, agencies, officers, employees and representatives from and against all claims, damages, losses and expenses including attorneys' fees arising out of or resulting from performance of the Work, provided that any such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, and is caused in whole or in part by any act or omission of Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, regardless of whether or not it is caused in part by part indemnified hereunder.

2. In any and all claims against Dane County, its boards, commissions, agencies, officers, employees and representatives or by any employee of Contractor, any subcontractor, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, indemnification obligation under this Contract shall not be limited in any way by any limitation on amount or type of damages, compensation or benefits payable by or for Contractor or any subcontractor under worker's compensation acts, disability benefits or other employee benefit acts.
3. Obligations of Contractor under this Contract shall not extend to liability of Architect / Engineer, its agents or employees arising out of:
    a) Preparation or approval of maps, drawings, opinion, reports, surveys, change orders, designs or specifications; or
    b) Giving of or failure to give directions or instruction by Architect / Engineer, its agents or employees provided such giving or failure to give is primary cause of injury or damage.
4. Dane County shall not be liable to Contractor for damages or delays resulting from work by third parties or by injunctions or other restraining orders obtained by third parties.

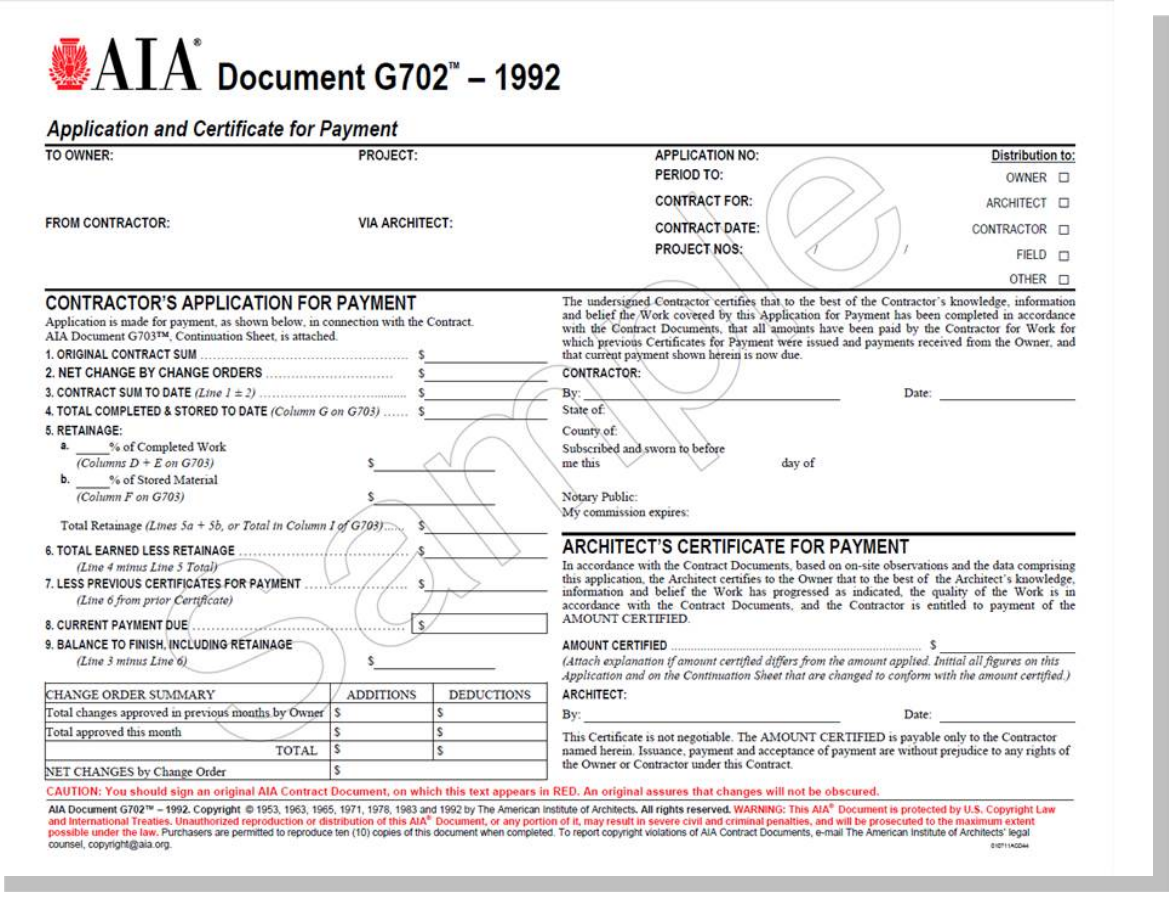
51. WISCONSIN LAW CONTROLLING

A. It is expressly understood and agreed to by parties hereto that in event of any disagreement or controversy between parties, Wisconsin law shall be controlling.

SUPPLEMENTARY CONDITIONS

1. APPLICATION & CERTIFICATE FOR PAYMENT

A. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit partial and final Application & Certificate for Payment for work under said contract. Form shall provide similar information as shown on AIA G702™ and G703™ forms (samples shown below). Forms shall be submitted to Public Works Project Manager for approval.



AIA® Document G702™ – 1992

Application and Certificate for Payment

TO OWNER: PROJECT: APPLICATION NO: Distribution to:
PERIOD TO: OWNER ☐
CONTRACT FOR: ARCHITECT ☐
FROM CONTRACTOR: VIA ARCHITECT: CONTRACT DATE: CONTRACTOR ☐
PROJECT NOS: / / FIELD ☐
OTHER ☐

CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract.
AIA Document G703™, Continuation Sheet, is attached.

1. ORIGINAL CONTRACT SUM ..... $
2. NET CHANGE BY CHANGE ORDERS ..... $
3. CONTRACT SUM TO DATE *(Line 1 ± 2)* ..... $
4. TOTAL COMPLETED & STORED TO DATE *(Column G on G703)* ..... $
5. RETAINAGE:
   a. ____% of Completed Work *(Columns D + E on G703)* $
   b. ____% of Stored Material *(Column F on G703)* $
   Total Retainage *(Lines 5a + 5b, or Total in Column I of G703)* ..... $
6. TOTAL EARNED LESS RETAINAGE ..... $ *(Line 4 minus Line 5 Total)*
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT ..... $ *(Line 6 from prior Certificate)*
8. CURRENT PAYMENT DUE ..... $
9. BALANCE TO FINISH, INCLUDING RETAINAGE *(Line 3 minus Line 6)* $

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	$	$
Total approved this month	$	$
TOTAL	$	$
NET CHANGES by Change Order	$	

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

CONTRACTOR:
By: Date:
State of:
County of:
Subscribed and sworn to before me this day of
Notary Public:
My commission expires:

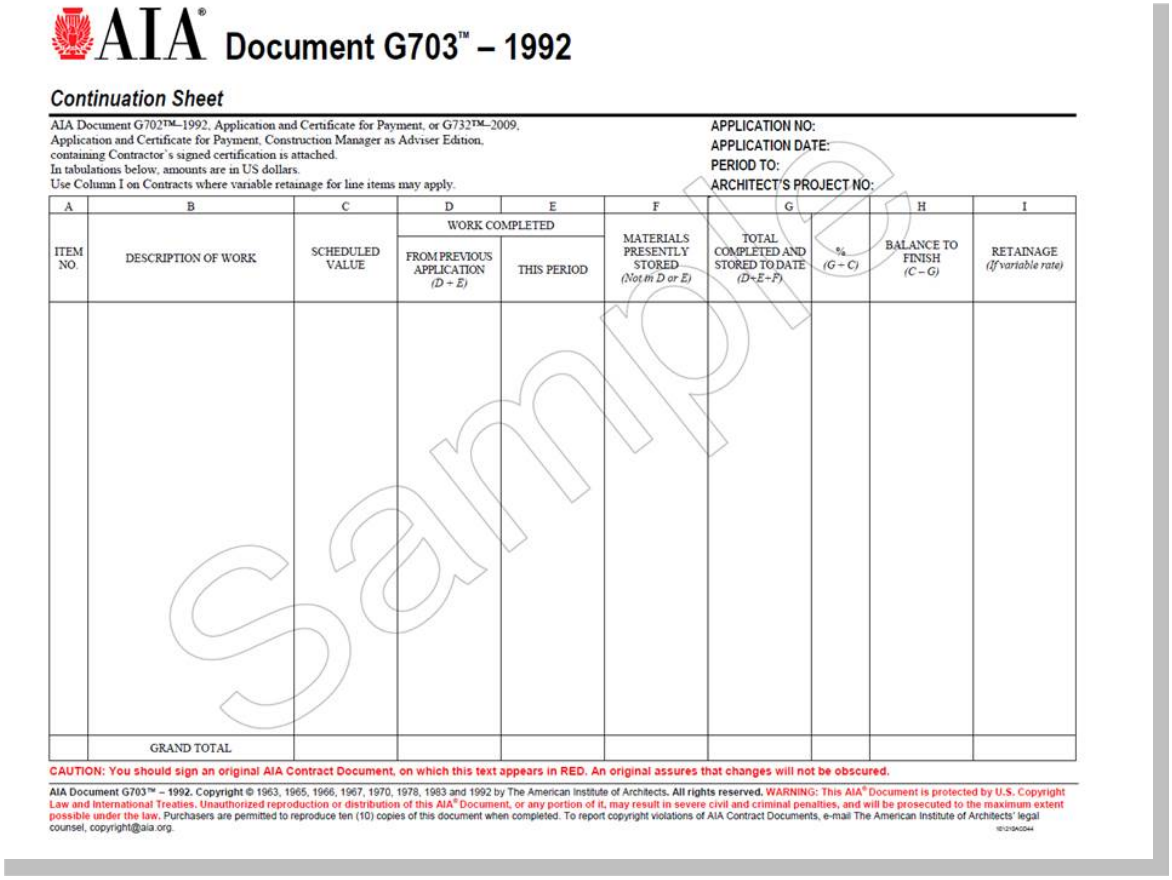
ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... $
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)
ARCHITECT:
By: Date:

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.



AIA® Document G703™ – 1992

Continuation Sheet

AIA Document G702™–1992, Application and Certificate for Payment, or G732™–2009, Application and Certificate for Payment, Construction Manager as Adviser Edition, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO:
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED: FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED: THIS PERIOD	MATERIALS PRESENTLY STORED (Not in D or E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C – G)	RETAINAGE (If variable rate)
	GRAND TOTAL								

CAUTION: You should sign an original AIA Contract Document, on which this text appears in RED. An original assures that changes will not be obscured.

2. CONTRACTOR WAGE AFFIDAVIT

A. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit to this Department, as requested and with final application for payment for work under said contract, affidavit in form as hereinafter set forth in this section. Affidavit affirms that all persons employed by contractor or by any of contractor's subcontractors on such contract have been paid no less than minimum wages established under Dane County Ordinances, Chapter 40, Subchapter II (Minimum Wage Ordinance) and in effect at date of execution of contract, that full payment of wages earned has been made, and that no rebates either directly or indirectly have been made. Form of such affidavit is included in this section.

B. Form should be included with a copy of the final contract invoice forwarded to your contract representative at Dane County.

DANE COUNTY, WISCONSIN

CONTRACTOR WAGE AFFIDAVIT

COMPANY NAME: _____

ADDRESS: _____

_____

CONTRACT NO.: _____ DIVISION(S) OF WORK: _____

AFFIDAVIT

STATE OF WISCONSIN)
) ss.
DANE COUNTY)

I, _____, being
name and title of person signing affidavit
first duly sworn at _____,
city & state of company incorporation
on oath, depose and say that with respect to the payment of the persons employed by the

_____, subcontractors on the _____
contractor company name division(s) of work
_____, at the _____
building or site of project
that during the period commencing _____, and ending _____
date date
all persons employed on said project have been paid the full wages earned, that no rebates have been or will be made either directly or indirectly by said contractor or subcontractor from the full weekly wages earned by any person, and that no deductions have been made either directly or indirectly from the full weekly wages earned by any person, other than authorized legal deductions (including taxes such as Federal Income Withholding and Social Security, State and

_____,
state any other legal deductions such as union dues, unemployment insurance, 401k contributions, etc., or fill in "N/A"
and that there is full compliance with the provisions and intent of the requirements of Dane County Ordinances, Chapter 40, Subchapter II (Minimum Wage Ordinance). This affidavit is made to induce Dane County to approve the application for payment to which this affidavit is attached.

_____
Contractor Company Name

_____ _____
Signature Title

Sworn to before me this ____ day of _____, 20__.

_____ My Commission expires _____
Notary Public Date

SECTION 01 00 00

BASIC REQUIREMENTS

PART 1 GENERAL

1.1 SECTION SUMMARY

A. Section Includes:

1. Section Summary
2. Summary of the Work
3. Contractor Use of Premises
4. Applications for Payment
5. Change Procedures
6. Alternates
7. Coordination
8. Cutting and Patching
9. Conferences
10. Progress Meetings
11. Submittal Procedures
12. Proposed Products List
13. Shop Drawings
14. Product Data
15. Samples
16. Manufacturers' Instructions
17. Manufacturers' Certificates
18. Quality Assurance / Quality Control of Installation
19. References
20. Interior Enclosures
21. Protection of Installed Work
22. Parking
23. Staging Areas
24. Occupancy During Construction and Conduct of Work
25. Protection
26. Progress Cleaning
27. Products
28. Transportation, Handling, Storage and Protection
29. Product Options
30. Substitutions
31. Starting Systems
32. Demonstration and Instructions
33. Contract Closeout Procedures
34. Final Cleaning
35. Adjusting
36. Operation and Maintenance Data
37. Spare Parts and Maintenance Materials
38. As-Built and Record Drawings and Specifications

1.2 SUMMARY OF THE WORK

A. Project Description: Perform the Work as specified and detailed in Construction Documents package. Contractor to provide construction services for remodeling of the former Chamber of Commerce building to create a Day Resource Center for Dane County.

B. Work by Owner: Abatement. Light fixture Type G & Type H provided by Dane County, installed and wired by electrical contractor, refer to E600.

C. Permits: Prior to commencement of the Work, Contractor to secure any and all necessary permits for completion of the Work and facility occupancy.

D. Diggers Hotline:
1. It is General Contractor's responsibility to contact Diggers Hotline to have all utility locations marked prior to excavation and planning an excavation in a timely manner so as not to delay the Work.
2. Diggers Hotline shall also be used to obtain information on safe working clearances from overhead lines.
3. Completely comply with all requirements of each affected utility company.
4. It is General Contractor's responsibility to contact & hire private utility locating services if necessary.

1.3 CONTRACTOR USE OF PREMISES

A. Limit use of premises to allow work by Contractors or Subcontractors and access by Owner.

B. Coordinate utility outages and shutdowns with Owner

C. Coordinate work times with Owner, typical work hours will be 7:30 a.m. through 6:00 p.m.

1.4 APPLICATIONS FOR PAYMENT

A. Submit two (2) original copies with "wet" signatures of each application on AIA G702™ and G703™ forms or approved contractors invoice form.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Payment Period: Monthly

D. Submit Applications for Payment to Public Works Project Manager for approval & processing for payment.

1.5 CHANGE PROCEDURES

A. Contractor's costs for Products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Change Orders authorizing expenditure of funds from contingency allowance.

1.6 ALTERNATES

A. Not Applicable.

1.7 COORDINATION

A. Coordinate scheduling, submittals, and work of various sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements.

B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.

C. Coordinate space requirements and installation of mechanical and electrical work that are indicated diagrammatically on Drawings.

D. Public Works Project Engineer may choose to videotape site or workers as the Work progresses.

1.8 CUTTING AND PATCHING

A. Employ a skilled and experienced installer to perform cutting and patching new work; restore work with new Products.

B. Submit written request in advance of cutting or altering structural or building enclosure elements.

C. Fit work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

D. Refinish surfaces to match adjacent finishes.

1.9 CONFERENCES

A. There will be pre-bid conference for this project; see Instructions to Bidders.

B. Contractor shall submit Construction Schedule at pre-construction meeting.

C. When required in individual Specification section, convene a pre-installation conference at project site prior to commencing work of Section.

1.10 PROGRESS MEETINGS

A. Schedule and administer meetings on-site throughout progress of the Work at of one (1) per week with Public Works Project Engineer].

B. Preside at meetings, record minutes, and distribute copies within two (2) business days to those affected by decisions made.

C. Owner shall schedule and administer meetings throughout progress of the Work at minimum of one (1) per week.

D. Owner shall preside at meetings, record minutes, and distribute copies within two (2) business days to those affected by decisions made.

1.11 SUBMITTAL PROCEDURES

A. Submittal form to identify Project, Contractor, Subcontractor or supplier; and pertinent Construction Documents references.

B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction work, and coordination of information is in accordance with requirements of the Work and Construction Documents.

C. Identify variations from Construction Documents and Product or system limitations that may be detrimental to successful performance of completing the Work.

D. Revise and resubmit submittals as required; identify all changes made since previous submittal.

1.12 PROPOSED PRODUCTS LIST

A. Within fifteen (15) business days after date of Award of Contract, submit complete list of major Products proposed for use, with name of manufacturer, trade name, and model number of each Product.

1.13 SHOP DRAWINGS

A. Submit number of copies that Contractor requires, plus three (3) copies that shall be retained by Public Works Project Manager.

1.14 PRODUCT DATA

A. Submit number of copies that Contractor requires, plus two (2) copies that shall be retained by Public Works Project Manager.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this Project.

1.15 SAMPLES

A. Submit samples to illustrate functional and aesthetic characteristics of Product.

B. Submit samples of finishes from full range of manufacturers' standard colors, textures, and patterns for Architect/Engineer and Public Works Project Manager's selection.

1.16 MANUFACTURERS' INSTRUCTIONS

A. When specified in individual Specification sections, submit manufacturers' printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.

1.17 MANUFACTURERS' CERTIFICATES

A. When specified in individual Specification sections, submit manufacturers' certificate to Public Works Project Manager for review, in quantities specified for Product Data.

B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.18 QUALITY ASSURANCE / QUALITY CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply fully with manufacturers' instructions.

C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.19 REFERENCES

A. Conform to reference standard by date of issue current as of date for receiving bids.

B. Should specified reference standard conflict with Construction Documents, request clarification from Public Works Project Manager before proceeding.

1.20 INTERIOR ENCLOSURES

A. Provide temporary partitions as required to separate work areas from Owner occupied areas, to prevent distribution of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

1.21 PROTECTION OF INSTALLED WORK

A. Protect installed work and provide special protection where specified in individual Specification sections.

1.22 PARKING

A. Arrange for temporary parking areas to accommodate construction personnel. Parking shall be available at the Work site.

1.23 STAGING AREAS

A. Coordinate staging areas with Public Works Project Manager prior to starting the Work.

B. On-site space for use as staging areas and storage of materials is limited and will be apportioned among various Contractors as their needs dictate with due regard for storage requirements of each Contractor. Each Contractor shall be responsible for safety of equipment and materials that are stored on site.

1.24 OCCUPANCY DURING CONSTRUCTION AND CONDUCT OF WORK

A. Areas of existing facility will be occupied during period when the Work is in progress. Work may be done during normal business hours (8:00 am to 4:30 pm), but confer with Owner, schedule work and store materials so as to interfere as little as possible with normal use of premises. Notify Owner when coring or similar noise making work is to be done and obtain Owner's written approval of schedule. If schedule is not convenient for Owner, reschedule and resubmit new times for Owner approval. Coring of floor along with other noisy work may have to be done on second and third shifts.

B. Work shall be done and temporary facilities furnished so as not to interfere with access to any occupied area and so as to cause least possible interference with normal operation of facility or any essential service thereof.

C. Contractor shall, at all times, provide approved, safe walkways and facility entrances for use by Owner, employees and public.

D. Contractor shall provide adequate protection for all parts of facility, its contents and occupants wherever the Work under this Contract is to be performed.

E. Contractor is responsible for providing & maintaining temporary toilet facilities.

F. Each Contractor shall arrange with Owner to make necessary alterations, do new work, make connections to all utilities, etc., at such times as will not cause interruption of utility services to facility. Contractor doing this work shall protect, cap, cut off and / or replace and relocate existing pipes, electrical work and other active utilities encountered which may interfere with new construction work.

G. New work in extension of existing work shall correspond in all respects with that to which it connects or similar existing work unless otherwise indicated or specified.
   1. Existing work shall be cut, altered, removed or replaced as necessary for performance of Contract obligations.

2. Work remaining in place, damaged or defaced by reason of work done under this Contract shall be restored equal to its condition at time of Award of Contract.
3. If removal of work exposes discolored or unfinished surfaces or work out of alignment, such surfaces shall be refinished or materials replaced as necessary to make continuous work uniform and harmonious.

1.25 PROTECTION

A. Contractor shall protect from injury all walks and driveways and pay for any damage to same resulting from insufficient or improper protection.

B. Contractor shall provide and maintain barricades & signage to prohibit public access to construction site.

1.26 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

1.27 PRODUCTS

A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components specifically identified for reuse.

B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by Construction Documents.

1.28 TRANSPORTATION, HANDLING, STORAGE AND PROTECTION

A. Transport, handle, store and protect Products in accordance with manufacturer's instructions.

1.29 PRODUCT OPTIONS

A. Where definite material is specified, it is not intentional to discriminate against "equal" product made by another manufacturer. Intention is to set definite standard of material quality.

B. Products and materials that are not specified, but have been approved for use by Public Works Project Manager shall be identified in addenda to all bidding contractors.

C. Requests for material or product substitutions submitted after Bid Due Date shall be considered. Owner reserves right to approve or reject substitutions based on Specification requirements and intended use.

1.30 SUBSTITUTIONS

A. Public Works Project Manager shall consider requests for Substitutions only within fifteen (15) calendar days after date of Public Works Construction Contract.

B. Document each request with complete data substantiating compliance of proposed Substitution with Construction Documents.

C. Submit three (3) copies of requests for Substitution for consideration. Limit each request to one (1) proposed Substitution.

D. Substitutions shall not change contract price established at Bid Due Date.

1.31 STARTING SYSTEMS

A. Provide written notification prior to start-up of each equipment item or system.

B. Ensure that each piece of equipment or system is ready for operation.

C. Execute start-up under supervision of responsible persons in accordance with manufacturers' instructions.

D. Submit written report that equipment or system has been properly installed and is functioning correctly.

1.32 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of Products to Owner's personnel prior to date of final inspection.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed-upon times, at designated location.

C. Owner may choose to videotape demonstration session; demonstration and demonstrator shall be to level of satisfaction of Owner.

1.33 CONTRACT CLOSEOUT PROCEDURES

A. Submit written certification that Construction Documents have been reviewed, the Work has been inspected, and the Work is complete in accordance with Construction Documents and ready for Public Works Project Manager's inspection.

B. Submit final Application for Payment identifying total adjusted Contract Sum / Price, previous payments, and amount remaining due.

1.34 FINAL CLEANING

A. Execute final cleaning prior to final inspection.

B. Clean interior and exterior surfaces exposed to view.

C. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.35 ADJUSTING

A. Adjust operating Products and equipment to ensure smooth and unhindered operation.

1.36 OPERATION AND MAINTENANCE MANUAL

A. Provide operation and maintenance manual for all mechanical and electrical equipment and systems supplied and installed in the Work.

1.37 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual Specification Sections.

B. Deliver to the Work site and place in location as directed.

1.38 AS-BUILT AND RECORD DRAWINGS AND SPECIFICATIONS

A. Contractor-produced Drawings and Specifications shall remain property of Contractor whether Project for which they are made is executed or not. Contractor shall furnish Architect / Engineer with original marked up redlines of Construction Documents' drawings and specifications that shall include all Addendums, Change Orders, Construction Bulletins, on-site changes, field corrections, etc. These are project As-Built Drawings & Specifications. Record Drawings & Specifications shall be created from these As-Builts by Architect/Engineer.

B. Architect / Engineer shall update original Construction Documents to include all Addendums & any other changes including those provided by Contractor in As-Built Drawings & Specifications. These updates are project Record Drawings & Specifications.

C. Architect / Engineer shall furnish Public Works Project Manager with Record Drawings as detailed in Professional Services Agreement.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT, DISPOSAL & RECYCLING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Summary
2. Waste Management Goals
3. Construction and / or Demolition Waste Management
4. Waste Management Plan
5. Reuse
6. Recycling
7. Materials Sorting and Storage On Site
8. Lists of Recycling Facilities Processors and Haulers
9. Waste Management Plan Form

B. Related Sections:
1. Section 01 00 00 - Basic Requirements
2. Section 02 41 19 – Selective Structure Demolition

1.2 WASTE MANAGEMENT GOALS

A. Dane County requires that as many waste materials as possible produced as result of this project be salvaged, reused or recycled in order to minimize impact of construction waste on landfills and to minimize expenditure of energy and cost in fabricating new materials. Additional information may be found in Dane County Green Building Policy, Resolution 299, 1999-2000.

1.3 CONSTRUCTION AND / OR DEMOLITION WASTE MANAGEMENT

A. All construction and demolition waste suitable for recycling must go to Dane County Construction & Demolition Recycling Facility located at 7102 US Hwy 12, Madison, located across from Yahara Hills Golf Course. This facility can receive mixed loads of construction and demolition waste. For complete list of acceptable materials see www.countyofdane.com/pwht/recycle/CD_Recycle.aspx.

B. Dane County Landfill, also at 7102 US Hwy 12, Madison, must receive all other waste from this project. www.countyofdane.com/pwht/recycle/landfill.aspx.

1.4 WASTE MANAGEMENT PLAN

A. Contractor shall develop Waste Management Plan (WMP) for this project. Dane County's Special Projects & Materials Manager may be contacted with questions. Outlined in RECYCLING section of this specification are examples of materials that can

B. Contractor shall complete WMP and include cost of recycling / reuse in Bid. WMP will be submitted to Public Works Project Manager within fifteen (15) business days of Bid Due date. Copy of blank WMP form is in this Section. Submittal shall include cover letter and WMP form with:

1. Information on:
    a. Types of waste materials produced as result of work performed on site;
    b. Estimated quantities of waste produced;
    c. Identification of materials with potential to be recycled or reused;
    d. How materials will be recycled or reused;
    e. On-site storage and separation requirements (on site containers);
    f. Transportation methods; and
    g. Destinations.

1.5 REUSE

A. Contractors and subcontractors are encouraged to reuse as many waste materials as possible. Salvage should be investigated for materials not reusable on site.

1.6 RECYCLING

A. These materials must be recycled at Dane County Construction & Demolition Recycling Facility:

1. Wood.
2. Wood Pallets.
3. PVC Plastic (pipe, siding, etc.).
4. Asphalt & Concrete.
5. Bricks & Masonry.
6. Vinyl Siding.
7. Cardboard.
8. Metal.
9. Unpainted Gypsum Drywall.
10. Shingles.

B. These materials can be recycled elsewhere in Dane County area:

1. Fluorescent Lamps.
2. Foam Insulation & Packaging (extruded and expanded).
3. Carpet Padding.
4. Barrels & Drums.

C. All materials must be recycled at WDNR permitted waste processing facilities that adhere to all State Statutes.

1.7 MATERIALS SORTING AND STORAGE ON SITE

A. Contractor shall provide separate containers for recyclable materials. Number of containers will be dependent upon project and site conditions.

B. Contractor shall provide on-site locations for subcontractors supplied recycling containers to help facilitate recycling.

C. Mixed loads of recycled materials are allowed only per instructions at www.countyofdane.com/pwht/recycle/CD_Recycle.aspx.

1.8 LISTS OF RECYCLING FACILITIES PROCESSORS AND HAULERS

A. Refer to www.countyofdane.com/pwht/recycle/CD_Recycle.aspx for information on Dane County Construction & Demolition Recycling Facility.

B. Web site www.countyofdane.com/pwht/recycle/categories.aspx lists current information for Dane County Recycling Markets. Contractors can also contact Allison Hackner at 608/266-4990, or local city, village, town recycling staff listed at site www.countyofdane.com/pwht/recycle/contacts.aspx. Statewide listings of recycling / reuse markets are available from UW Extension at https://www.uwgb.edu/shwec/.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

WASTE MANAGEMENT PLAN FORM

Contractor Name: _____

Address: _____

_____

Phone No.: _____ Recycling Coordinator: _____

MATERIAL	ESTIMATED QUANTITY	DISPOSAL METHOD (CHECK ONE)	RECYCLING / REUSE COMPANY OR DISPOSAL SITE
Salvaged & reused building materials	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Wood	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Wood Pallets	_____ units	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
PVC Plastic	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Asphalt & Concrete	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Bricks & Masonry	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Vinyl Siding	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Cardboard	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Metals	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Unpainted Gypsum / Drywall	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Shingles	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Fluorescent Lamps	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Foam Insulation	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Carpet Padding	_____ cu. ft. _____ lbs.	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Barrels & Drums	_____ units	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____

WASTE MANAGEMENT PLAN FORM

Glass	_____ cu. yds. _____ tons	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____
Other	_____	_____ Recycled _____ Reused _____ Landfilled _____ Other	Name:_____

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the demolition of such features as required in these specifications and on the drawings. Included are the following:
   1. Protect portions of building adjacent to or affected by selective demolition. Take appropriate measures to protect existing facilities operations against dust contamination. Materials shall be removed from the existing building without disruption to the Owner or facility operations.
   2. Remove and legally dispose of demolished materials off-site.
   3. Demolish and salvage for reuse those items noted on the drawings.
   4. Recycle construction and demolition waste including metals and cardboard. Recycle carpet and ceiling tiles if practicable.

1.03 RELATED WORK

A. Resilient Flooring, Section 09 65 00.
B. Special Concrete Floor Finishes, Section 03 36 02.
C. Metal Fabrication, Section 05 50 00.
D. Recycling, Section 01 74 19.

1.04 SUBMITTALS

A. For utilities or other services requiring removal or abandonment in-place, submit materials documenting completion of such work.

B. Submit copies of records documenting recycling of demolition materials from the site.

1.05 DEFINITIONS

A. “Remove”: Remove and legally dispose of items, except those indicated to be reinstalled.

B. “Remove and Reinstall”: Remove items indicated; clean, service and otherwise prepare them for reuse; store and protect against damage. Reinstall in the same location or in locations indicated.

C. “Existing to Remain”: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the A/E, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

1.06 QUALITY ASSURANCE

A. Comply with governing codes and regulations.

1.07 RECORD DRAWINGS

A. Maintain record drawings showing actual locations of utilities and other features encountered, and any deviations from the original design. Show actual limits of removal and demolition.

1.08 SAFETY

A. Verify that all gas and electrical utilities have been abandoned or disconnected and associated hazards mitigated, prior to beginning any demolition.

B. Take all necessary precautions while dismantling piping containing gas, gasoline, oil or other explosive or toxic fluids or gases. Purge lines and contain materials in accordance with all applicable regulations. Store such piping outdoors until fumes are removed.

C. Maintain a clean and orderly site. Remove debris at end of each workday.

D. If hazardous materials are not anticipated, but encountered, terminate operations and contact the Owner immediately. Follow all applicable local, state and federal regulations pertaining to hazardous materials.

1.09 PERMITS

A. Unless otherwise noted, Contractor shall be responsible for obtaining and paying for all permits necessary to complete demolition work.

B. If necessary, file and maintain Notification of Demolition and/or Renovation and Application for Permit Exemption (WDNR Form 4500-113) in accordance with the Wisconsin Administrative Code Chapter NR447.

1.010 DISCONNECTION OF SERVICES

A. Prior to starting removal and/or demolition operations be responsible and coordinate disconnection of all existing utilities, communication systems, alarm systems and other services.

B. Disconnect all services in manner which insures continued operation in facilities not scheduled for demolition.

C. Disconnect all services in manner which allows for future connection to that service.

D. Disconnect services to equipment at unions, flanges, valves, or fittings wherever possible.

1.011 REMOVAL/SALVAGING OF ITEMS

A. Carefully remove all items that are scheduled to be salvaged.

B. Secure salvaged items to allow for future movement; provide pallets, skids and other devices as necessary. Secure all loose parts.

C. Provide crates, padding, tarps and other measures necessary to protect salvaged items during storage. Store items in secure location, safe from vandalism, weather, dust and other adverse elements.

D. Where salvaged items are indicated to be turned over to Owner, deliver to location on property where designated by Owner.

E. Where indicated to be incorporated into new work, store the salvaged item in secure location until trade responsible for re-installation mobilizes his equipment and storage facilities to the site, or otherwise accepts responsibility for the salvaged item.

F. Items of salvage value that are not to be returned to the Owner or the A/E shall be removed from the structure. Storage or sale of such salvage items at project site is prohibited.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Use Contractor's normal equipment for demolition purposes and which meets all safety requirements imposed on such equipment.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine all areas of work, verify all existing conditions, and report any unsatisfactory conditions.

3.02 PROTECTION OF EXISTING WORK AND FACILITIES

A. Verify the locations of, and protect, any building elements, utilities, and all other such facilities that are intended to remain or be salvaged.

B. Make such explorations and probes as necessary to ascertain any required protection measures that shall be used before proceeding with demolition.

C. Take all measures necessary to safeguard all existing work and facilities which are outside the limits of the work.

D. Furnish and install temporary enclosures or other barriers as shown on the plans or as otherwise necessary to protect existing features.

E. Protect adjacent interior areas from collection of dust and noxious fumes. Seal HVAC system ductwork and grilles to prevent contamination of building or mechanical systems.

F. Provide protection for workers, public, adjacent construction and occupants of existing building(s).

G. Report damage of any facilities or items scheduled for salvaging to the Owner.

H. Repair or replace any damaged facilities that are not scheduled for demolition.

I. Do not damage building elements and improvements indicated to remain.

J. Do not close or obstruct walks, drives, other occupied or used spaces, or facilities without the written permission from the A/E and the authorities having jurisdiction.

K. Do not interrupt utilities serving occupied facilities without permission from the A/E and authorities having jurisdiction. If necessary, provide temporary utilities.

L. Cease operations if public safety or remaining structures are endangered. Perform temporary corrective measures until operations can be continued properly.

M. If necessary, provide additional materials to protect existing building components that are to remain.

N. Where necessary to prevent collapse of any construction, install temporary shores, struts or bracing. Do not commence demolition work until all temporary construction is complete.

O. Take precautions to guard against movement, settlement or collapse of any surrounding construction designated to remain and be liable for any such movement, settlement or collapse.

3.03 DEMOLITION

A. Remove all equipment, fixtures and other materials scheduled for salvage prior to beginning demolition operations.

B. Abandon gas, electric and communication utilities in accordance with local utility company requirements, or applicable substantive requirements if considered private.

C. Remove all sealant, fasteners and damaged or rotten blocking from existing construction to remain where demolition occurs.

3.04 RECYCLING

A. Transport and dispose all demolition waste in accordance with local, state, and federal guidelines and Section 01 74 19 Recycling.

3.05 SCHEDULE

A. Items to be removed shall be as indicated on the Drawings.
   1. Items to be stored and reinstalled.
   2. Items to be removed from site by Contractor.

B. Items to remain (if clarification required).

3.06 CLEANING

A. All adjacent areas shall be broom cleaned and ready to receive new construction.

B. Remove from the site all debris resulting from the Work of this Section.

END OF SECTION 02 41 19

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, accessories, mixture design, placement procedures, and finishes.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete mixture.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Field quality-control test reports.

E. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
2. Admixtures.
3. Form materials and form-release agents.
4. Steel reinforcement and accessories.
5. Fiber reinforcement.
6. Curing compounds.
7. Floor and slab treatments.
8. Vapor retarders.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities.

B. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

PART 2 - PRODUCTS

2.01 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.02 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.03 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
   a. Fly Ash: ASTM C 618, Class C.
   b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
2. Normal-Weight Aggregates: ASTM C 33 Free of materials with deleterious reactivity to alkali in cement.

B. Water: ASTM C 94/C 94M and potable.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

Concrete Mix Design Schedule							
Type of construction	28 day strength (psi) (ASTM C39)	Max Slump +/- 1" (inches) (ASTM C143) (D)	Maximum aggregate size (inch)	Percent of air entraining +/- 1-1/2%	Maximum water/cementitious material ratio	Minimum Cementitious Materials per cubic yard	Additional Comments
Footings	3000	4	1-1/2	--	--	--	(A)

Comments:

A) Maximum replacement of cementicious materials by weight flyash 25%, slag 50%, Limit total replacement of cementicious materials to 50%
B) Maximum replacement of cementicious materials by weight flyash 15%, slag 30%, Limit total replacement of cementicious materials to 30%,
C) Provide 4-1/2% Air Entrainment At Exposed Conditions
D) Slump may be increased when chemical admixtures are used, provided that the admixture treated concrete has the same or lower water-cement ratio and does not exhibit segregation potential or excessive bleeding.
E) Concrete supplier and finisher shall coordinate approximate set times of proposed mix design under various weather conditions and adjust mix design as necessary to assure set time is acceptable to complete placing and finishing of slab in a timely manner.

2.04 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.05 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 FORMWORK

A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Chamfer exterior corners and edges of permanently exposed concrete.

3.02 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.03 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.04 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

3.05 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

C. Cold-Weather Placement: Comply with ACI 306.1.

D. Hot-Weather Placement: Comply with ACI 301.

3.06 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

3.07 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

END OF SECTION 03 30 00

SECTION 03 36 02

SPECIAL CONCRETE FLOOR FINISHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS:

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. This section includes the following.
1. Filling joints, applying smoothing and resurfacing compound, applying Stain, Sealer, and Hardener, and polishing concrete to specified finish level.

1.03 RELATED WORK

A. Section 09 68 00, Carpet, for Metal Transition Strip.

1.04 REFERENCES

A. American Society for Testing and Materials:
1. ASTM-C779, Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
2. ASTM G23-81, Ultraviolet Light & Water Spray
3. ASTM C805, Impact Strength

B. American Concrete Institute
1. ACI 302. 1R-89, Guide for Concrete Floor and Slab Construction

C. Other Test:
1. Reflectivity

1.05 SUBMITTALS

A. Submit in accordance with general conditions of this contract.

B. Product data:
1. Submit special concrete finishes manufacturer's specifications and test data.
2. Submit special concrete finishes describing product to be provided, giving manufacturer’s name and product name for the specified material proposed to be provided under this section.
3. Submit special concrete finishes manufacturer's recommended installation procedures; which when app roved by the Architect, will become the basis for accepting or rejecting actual installation procedures used on the work.
4. Submit special concrete finishes technical data sheet giving descriptive data, curing time, and application requirements.
5. Submit special concrete finishes manufacturer’s Material Safety Data Sheet (MSDS) and other safety requirements.
6. Follow all special concrete finishes published manufacturer’s installation instructions.

C. Test Reports:

1. Provide certified test reports, prepared by an independent testing laboratory, confirming compliance with specified performance criteria.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled workmen who are thoroughly trained and experienced in the necessary craft.
   2. The special concrete finish manufacturer shall certify applicator.
   3. Applicator shall be familiar with the specified requirements and the methods needed for proper performance of work of this section.

B. Manufacturer's Certification:
   1. Provide letter of certification from concrete finish manufacturer stating that installer is certified applicator of special concrete finishes, and is familiar with proper procedures and installation requirements required by the manufacturer.

C. Mock-ups:
   1. Apply mock-ups of each type finish, to demonstrate typical joints, surface finish, color variation and standard of workmanship.
      a. Provide 3 (three) 10 square foot on-site mockups that provide 3 (three) varied levels of dye (lightness/darkness or density of color) in the location indicated or if not indicated, as directed by the Architect or Owner Representative. Install colors on an area with both of new concrete (see plan for accent color location) and on existing slab on grade.
      b. Build mock-ups approximately 50 square feet of the selected value noted above in the location indicated or if not indicated, as directed by the Architect or Owner Representative.
      c. Notify Architect or Owner Representative seven days in advance of dates and times when mock-ups will be constructed.
      d. Obtain from the Architect or Owner Representative approval of mock-ups before starting construction.
      e. If the Architect or Owner Representative determines that mock-ups do not meet requirements, demolish and remove them from the site and cast others until mock-ups are approved.
      f. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed work.
      g. Approved mock-ups may become part of the completed work if undisturbed at time of substantial completion.
      h. Field verify if existing brick pavers exist and provide mock up at existing pavers.

D. Protection:
   1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from the concrete surface. Prevention is therefore essential.
      a. All hydraulic powered equipment must be diapered to avoid staining of the concrete.
      b. No trade will park vehicles on the inside slab. If necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
      c. No pipe cutting machine will be used on the inside floor slab.
      d. Steel will not be placed on interior slab to avoid rust staining.
      e. Acids and acidic detergents will not come into contact with slab.
      f. All trades informed that the slab must be protected at all times.

E. Pre-Installation Conference:
   1. Conduct conference at project site prior to commencing installation.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original containers, with seal's unbroken, bearing manufacturer labels indicating brand name and directions for storage.

B. Dispense special concrete finish material from factory numbered and sealed containers. Maintain record of container numbers.

1.08 PROJECT CONDITIONS

A. Environmental limitations:
   1. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.
      a. Concrete Floor Flatness rating recommended at least 40, where possible.
      b. Concrete Floor Levelness rating recommended at least 30, where possible.
      c. Concrete must be cured a minimum of 45 days or as directed by the manufacturer before application of hardening/sealing system can begin.
      d. Application of hardening/sealing shall take place 10 days prior to installation of equipment and substantial completion, thus providing a complete, uninhibited concrete slab for application.

B. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
   1. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

PART 2 - PRODUCTS

2.01 MATERIALS AND MANUFACTURERS

B. Sealer: CF-1
   1. Prosoco Consolideck LS Sealer Hardener Densifier
      a. Manufacturer's recommended stain. Color: As selected by Architect from manufacturer's full line of colors, minimum of 3.
      b. Or approved equal.

C. Sealer Top Coat:
   1. Prosoco Polish Guard
   2. Or approved equal.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS:

A. Examine substrate, with installer present, for conditions affecting performance of finish. Correct conditions detrimental to timely and proper work. Do not proceed until unsatisfactory conditions are corrected.

B. Fill joints with a poly-urea flexible joint filler.

C. Install trowel-grade concrete repair mortar and high performance underlayment: polymer-modified two-component smoothing and resurfacing compound at irregular areas requiring repair or openings to be patched. Miracote MiraPatch RM1 or approved equal. Submit aggregate for Architect approval to match existing.

D. Prior to application, verify that floor surfaces are free of construction laitance.

3.02 APPLICATION

A. CF-1 Sealing, Hardening and Polishing of Concrete Surface
   1. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.
   2. Application is to take place at least 10 days prior to racking and other in-store accessory installation, thus providing a complete, uninhibited concrete slab for application.
   3. Only a certified applicator shall apply hardening/sealing system.
   4. Applicable procedures must be followed as recommended by the product manufacturer and required to match approved test sample.
   5. Achieve waterproofing, hardening, dust-proofing, and abrasion resistance of the surface without changing the natural appearance of the concrete, except for the sheen.
   6. Polish to required sheen level as determined by A/E. Provide ADA slip resistance.

3.03 WORKMANSHIP AND CLEANING:

A. Remove splatter from adjoining surfaces as needed.

B. Repair damages to surface caused by cleaning operation.

C. Remove debris from jobsite.
   1. Dispose of materials in separate, closed containers in accordance with local regulations.

3.04 PROTECTION:

A. Protect finished work until fully cured in accordance with manufacturer's recommendations.

END OF SECTION 03 36 02

SECTION 04 05 19

MASONRY ANCHORAGE AND REINFORCING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Single Wythe Wall Reinforcing

B. Composite/Veneer Wall Reinforcing

C. Anchors

D. Compression Seals

E. Lintel Reinforcing

1.03 RELATED WORK

A. Section 01 74 19, Recycling

B. Section 04 10 00, Mortar and Masonry Grout

C. Section 04 20 00, Unit Masonry

D. Section 07 21 00, Building Insulation

1.04 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.

B. Manufacturer's Literature
   1. Manufacturer's product literature for each accessory specified.

1.05 QUALITY ASSURANCE

A. Anchorage and reinforcing system, accessories, imbeds, anchors, steel angles, etc. for architectural precast concrete shall be designed and engineered by the architectural precast concrete manufacturer and reviewed by the A/E.

B. Anchorage and reinforcing system, accessories, imbeds, anchors, steel angles, etc. for cast stone shall be designed and engineered by the cast stone manufacturer and reviewed by the A/E.

C. Provide Engineer approved design calculations for all anchorage and reinforcing.

PART 2 - PRODUCTS

2.01 ACCESSORIES, GENERAL

A. Materials: Including, but not limited to the following, ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.

B. Provide hot-dipped galvanized accessories unless noted otherwise.
   1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with ASTM A 153/A 153M, Class B-2 coating.
   2. Galvanized Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 (Z180) zinc coating.

C. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90 degrees and extend 2 inches parallel to face of veneer.

D. Adjustable Anchors for Connecting to Structural Concrete or Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

E. Post-installed Anchors: Torque-controlled expansion anchors.

F. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.02 REINFORCING, GENERAL

A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.

B. Provide hot-dipped galvanized reinforcing, ASTM A153, Class B2, unless noted otherwise.

C. Provide stainless steel reinforcing at all cast stone assemblies.

   1. ASTM A167 Stainless Steel, ASTM A580 Stainless Steel.

D. Furnish prefabricated corners and tees.

E. Concrete masonry walls shall be reinforced at every other bed joint with joint reinforcement.

2.03 SINGLE WYTHE WALL REINFORCING

A. 9 gauge, ladder type joint reinforcement.
   1. Hohmann & Barnard No. 220.
   2. Or approved equal.

B. Wall ties/anchors for anchorage to columns.
   1. Hohmann & Barnard 360 Gripstay ™: 12 gauge, with 363 Flexible Gripstay™ Channel Slot Anchor Head: 14 gauge, 3/16" wire.
   2. Or approved equal.

2.04 VENEER ANCHORS (BRICK VEENEER TO METAL STUD, MASONRY, CONCRETE OR WOOD BACK-UPS)

A. Hohmann & Barnard DW-10HS Veneer Anchor
   1. Hot galvanized
   2. 12 gauge
   3. Tie diameter: 3/16”
   4. Tie Length: Varies; refer to drawings for depth of wall system. Provide manufacturer recommended length for veneer wall system depth.

B. Or approved equal.

2.05 FASTENERS

A. Use predrilled Tapcon fastener at concrete backup, spot welded connection at steel backup.

2.06 MISCELLANEOUS

A. Lintel Reinforcing: Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

B. Compression Seal: Flexible semi-closed urethane, Brock White No. 4290 Shok Pak
   1. Or approved equal.
      a. Installed 1/2" thicker than joint thickness.

C. Compressible Filler:
   1. Emseal 20H,
   2. Willseal,
   3. Or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF ACCESSORIES IN MASONRY

A. Fabricate wall flashing to conform to actual dimensions of wall and as follows:

   1. Exposed portion of flashing, when installed, shall break surface of wall uniformly.

   2. Concealed portion of flashing shall have a minimum 4” vertical back dam; bend between back dam and horizontal shall be slightly greater than 90 degrees. End dams shall be a minimum of 2” in height.

   3. Slope flashing to drain with masonry grout under horizontal portion of flashing.

   4. Exposed portion of flashing shall have a ¾” hemmed drip.

   5. Provide prefabricated continuous pieces fabricated specifically for each corner; pieces shall be a minimum of 18” in length, in both directions from the corner.

   6. Notch and lap joints 3" between sections. Apply a continuous bead of sealant within the lap.

B. See Section 04 20 00 for installation of accessories.

END OF SECTION 04 05 19

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SECTION 04 10 00

MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Mortar.

B. Masonry Grout.

1.03 RELATED WORK

A. Masonry Accessories: Section 04 05 19.

B. Unit Masonry: Section 04 20 00.

1.04 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.

1. Test Reports: Submit information copies of all test reports in duplicate to the Architect/Engineer.
2. Refer to Section 04 20 00 - Unit Masonry for pre-installation conference requirements.
3. Pointing Mortar: Submit sets of mortar for pointing in the form of sample mortar strips, 6 inches long by 1/4 inch wide, set in aluminum or plastic channels.
    a. Have each set contain a close color range of at least five Samples of different mixes of colored sands and cements that produce a mortar matching A/E's sample when cured and dry.
    b. Submit with precise measurements on ingredients, proportions, gradations, and sources of colored sands from which each Sample was made.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Portland Cement: ASTM C150, Type 1 or II, except Type III may be used for cold-weather construction.

B. Hydrated Lime: ASTM C207, Type S.

C. Aggregate for Mortar: ASTM C144.
1. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.

D. Water: Potable.

E. Antifreeze Compounds: Not allowed.

F. Masons Cement: Not allowed.

G. Chloride mixtures: Not allowed.

H. Air entrainment: Not allowed

I. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Davis Colors; True Tone Mortar Colors.
   b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
   c. Solomon Colors, Inc.; SGS Mortar Colors.

2. Grout Color: As selected by Architect from manufacturer's full line.

2.02GROUT MATERIALS

A. Grout: ASTM C476, Slump 8-9 inches.

B. Aggregate for Grout: ASTM C 404.

2.03MEASURING AND MIXING

A. Measure and mix in accordance with ASTM C270.

B. Mix mortar as required for immediate use only and discard any mixed for a period exceeding 2-1/2 hours.

C. Mortar Proportions by Volume.

Mortar Type	Parts by Volume (Port.Cem.)	Parts by Volume (Lime)	Aggregate measured in a damp, loose condition
S	1	over 1/4 to 1/2	Not less than 2-1/4 and not more than 3 time the sum of the volumes of the Cement and lime used.

A. The specific proportions of the mortar materials shall be controlled and accurately maintained during the entire progress of the work.

B. Thoroughly mix cementitious materials and aggregates with the amount of water to produce satisfactory workability. All mortar shall be machine mixed.

C. Contractor's Option: Spec Mix, Inc. (licensed manufacturers only) using the same materials and proportions of material specified above.
1. Licensed Manufacturers:
   a. Wisconsin: Twin City Concrete Products [800-642-3887]
   b. Quikrete Wisconsin [800-657-0789]
   c. Tews Company [414-447-8400]

2. Material shall be delivered to jobsite in manufacturer's prepackaged bags indicating manufacturer's name, materials and proportions of materials.
3. Use manufacturer's proprietary dispensing silo.

D. Mortar at existing brick repair to match existing mortar and to be a compatible material. Verify in field, submit mortar mix and samples.

PART 3 - EXECUTION

3.01 APPLICATION

A. See Section 04 20 00 for application.

3.02 FIELD QUALITY CONTROL

A. Determine the water retentivity and compressive strength of mortar in accordance with the test procedures described in ASTM C780.

B. Mix mortar for testing in the laboratory from representative samples of mortar materials and proportions to be used in the construction.

C. Make compressive strength tests on one set of samples before starting masonry work.

END OF SECTION 04 10 00

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SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Concrete Masonry.

B. Glazed Structural Tile.

1.03 RELATED WORK

A. Masonry Anchoring and Reinforcing: Section 04 05 19.

B. Mortar and Masonry Grout: Section 04 10 00.

C. Sheet Metal Flashing and Trim: Section 07 62 00.

D. Joints Sealants: Section 07 92 00.

E. Toilet and Bath Accessories: 10 28 00.

1.04 QUALITY ASSURANCE

A. Masonry Units: From one manufacturer for each kind of unit required.

B. Prior to commencement of work conduct a pre-installation conference with the Architect/Engineer and Owner Project Representative in accord with the General Conditions of the Contract. Obtain Architect/Engineer acceptance of work before continuing work.

C. Masonry Units: From one manufacturer for each kind of unit required.

D. Production and construction of concrete masonry shall be in accordance with the building code requirements for concrete masonry structure, ACI (American Concrete Institute) 530.1, latest edition, and the NCMA technical guide.

E. Inspected Workmanship stress values were used in design. Appropriate inspection shall be required.

1.05 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
   1. Samples: Minimum 16”x 16” of each type of exposed masonry unit. Include in each set of samples the full range of exposed colors and textures to be expected in completed work.
   2. Sealant Materials: See Division 07 Section "Joint Sealants."

1.06 PROJECT CONDITIONS

A. During erection, cover top of walls with waterproof sheeting at end of each day's work. Cover partially completed structures when work is not in progress.

B. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

C. Do not apply uniform floor or roof loading for at least 12 hours after building masonry walls or columns.

D. Do not apply concentrated loads for at least 3 days after building masonry walls or columns.

E. Staining: Prevent grout or mortar or soil from staining the face of masonry to be left exposed or painted. Immediately remove grout or mortar in contact with such masonry. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

F. Protect sills, ledges and projections from droppings of mortar.

G. Cold Weather Protection:
   1. Do not lay masonry units which are wet or frozen.
   2. Remove any ice or snow formed on masonry bed by carefully applying heat until top surface is dry to the touch.
   3. Remove all masonry determined to be damaged by freezing conditions.
   4. Perform the following construction procedures while masonry work is progressing. Temperature ranges indicated below apply to air temperatures existing at time of installation except for grout. For grout, temperature ranges apply to anticipated minimum night temperatures. In heating mortar and grout materials, maintain mixing temperatures selected within 10ºF.
   5. 40ºF to 20ºF: Mortar:
      a. Heat mixing water and sand to produce mortar temperatures between 40ºF and 120ºF; maintain temperature of mortar on boards above freezing.
   6. Grout:
      a. Heat grout materials to 90 F to produce in-place grout temperature of 70ºF at end of work day.
   7. 25ºF and Below: Mortar:
      a. Heat mixing water and sand to produce mortar temperatures between 40ºF and 120ºF. Maintain temperature of mortar on boards above freezing.
   8. Grout: Heat grout materials to 90ºF to produce in-place grout temperature of 70ºF at end of work day.
   9. Masonry Units: Heat masonry units so that they are above 20ºF at time of laying.
      a. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40ºF for 24 hours after laying units.
      b. Protect completed masonry and masonry not being work on by maintaining air temperature above 40ºF on both sides of masonry for 72 hours after laying.

H. Hot Weather Protection:
   1. Protect masonry construction from direct exposure to wind and sun when erected in ambient air temperatures of 95ºF with relative humidity less than 50%.
   2. Masonry walls shall be adequately braced to resist wind forces until permanent design supports are in place and functional. The contractor shall design bracing.

1.02 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.

1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fire Performance Characteristics: Where fire-resistance ratings are indicated for unit masonry work, provide materials and construction which are identical to those of assemblies whose fire endurance has been determined by testing in compliance with ASTM E 119 by a recognized testing and inspecting organization or by another means, as acceptable to authority having jurisdiction.

2.02 CONCRETE MASONRY UNITS (CMU)

A. Size: Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.

B. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.

C. Standard: ASTM C90, Type II, normal weight.

D. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.

E. Admixtures: As approved by A/E. Calcium chloride or admixtures containing calcium chloride shall not be permitted.

F. Burnished Block Masonry Units

1. Manufacturer's standard units with nominal face dimensions of 16" long x 8" (15-5/8" x 7-5/8" actual), unless otherwise indicated.
2. Special Shapes: Provide where required for lintels, corners, jambs, sash, control joints, headers, bonding and other special conditions.
3. Standard: ASTM C90, Type II, normal weight.
4. Manufacturer: County Materials Corporation
5. Product Name: ACME Block and Brick Inc. honed finish
6. Color: Ground Face, color to be selected from manufacturer’s standard colors similar to Hershey Red or Cocoa.
7. Provide burnished returns on all exposed surfaces.
8. Dryblock added as per manufacturer’s recommendations.

2.03 CONCRETE AND MASONRY LINTELS

A. General: Provide either concrete or masonry lintels, at Contractor's option, complying with requirements below.

B. Concrete Lintels: Precast units matching concrete masonry units and with reinforcing bars indicated or required to support loads indicated.

C. Masonry Lintels: Made from bond beam concrete masonry units with reinforcing bars placed as indicated and filled with coarse grout.

2.04 GLAZED STRUCTURAL TILE

A. Manufacturers and Type: Stark Ceramics, Inc. 6T Series or approved substitute.

B. Standards: ASTM C126, Grade SS and ASTM C652, Grade SW, Type HBX.

C. Size 5-1/3”X12”, various depths. See drawings.

D. Colors:

1. Color 1: Color to be selected from manufacturer’s full range.

E. Glazed Faces: Provide exposed faces, one or more faces, as required.
1. See finished end details and finished exterior corners.

F. Special Shapes:

1. Provide matching cove bases.
a. Color to be selected from manufacturer’s full range.

2. Provide special shapes, as required or detailed.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Build walls, partitions to full thickness shown, except single wythe walls to actual thickness, using units of nominal sizes shown or specified.

B. Provide flush joints on all masonry concealed or which will receive an applied finish.

C. Fill all collar joints solid with mortar, except cavity walls.

D. Lay all units true to dimensions, plumb and square, and bond and proper anchored with vertical joints aligned plumb and true.

E. No sight exposed broken, chipped or cracked units allowed. Chips and cracks allowed under ASTM C90 will be allowed at areas not sight exposed.

F. Build-in grounds, nailing boards, anchors, lintels, flashing, accessories and similar items as required.

G. Form chases, slots and similar voids, and patch masonry work as required for all trades. Break out of face shells after installation not allowed. Provide minimum of 8 inches solid masonry between chase and adjacent chases, recesses or openings.

H. Bond or tie with steel ties all intersections of walls, columns and partitions, incorporate control joint filler and column wrap where detailed.

I. Take care to wipe masonry work with rough cloth or brush as work progresses to prevent unsightly and unnecessary mortar stains. Do not wait until mortar reaches final set before cleaning.

J. In laying masonry avoid over-plumbing and pounding of the corners and jambs to fit stretcher units after being set in position. Where an adjustment must be made after the mortar has started to set, remove mortar and replace with fresh mortar.

K. Cut masonry units with power equipment designed for the purpose.

L. As necessary, set one course on floor slab as an outline to define various room areas as an aid for roughing-in of pipes, conduits and similar items.

M. Build all conduits, switch boxes, receptacle boxes, access panels, similar items within partitions and masonry where required.

N. Set all bucks, blocking, and anchors as required.

O. No cells or unfinished ends exposed.

P. Do not allow scaffolding or other objects to bump or rub against masonry.

Q. Provide minimum of 8 inches solid masonry at all door jambs and at each end of masonry wall panels and at openings.

R. Bond all intersecting masonry walls together. Where interior exposed masonry walls intersect exterior walls at right angles, install control joint filler and leave joint free of mortar for sealing.

S. Keep concrete masonry units dry at all times prior to delivery to job site, well off the ground and well covered at the job site and keep exposed walls dry by covering entire walls at the end of each day or shut down period with waterproof material.

T. Rake out mortar joints where required for application of sealant.

U. Place horizontal joint reinforcement continuous every 16 inches vertically, except that such reinforcement shall not be continued through control joints. Lap ends and corners a minimum of 6 inches.
   1. Use prefabricated "L" and "T" units at corners and intersecting walls.

V. Construct continuous control joints in the manner and at locations indicated on Project Drawings. Keep control joints in true vertical line and delay sealing as long as work permits in order to allow for maximum action to take place at these joints. Insert rubber control joint material where detailed.

W. Fill all joints between masonry and structure above solid with mortar except where compressible filler is detailed. Delay grouting or sealing until dead load deflection of structure above has taken place.

X. In multi-wythe walls, provide reinforcement as specified in Section 04 05 19. Space 16 inches on center vertically.
   1. Ties engage eyes or slots in reinforcement and extend at least halfway through facing wythe but with at least 5/8-inch cover on outside face.
   2. Space veneer anchors and ties a minimum of 16 inches horizontal and vertical.

Y. When resuming work after stopping, clean exposed surfaces of set masonry, wet lightly (if specified to be wetted) and remove all loose units and mortar before commencing with new work.

Z. Completely fill jambs and head of hollow metal door frames in masonry walls with grout as specified in 04 10 00.

AA. Install all angles, lintels, and miscellaneous steel support pieces as shown on drawings.
   1. Mason to provide all stainless steel bolts and anchors.

3.01 LAYING CONCRETE MASONRY

A. Lay in running bond except where otherwise shown.

B. Double tool all exposed joints of regular concrete masonry units to a slightly concave, densely compacted joint. Cut off concealed joints flush.

C. Do not lay wet units.

D. Lay with full mortar coverage on horizontal and vertical face shells as well as web beds.

E. Where built-in items are to be embedded in cores of units, place a layer of metal lath in joint below and rod mortar or grout into core.

3.02 REINFORCING

A. Reinforce masonry lintels, structural masonry walls as detailed.

B. Position reinforcing in manner that will prevent movement during placement of grout.

C. Place grout, as specified in Section 04 10 00, having compressive strength of 3,000 psi, completely filling all voids in inner wythes around reinforcing.

D. Provide length of reinforcing for lintels to include bearing.

E. Where grouting of cells occurs, align vertical cells to provide a continuous, unobstructed opening.

3.03 FLASHING

A. Incorporate all flashing provided by other Sections.

B. Refer to Project Drawings for type, location.

3.04 SEALANT

A. Install sealant joints in control joints at locations indicated:
   1. Sealant color at vertical masonry joints to match color of adjacent masonry.
   2. Sealant color at horizontal mortar joints to match color of mortar.

3.05 PROTECTION

A. At the completion of work each day or each shut-down period, cover the top of all unfinished masonry work exposed to the weather with waterproof canvas tarpaulins, securely weighted down in place. Keep these covers in place at all times over unfinished work except while work is in progress.

3.06 POINTING AND CLEANING

A. Upon completion of the work, fill all holes in exposed mortar joints with fresh mortar and suitably tool.

B. After pointing has set and hardened, thoroughly clean all exposed surfaces with stiff brushes, cleaning tools and potable water. Flush clean with a low pressure water stream.

C. Protect adjoining work not being cleaned such as glass, wood, finished floors, slabs and similar items during cleaning operations.

D. After cleaning with water and brush, thoroughly rinse all surfaces by washing off all dirt and mortar particles using clean, low pressure water.

E. Leave all exposed masonry clean free from mortar and with tight mortar joints.

END OF SECTION 04 20 00

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SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes structural steel and grout.

1.02 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Show fabrication of structural-steel components.

C. Welding certificates.

D. Source quality-control test reports.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category Sbd.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.

C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings and Bridges.

PART 2 - PRODUCTS

2.01 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M Grade 50.

B. HSS Sections: ASTM A500 Grade B

C. Plate and Bar: ASTM A 36/A 36M.

D. Welding Electrodes: Comply with AWS requirements.

2.02 BOLTS, CONNECTORS, AND ANCHORS

A. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
   1. Configuration: As detailed.
   2. Finish: Plain unless noted otherwise.

B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
   1. Finish: Plain unless noted otherwise.

C. Threaded Rods: ASTM A 36/A 36M.
   1. Finish: Plain unless noted otherwise.

2.03 PRIMER

A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

2.04 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.05 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's AISC's “Specification for Structural Steel Buildings (AISC 360-05)

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

2.06 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

2.07 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports. Comply with testing and inspection requirements of Part 3, Article "Field Quality Control.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding.

PART 3 - EXECUTION

3.01 ERECTION

A. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings (AISC 360-05)"

C. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

C. In addition to visual inspection, test and inspect shop and field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.

D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

END OF SECTION 051200

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SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Exterior non-load-bearing wall framing.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide cold-formed metal framing capable of withstanding design loads within limits and under conditions indicated.
   1. Design Loads: Snow = 30 psf.; Wind = 25 psf lateral and uplift.
   2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following.
      a. Exterior Load-Bearing and Non-Load-Bearing Wall Framing: Horizontal deflection of 1/360 of wall height except at wall framing supporting masonry wall where horizontal deflection shall be 1/600 of the wall height.
   3. Design framing systems to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F .

B. Cold-Formed Steel Framing, General: Design according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Headers: Design according to AISI's "Standard for Cold-Formed Steel Framing - Header Design."
   2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

1.03 SUBMITTALS

A. Product Data: For each type of product and accessory indicated.

B. Shop Drawings: Show layout, spacings, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification data.

E. Product test reports.

F. Research/evaluation reports.

1.04 QUALITY ASSURANCE

A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

C. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements.

D. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Fire-Test-Response Characteristics: Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

F. AISI Specifications and Standards: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" and its "Standard for Cold-Formed Steel Framing - General Provisions."
   1. Comply with AISI's "Standard for Cold-Formed Steel Framing - Truss Design."
   2. Comply with AISI's "Standard for Cold-Formed Steel Framing - Header Design."

G. Comply with AISI's "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
   1. Grade: As required by structural performance.
   2. Coating: G60, A60, AZ50, or GF30.

2.02 FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and same minimum base-metal thickness as steel studs.

C. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

2.03 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members, unless otherwise indicated.

B. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

C. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by mechanically deposition according to ASTM B 695, Class 50.

D. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

E. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

F. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
   1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

2.04 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing - General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicated.

B. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened.

C. Install framing members in one-piece lengths.

D. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

E. Erection Tolerances: Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
   1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.02 INSTALLATION

A. Install continuous tracks sized to match joists. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of joists to track, unless otherwise indicated. Space studs as follows:
   1. Joist Spacing: As indicated; 16” on center maximum.

3.03 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Custom steel Guardrails

B. Steel post ADA site signage.

C. Steel Grates and Frames: Galvanized (at treads)

D. Steel Angles, Tubes, Channels, Bar Stock, Plates and Steel Plating at Stairs

E. All angles and miscellaneous metals to be set in concrete.

F. All angles, tubes, channels, bent metal, lintels and miscellaneous steel supports for masonry.

G. Metal accessories.
   1. Including, but not limited to, anchors, bolts, screws, joist hangers, and fasteners.

H. Misc. Metal Brackets, supports, etc. as shown on drawings.

1.03 RELATED WORK

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

B. Unit Masonry: Section 04 20 00.

C. Structural Metal Framing: Section 05 10 00.

D. Finished Carpentry: Section 06 20 00.

E. Painting: Section 09 90 00.

1.04 REFERENCES

A. Metal Fabrications shall be in strict accord with Wisconsin Commercial Building Code, Chapter 11 - "Accessibility".

1.05 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
   1. Shop drawings required for all items. Show all work to be fabricated with all construction details shown in appropriate scale, methods of attachments to other materials, finished dimensions, shop welds and grinding of welds, field assembly joints, etc.

2. Coordinate work with other suppliers and subcontractors; obtain their approved shop drawing where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

1.06 QUALITY ASSURANCE

A. Take field measurements prior to shop drawing preparation and fabrication.

B. Comply with the provisions of the following except as otherwise indicated:
1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.
3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
4. AWS D1.1 "Structural Welding Code".

C. Qualify welding process and welding operators in accordance with the AWS "Standard Qualification Procedure". Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous twelve months. If recertification of welders is required, retesting will be the Contractor's responsibility.

D. Structural Performances
1. Treads and platforms shall be capable of withstanding a uniform load of 100 lbs. per sq. ft. or a concentrated load of 300 lbs. located to produce maximum stress conditions.
2. Handrails and toprails shall be capable of withstanding concentrated loads of 200 lbs. applied at any point in any direction or a uniform load of 50 lbs/ft applied horizontally at the top rail, whichever produces the greatest stress.

E. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation. Damaged material will be rejected.

B. Items to be built into concrete, masonry, etc. shall be furnished by the respective contractor and the contractor shall build this into the work as the work progresses.

1.08 PROJECT CONDITIONS

A. Verify dimensions in field for pre-cut or prefabricated items.

B. Examine job conditions and adjoining construction which may affect the acceptability of the work.

C. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing embedments and other items that are to be embedded in concrete. Deliver such items to Project site in time for installation.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:

1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.
2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints", Second Edition, January 7, 1997. For applications on ferrous metal substrates.
3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

B. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 METAL FOR FABRICATIONS

A. Cold-rolled carbon steel sheets: ASTM A336.

B. Structural Steel Sheet: Hot rolled ASTM A570, or cold-rolled ASTM A611, of grade required for design loading, minimum of Grade C.

C. Galvanized carbon steel sheets: ASTM A446, with G90 zinc coating.

D. Welding materials: AWS D1.1; type required for materials being welded.

E. Shop coat primer: FS-TT-P-32, for shop application and field touch-up.

F. Touch-up primer for galvanized surfaces.
1. Steel shapes and fasteners, in general, for exterior use and where built into exterior wall: zinc coated.

G. Structural Steel: ASTM A36.

H. Structural Steel Angles: ASTM A36, hot dipped galvanized.

I. Steel Pipe: ASTM A53, Type S, Grade A, standard weight, schedule 40.

J. Steel Bars and Bar Size Shapes: ASTM A 306, Grade 65, or ASTM A 36.

K. Castings: Gray iron, ASTM A48-83 Class 35B; or Ductile iron ASTM A536-80 Grade 65-45-12.

L. Stainless Steel: AISI Type 302/304, #4 finish, as specified vertical grain except as otherwise specified.

2.02 GALVANIZED STEEL

A. All exterior galvanized steel shall be hot-dipped galvanized.

2.03 ACCESSORIES

A. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers and shims as require, hot-dipped galvanized, ASTM A 153.

B. Fasteners: Including, but not limited to the following;
   1. Provide zinc-coated fasteners for exterior use where built into exterior walls or where shown on drawings. Select fasteners for the type, grade and class required.
      a. Provide hot-dipped galvanized coating for fasteners less than 1/2" diameter that are in contact with pressure-treated wood.
   2. Bolts and Nuts: Regular hexhead type, ASTM A 307, Grade A or Type 304 stainless steel, ASTM A 320. High Strength bolts and nuts, ASTM A 325.
   3. Lag Bolts: Type, FS FF-B-561.
   4. Machine Screws: Cadmium plated steel, FS FF-S-92, Security Screw
   5. Wood Screws: Carbon steel, FS FF-S-111.
   6. Plain Washers: Round, carbon steel, FS FF-W-92.
   7. Concrete Anchorage Devices: Wedge-type expansion bolts, FS FF-S-325, Group II, Type 4, Class 1, zinc coated or stainless steel as shown on the drawings and installed in accordance with manufacturer's recommendations.
      a. "Kwik-bolt", Hilti Corporation.
      b. "Wej-it", Wej-it Corporation.
   8. Masonry Sleeve Anchors: zinc coated or stainless as shown on the drawings.
      a. Rawl "Lok/Bolt".
      b. HILTI - Sleeve anchor.
   9. Toggle Bolts: Spring-wing type, FS FF-B-558, Type I, Class I and Style 1 zinc coated or stainless steel as shown on the drawings.
   10. Lock Washers: Helical spring type carbon steel, FS FF-W-84.
   11. Countersunk Washer: Type 316 stainless steel and stainless steel wood screw at solid surface 'panel' ADA vanity enclosure assembly.

C. Electrodes for Welding: Comply with AWS code.

2.04 FABRICATION

A. Weld permanent connections wherever possible; use continuous welds where exposed. Grind smooth all welds where exposed; straighten members after welding.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

B. Do shop cutting, drilling, fitting wherever possible. Field measure before fabrication when necessary or required.

C. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form

bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, security (countersunk) screws or bolts.

F. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

2.05 STEEL GUARDRAIL

A. Provide all connectors, splices, end caps, anchor bolts, etc. for the complete design, fabrication and installation of a steel guardrail in Stair A and Stair B.
B. Provide 12" corner mock up.
C. Complete all field verification and shop drawing submittal.
D. Fabrication and design to include review of structural guardrail loading criteria and panel perimeter channel size and spacing with attachment to existing handrails/stairs to meet loading criteria.
E. Perimeter frame
    1. 13 gauge U-Edge frame
    2. Exposed fasteners or welded connections with bent plate offsets to maintain clearance at handrails.
F. Woven stainless steel fabric system
    1. Manufacturers:
        a. BankerWire
        b. Cambridge Architectural
        c. GKD
        d. Or approved equal
    2. Basis of Design: Banker Wire M13Z-145 Rigid Cable wire mesh

2.06 STRUCTURAL PERFORMANCE

A. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
    1. Handrails:
        a. Uniform load of 50 lbf/ ft applied in any direction.
        b. Concentrated load of 200 lbf applied in any direction.
        c. Uniform and concentrated loads need not be assumed to act concurrently.

    2. Top Rails of Guards:
        a. Uniform load of 50 lbf/ ft. applied in any direction.
        b. Concentrated load of 200 lbf applied in any direction.
        c. Uniform and concentrated loads need not be assumed to act concurrently.

    3. Infill of Guards:
        a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
        b. Infill load and other loads need not be assumed to act concurrently.

2.07 STEEL FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
    1. ASTM A 123/A 123M, for galvanizing steel products.
    2. ASTM A 153/A 153M, for galvanizing steel hardware.
    3. Except for items indicated to be fabricated of stainless steel, exterior metal fabrication items shall be hot-dip galvanized.

B. Preparation for Shop Painting: Clean steel items free of mill scale, rust and foreign matter, grease, oil, dust, and dirt in accordance with SSPC SP-2, SP-3, or SP-7.

C. Shop Priming: Apply one shop coat of metal primer using manufacturer's standard primer, except stainless steel, galvanized steel, and other non-ferrous items.

2.08 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Unless otherwise indicated, grind and polish surfaces to produce uniform finish indicated, free of cross scratches.
   1. Run grain of directionally textured finishes with long dimension of each piece.
   2. Directional Satin Finish: No. 4 finish unless noted otherwise.

C. When finishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchorage to masonry with expansion bolts, sleeves, toggle bolts or approved similar. Do not use wood plugs for anchorage.

B. Bolts, screws, and similar fastenings for field connections shall be of the same material and finish as the parts being fastened.

C. Immediately after erection, repaint field connections, weld burns, abraded surfaces. Scrape and wire brush loose and scaling paint to sound metal, follow with spot priming.

D. Install manufactured units and specialty products in accordance with the manufacturer's instructions and approved shop drawings.

E. Do not proceed with installation until conditions are satisfactory.

F. Install in accordance with approved shop drawings.

G. Perform field welding in accordance with AWS D1.1.

H. Corrosion Protection: Coat concealed metal surfaces that will come into contact with grout, concrete, or dissimilar metals with a heavy coat of bituminous paint.

3.02 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

C. Protect stainless steel finishes from contamination by materials containing iron.

END OF SECTION 05 50 00

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SCOPE

A. Perform all Work required to complete the Rough Carpentry indicated by the Construction Documents, and furnish all items necessary for its proper installation.

1.03 WORK INCLUDED

A. Wood Blocking, Cants and Nailers.

B. Plywood Backing Panels.

C. Sheathing.

1.04 RELATED WORK

A. Solid Surface, Section 06 61 00.

B. Plastic Laminate-Faced Casework, Section 06 41 16.

C. Division 7, Thermal and Moisture Protection

1.05 SUBMITTALS

A. Submit in accordance to the General Conditions of the contract.

B. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses indicated on the documents. Indicate species and grade selected for each use, and design values approved by American Lumber Standards Committee.

C. Schedule for completion of rough framing for coordination of templating for shop fabrication of architectural woodwork.

D. Wood treatment data as follows, including chemical treatment manufacturer's warranty and instructions for handling, storing, installing, and finishing treated materials:

1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standard.

1.06 REFERENCES

A. American Institute of Timber (AITC)
1. AITC, Timber Construction Manual

B. American Forest and Paper Association (AFPA)
1. AFPA, National Design Specification for Wood Construction.
2. AFPA, Design Values for Wood Construction, NDS Supplement.

C. American Plywood Association (APA)
1. APA, Plywood Design Specification.

D. American National Standards Institute (ANSI)
1. ANSI A190.1, Structural Glued Laminated Wood.
2. ANSI A208.1, Material Formed Wood Particle Board.

E. American Society for Testing and Materials (ASTM)
1. ASTM E84, Test for Surface Burning Characteristics of Building Materials.

F. American Wood Preservers Association (AWPA)
1. AWPA C-20, Structural Lumber - Fire Retardant Treatment by Pressure Processes.

G. American Wood Preservers Bureau (AWPB)
1. AWPB LP-2, Pressure Treatment with Water-Borne Preservatives.

H. National Bureau of Standards (NBS)
1. NBS PS 1, Voluntary Product Standard for Construction and Industrial Plywood.
2. NBS PS 20, Voluntary Product Standard for Lumber.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site dry and store above ground on level wood blocking, cover from rain, allowing drainage of water from all parts. Handle with care to avoid damage.

1.08 COORDINATION

A. Correlate location of all framing, furring, blocking, grounds and similar items with all trades.

B. Verify all dimensions and shop drawing requirements prior to proceeding with work.

C. Avoid delay of work of other trades dependent on or affected by carpentry work.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

B. Low- Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the weatherproofing system shall contain no added urea-formaldehyde resins.
1. Laminating Adhesives used to fabricate on-site and shop applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wood for nailers, blocking, furring, sleepers and other miscellaneous boards: Construction grade, S4S, dried, 19 percent maximum moisture content. Pressure preservative treat items in contact with flashing, waterproofing, masonry, concrete or the ground.

B. Wall Sheathing

1. Plywood sheathing shall be 5/8 inch thick (or as indicated on drawings), 5-ply, CDX APA Rated, un-sanded with a minimum 24/0 span rating. Sheathing shall be by 48 inches wide by 96 inches long.

C. Exterior plywood, thickness as indicated on drawings, 7-ply, CDX APA Rated, un-sanded with a minimum 16/0 span rating. Refer to drawings for sizes.

D. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.

1. Treat wood materials subject to insect attack. Moisture content after treatment shall be 19 percent for lumber and 15 percent for plywood.
2. Preservative Chemicals: Water-borne, alkaline copper quaternary (ACQ) preservatives.
    a. Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

E. Fire-retardant treated wood products shall be pressure-impregnate wood materials to comply with ASTM E84, Class A and with AWPA C-20 and C-27. Each piece shall bear UL label "FR-S" for 25 maximum flame spread. Moisture content after treatment shall be 19 percent for lumber and 15 percent for plywood.

1. Treated materials shall be "Dricon" as manufactured by Koppers Company, Inc.
2. Application: Treat all rough carpentry, unless otherwise indicated.
    a. Concealed blocking.
    b. Plywood backing panels.

F. Rough hardware shall include all nails, spikes, screws, bolts and similar items of types and sizes sufficient to draw and rigidly secure members for which they are used. Fasteners shall be galvanized plated at exterior locations and at all treated wood applications.

G. Adhesive shall be of proper design and characteristics to rigidly secure materials for which they are used. Adhesive shall be "Titebond VOC-Compliant Heavy Duty Construction Adhesive" conforming with ASTM C557, as manufactured by Franklin International; or approved equal.

1. Provide construction adhesive with a VOC content of less than 70 g/l.

H. Miscellaneous Materials

1. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from manufacturer's standard widths to suit width of sill members indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine all adjoining work, verify all governing dimensions, and report any unsatisfactory conditions.

B. Provide temporary enclosures, partitions, or stairs to properly protect and facilitate the work.

3.02 GENERAL INSTALLATION

A. Install materials and systems in accordance with manufacturer's published instructions and requirements. Install materials with uniform appearance and in proper relation with adjacent construction.

B. Cut and frame all lumber into the respective locations, true to line, grade, plumb and level. Form nailers, blockings and bucks to the shape and dimension indicated. Cut and frame all rough carpentry work required by the other sections.

C. Use only sound, thoroughly seasoned materials of longest practical lengths and sizes to minimize jointing. Use materials free from warp which cannot be easily corrected by anchoring and attachment.

D. Treat all wood nailers, sleepers, blocking, furring, other wood in contact with concrete, masonry adjacent to grade or exterior which shall be inaccessible in finished work.

E. Provide blocking, bucks and framing for all trades as required.

1. Blocking to be provided at the following locations:
    a. All wall hung casework, cabinetry, countertops and shelving.
    b. All wall hung/mounted equipment, including but not limited to flat screen monitors, brackets, autopsy/lab equipment, etc.
    c. All wall hung writing surfaces
    d. And as indicated on drawings.

F. Include 2 inch nominal blocking in metal stud partitions required for backing of all accessories, cabinetry, and other surface or recessed items.

G. Where finish trim is applied directly to framing members or blocking, such members shall be perfectly straight, clear and well seasoned. Warp or other poor characteristics not allowed.

H. Provide solid surfaces at least 1 1/2 inches wide in both directions at all corners for securing finishes.

3.03 HARDWARE

A. Secure permanently and in proper position all materials with the necessary fastenings to provide the strength and rigidity required to complete the work. Provide washers under bolt heads and nuts in contact with wood.

B. Bolt nailers and blocking to steel, masonry or concrete members with bolts of proportionate strength of members attached, length required, spaced 2 feet 0 inches on center and 4 inches from each end, except as otherwise indicated. Unless otherwise indicated, anchor bolts shall be 3/8 inch diameter by length required or comparable power actuated fasteners.

C. Nail plywood in accord with APA recommendations.

3.04 ROOF SHEATHING

A. Place sheathing with face grain at right angles to supports and end joints over supports. Provide 1 1/2 inch framing at all joints not over support where blocked joints are noted on Drawings.

B. Stagger end joints so that joint between adjacent panels occurs over different supports. Allow 1/8 inch spacing between panels on all sides.

C. Fasten with 8d ring-shank nails at 6 inch on center at all edges and 12 inch on center at all intermediate supports, unless noted otherwise. Sheathing may be stapled with 1 1/2 inch long 15 gauge staples at 4 inch on center at all edges and 12 inch on center at all intermediate supports, unless noted otherwise.

D. Install in accordance with recommendations of APA.

E. All lumber used on this project shall be graded by an agency certified by ALSC. Softwood Lumber: ALSC PS20, grade No. 2 or better; 19 percent maximum moisture content, size as detailed or required.

F. Pressure Treated Plywood and Lumber: These products shall not be specified or provided for use in roofing projects as a substrate material intended to receive mechanical fasteners used to secure metal roof panels, panel clips, metal coping, roof penetration curbs cap and counterflashing, all other metal flashing, roofing insulation and membrane installations that are a part of the roof system.

G. The manufacture shall approve of all mechanical fasteners used to secure all roof system components.

3.05 TEMPORARY ENCLOSURES

A. The Subcontractor shall furnish, erect, keep in good repair and remove all necessary temporary guard rails, barricades, pedestrian walkways, temporary ladders, building enclosures and partitions (including temporary wood doors hung on temporary wood bucks at exterior door entrances, doors to allow emergency egress by building occupants) and all other necessary temporary enclosures as required as the work progresses.

3.06 CLEANING

A. Remove from the site all debris resulting from the Work of this Section.

END OF SECTION 06 10 00

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SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

2.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

2.02 WORK INCLUDED

A. Carpentry work which is exposed to view, non-structural, and not specified as part of other sections.
B. The types of finish carpentry include, but are not necessarily limited to the following:
1. Wood fence
2. Interior wood at walls, benches and shelving.

2.03 RELATED WORK
1. Metal Fabrications: Section 05 50 00.
2. Rough Carpentry: Section 06 10 00.
3. Painting: Section 09 90 00.

2.04 SUBMITTALS

A. General: Submit each item in this article according to the General Conditions of the Contract.
1. Shop drawings for all millwork; receive approval prior to fabrication; draw in related or dimensional position with sections shown either full size or 3-inch scale.
2. Samples:
1. One 24-inch- long section of wood running trim, slats or similar lineal mill work.

B. Product Data: For each type of component required. Include but not limited to the following:
1. Manufacturer’s data on hardware, accessories, and finishes.

2.05 REFERENCES

A. Western Red Cedar Lumber Association "Designer's Handbook".

2.06 QUALITY ASSURANCE

A. Quality Standards: Architectural Woodwork Quality Standards, Guide Specification and Quality Control Program as set forth by the Architectural Woodwork Institute (AWI).
B. Architectural Woodwork Manufacturer: Experienced in this type of work; successfully completed comparable work.
C. Deviations from quality, grade, species, and finish specified under AWI Interior Woodwork for Transparent Finish and Interior Woodwork for Paint Finish will be allowed for individual items or components only if specified under separate headings covering such items.

2.07 DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.
B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed.

2.08 ENVIRONMENTAL REQUIREMENTS

1. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
2. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

2.09 Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.

1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

2.010 Low- Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the weatherproofing system shall contain no added urea-formaldehyde resins.

1. Laminating Adhesives used to fabricate on-site and shop applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Lumber standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

2.02 Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA – Northeastern Lumber Manufacturers Association.
2. NHLA – National Hardwood Lumber Association.
3. NLGA – National Lumber Grades Authority.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB – West Coast Lumber Inspection Bureau.
6. WWPA – Western Wood Products Association.

2.03 Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

2.04 For exposed lumber, furnish pieces with grade stamps applied to ends of back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

2.05 SCHEDULE OF MATERIALS

A. WD-1
1. Species: Western Red Cedar
2. Grade: WRCLA, A Clear.

3. Texture: See below.
4. Moisture Content: Kiln dried to less than 15% moisture content.
5. Sight exposed.
6. Finish: see 09 90 00.
7. Sizes:
    1. 1 x 6 noted on drawings on the exterior fence are to be 5/4 x 6 x lengths as indicated on drawings at exterior fence. S4S Smooth.
    2. 1 x 6 and 1 x 4 at interior walls/soffits. S1S2E smooth.
    3. 2 x 10 x length indicated on drawings at interior help desk. S4S Smooth.

2.06 ACCESSORIES

A. Provide nails, screws and other anchoring devices of the proper type, size, material and finish for application to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.

B.
1. Nails, Wire, Brads and Staples: FS FF-N-105.
    1. Nails must not penetrate finished interior surface of Cedar at benches, shelves, reception desk.
2. Power-Driven Fasteners: CABO NER-272.
3. Cedar to be fastened with 304 (18-8) or better stainless steel fasteners only.

    1. Where interior finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153 or No. 304 stainless steel.
    2. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use. Exterior rated for exterior use.

Sealants: Comply with requirements of Division 7 Section "Joint Sealants" for materials required for sealing work.

2.07 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry.

B. Field Dimensions
1. Millwork Manufacturer: Responsible for details, dimensions not controlled by job conditions; show on shop drawing all field measurements beyond his control. Contractor, Woodwork Manufacturer: Cooperate to establish, maintain these field dimensions.

C. Leave all surfaces clean and true and all exposed wood surfaces sanded parallel with grain, free of discernible marks and ready for work under Division 9 Section "Painting

D. Cutouts: Make those required for mechanical and electrical items.

E. Back out or kerf backs of the following members, except members with ends exposed in finished work:
1. Standing and running trim wider than 5 inches.

F. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius.

G. Ease edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

H. Fabricate handrails to match existing handrail sizes and profiles and as indicated on Drawings.

EXECUTION

2.01 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting installation and performance of finish carpentry. Do not proceed with installation until unsatisfactory conditions have been corrected.

2.02 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

B. Examine substrate before installation. Verify that substrate is sound and plumb/level. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Coordinate woodwork installation with wall flashings and other built-in components.

D. Prime and backprime exterior wood, including cut ends, for painted, stained and oil finish exposed on the exterior. Comply with requirements for surface preparation and application in Division 9 Section "Painting".

2.03 INSTALLATION

A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

B. Install finish carpentry plumb, level, true and aligned with adjacent materials. Use concealed shims where required for alignment.

C. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   1. Countersink nails; fill surface flush and sand where face nailing is unavoidable.

D. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

E. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails.
   1. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.

F. Finish according to specified requirements.
   1. Refer to Division 9 Sections for final finishing of finish carpentry.

2.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
   1. Stagger joints in adjacent and related standing and running trim.
      1. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint.
      2. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required.

B. Match color and grain pattern across joints.

C. Drill pilot holes in wood before fastening as required to prevent splitting.
    1. Fasten to prevent movement or warping.
        1. Countersink fastener heads on exposed carpentry work and fill holes.
        2. Stagger nails along the length of long pieces of trim.

2.05 EXTERIOR LUMBER INSTALLATION

A. Drill pilot holes in hardwood species before fastening as required to allow penetration of fasteners and to prevent splitting.
    1. Fasten to prevent movement or warping.
        1. Countersink fastener heads on exposed carpentry work.

2.06 ADJUSTING

A. Repair damaged or defective work as directed.
B. Adjust and lubricate hardware for proper operation.

2.07 CLEANING

A. Clean exposed surfaces.
B. Clean shop-finished woodwork, touch-up finish as required and remove and refinish damaged or soiled areas of finish.
C. Protect finish carpentry and maintain conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION 06 20 00

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SECTION 06 41 16

PLASTIC LAMINATE CLAD CASEWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Base, Wall and Custom Storage Cabinets and associated Partitions and Shelving.

B. Countertops.

C. Work Surfaces (with braces beneath).

D. Hardware.

1.03 RELATED WORK

A. Rough Carpentry: Section 06 10 00.

B. Joint Sealers: Section 07 92 00.

C. Solid Surface: Section 06 61 18.

D. Stainless Steel Kitchen Countertops: Food Preparation Surfaces Section 11 42 16.

E. Plumbing (Sinks, pipe, fittings, final connections, etc.): Division 22.

1.04 REFERENCES

A. Plastic Laminate: National Electrical Manufacturers Association (NEMA) Publication No. LD3-1991.

B. Fiberboard Core: ANSI A208.2.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Product Data: Manufacturer's catalog information edited to indicate specific products and related accessories to be provided for this Project.
   2. Shop Drawings: Show layout of casework, typical details of construction, and finish selections.
      a. Locate rough-in for services required and show methods of compensating for minor variations in actual job conditions within specified tolerances.
      b. Include details of fastening to all other work, countertop layout for each location, details of countertop construction including backsplash, endsplash, and edge details, plastic laminate selections previously made by Architect/Engineer and type of core substrate material.
      c. Field measure for all countertops.
      d. Indicate all hardware and keying schedule.

1.06 QUALITY ASSURANCE

A. Quality Standards: Perform work in accordance with Architectural Woodwork Quality Standards (current edition), Guide Specification and Quality Control Program as set forth by the Architectural Woodwork Institute (AWI).

B. ANSI/BHMA A156.9 – Cabinet Hardware.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver casework items only when proper storage conditions will be available. Store casework in protected area until ready for installation.

B. Maintain optimum humidity and temperature conditions after receipt of materials.

C. Store in manner to allow free circulation of air around all items.

D. Maintain temperature of casework storage areas between 50 to 75 degrees Fahrenheit.

PART 2 - PRODUCTS

2.01 CASEWORK

A. AWI Section 400, Custom grade.

2.02 MANUFACTURERS

A. The following casework manufacturers are acceptable as long as they meet or exceed this specification.
   1. A.J. Pietsch Company, (414) 342-0531.
   2. Carley Wood Associates, Inc. (608) 249-7444.
   3. Central Wisconsin Woodworking, (715) 675-4491.
   4. Creative Laminates, Inc., (800) 441-5885.
   5. Diversified Woodcrafts Inc., (920) 842-2136.
   6. Glenn Rieder, Inc., (414) 449-2888.
   7. Hillcraft Ltd., (608) 221-3220.
   8. Lange Brothers Woodwork Co, Inc., (414) 466-2226.
   9. Stück Wood Works Inc., (414) 351-5595.
   10. T. J. Hale Company, (262) 255-5555.
   11. Techline, (608) 238-6868.
   12. Wood Design Inc., (920) 563-4833.
   13. Woodmill Products, Inc., (262) 754-4641.
   14. Or approved equal.

B. Hardware manufacturers.
   1. Doug Mockett & Co. (800) 523-1269.
   2. A&M Hardware (888) 647-0200
   3. Or approved equal.

2.03 BASE AND CUSTOM STORAGE CABINETS

A. Bottoms, Sides and Sub-top: 3/4-inch 45-47 pound density particle board.
   1. Finish where not exposed: 8 to 11 mil melamine resin overlay.

B. Back Panel: 3/8-inch 45-47 pound density particle board.
   1. Finish: 8 to 11 mil melamine resin overlay to match cabinet interior.
   2. Non-Exposed Side Finish: 8 to 11 mil melamine resin overlay to match.
   3. If back exposed, provide 3/4-inch material, finished to match.

C. Top of Base, Custom Storage Cabinet: Full framed wood. Provide full sub-top and 6 inch spreaders between all drawers and door/drawer.

D. Back panels rabbeted into sides top and bottom. Secure with hot melt glue or glue and mechanical fasteners.

E. Provide finished end panels at all exposed end locations. Ends adjacent to appliances shall be considered as exposed ends.

2.04 DOOR/DRAWER CONSTRUCTION AND EDGING

A. Door/Drawer Fronts: 3/4-inch thick core.

B. Exposed Edges, Endsplashes:

   1. Finished to match exposed face.
   2. At repair in Room 107. Provide PVC edge. Color to be selected from manufacturer's full line of color.

C. Laminate face/balancer to core with PVA rigid adhesives, under pressure, nor natural setting process. Heat process or contact adhesive not allowed.

D. Door/Drawer/Cabinet Body Edges: 1 mm PVC thru-color, acid resistant hot melt applied.

2.05 PLASTIC LAMINATE SURFACING

A. Manufacturers: Wilsonart , Arpa, Formica, Lamin-Art, Nevamar, or approved equal.

B. Exposed Exterior Surfaces (except countertops): NEMA GP28, 0.028 inch thick, standard vertical grade.

C. Interior Surfaces/Backing Sheets: NEMA CL20, 0.020 inch thick, standard cabinet liner grade if applicable.

D. Colors:

   1. Horizontal Surface Plastic Laminate color to be selected from manufacturer's full range.
   2. Vertical Surface Plastic Laminate color to be selected from manufacturer's full range.

E. Contrasting text where indicated on drawings.

2.06 DRAWERS

A. Backs, Sides, Fronts: 1/2-inch thick, medium density fiberboard with melamine overlay.

B. Dovetail/dado fronts and backs, secure with glue.

C. Bottoms: 3/8-inch thick.

D. Rabbet bottoms into sides, front and back; staple and glue.

E. Drawer fronts screwed on from drawer inside.

F. Reinforcement: 1/2 inch thick under-bottom stiffeners, one at 24 inch drawers, two at 36 inch drawers, four at 48 inch drawers.

2.07 SHELVES

A. Shelves under 27 inches long: 3/4-inch thick 45-47 pound density particle board.

B. Shelves over 27 inches long: 1 inch thick 45-47 pound density particle board.

C. Finish: Finished to match faces.

D. Edging: Material to match the shelf.

2.08 BASES

A. Two, continuous, 4 inch high by 1-1/2 inch thick lumber, or 4 inch high by 3/4 inch exterior grade plywood, 2 foot on center. See drawings for base dimension.

B. Provide two positioning strips to cabinet bottom for concealed fastening.

2.09 COUNTERTOPS

A. Plastic Laminate: 1-1/2 inches thick 45-47 pound density particle board, NEMA GP50 finish top and edges, and NEMA CL20 backer sheet.
   1. Square front edge, back and side splashes. Provide cutouts for built-in fixtures.

2.010 HARDWARE

A. Pulls:
   1. Doug Mockett & Co. 5 21/32" Aluminum Extrusion Pull – DP117B, Satin Aluminum at Copy Room 107 to match existing.
   2. Hafele Hardware Pull 124.02.320, Polished.

B. Self-Closing Hinges: Blum Model 71.6530 with 175L8100 base plate.

C. Drawer Slides: Accuride or approved equal.

D. Locks:
   1. Cabinet Locks: Keyed to match, five pin. All casework to be lockable. Key casework alike per area.
   2. Custom Storage Cabinet Locks: Hafele, Safe-o-Mat Coin Return Locks, Series 500.

E. Steel Brackets
   1. For upper shelving and work surfaces: Hafele, Hebgo bracket, approved equal by A&M Hardware or approved equal.
      a. Color: To be selected by Architect from full line of powder coat finishes.

F. Hardware finish: 626 (US26D) Brushed Chrome.

G. Waste Bin Deflector: Stainless steel sheet metal, type 304, 16 gauge, #4 finish, hemmed edges.

H. Paper Feed Grommet: Plastic, color to be from manufacturer's full range, inside opening of 1 9/16 inches by 11 3/4 inches by 1 inch deep, 3/8 inch flange at the exterior. To be used at the recycle/waste paper bins.
   1. Doug Mockett and Co.; "CP2"or equivalent.

I. Keyboard Platform: Doug Mockett & Co., "KP1", adjustable type with non-skid pads and gel wrist pad. Mouse Support: Doug Mockett & Co., "KPA1".

J. Clothes Hook: Bobrick B-6727, stainless steel.

K. Thin Client CPU holder
   1. Ergomart Thin Client CPU Holder, finish to be selected from manufacturer's full range.

L. Wastebasket/Recycle Bin:
   1. Corridor 1001: Rubbermaid Commercial Untouchable Waste Container or approved equal, size to fit in cabinet. Square, Plastic, 35 gal, gray, Rubbermaid 3958: 19 ½" x 19 ½" x 27 5/8".
   2. Rubbermaid 2957 bin or equal, size to fit in drawer and cabinet: 15 ¼"x11"x19 7/8".

2.011 WORKMANSHIP

A. Cabinet parts shall be accurately machined utilizing hardwood dowels for premium quality grade joinery construction. Glue and mechanically fasten all joints for maximum rigidity.

B. All cases shall be square, plumb, true and self-supporting.

C. Provide removable back panels and closure panels for plumbing access where shown on Project Drawings.

PART 3 - EXECUTION

3.01 DELIVERY

A. Store and install in a ventilated building not exposed to extreme temperature and/or humidity.

3.02 INSTALLATION

A. Installation shall be by the manufacturer's authorized representatives using factory trained personnel experienced in the installation of this type of equipment.

B. Uncrate, set up, place, level, scribe and anchor all cabinets according to manufacturer's recommendations.

C. Remove and replace tops, backs, panels, shelves and other items necessary to allow other Sections to complete their work of connecting services.

D. Do all cutting, boring, patching required for the installation of work of other Sections.

E. Provide all necessary fillers, panels, end panels, scribes required to make complete installation as detailed.

F. Where casework meets wall surfaces, set with uniform space not to exceed 1/8-inch. Seal all joints with silicone sealant to a slightly concave joint, using backer rod where required. Apply sealant in accord with Section 07 92 00.

G. Cabinets with surfaces having machine or tool marks will be rejected.

H. All finishes must be smooth, uniform in color and match approved sample.

I. Prior to final inspection, examine installation of the work of this Section. Repair or replace all defects found. Leave installation clean, undamaged and ready for use.

3.03 FINISH SCHEDULE

Plam Horizontal Surfaces
Plam Vertical Surfaces – lowers
Plam Vertical Surfaces – uppers
Plam Vertical Surfaces – lowers Kitchen 127
Plam Vertical Surfaces – uppers Kitchen 127

END OF SECTION 06 41 16

SECTION 06 61 18

SOLID SURFACE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Solid surface countertops and caps

1.03 RELATED WORK

A. Rough Carpentry: Section 06 61 00.

B. Plastic Laminate Clad Casework: Section 06 41 16 for shelf or work surface brackets.

C. Gypsum Wall Board Section 09 29 00.

1.04 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
   1. Product Data: Manufacturer's catalog information edited to indicate products to be provided for this Project.
      a. Joint adhesives or mastics, color matched.
      b. Joint sealants.
      c. Fastening adhesive

   2. Samples:
      a. Product Data.
      b. Solid surface sheet material.
      c. Include color chart showing full range of available colors for sheet

1.05 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications: Minimum three years experience in fabrication and installation of solid surface materials or certification by Distributor.
   1. Qualifications: Proof of fabricator qualifications.
   2. Certificates: Copies of ISO certifications.
   3. Test Reports:
      a. Flammability test reports.
      b. Food preparation zone use test reports.
   4. Manufacturer’s Fabrication and Installation Manual.
   5. Manufacturer’s Fabrication and Installation Check List.

B. Shop Drawings: Provide plans, sections, and large-scale details. Include attachment provisions and fabrication methods.

1.06 WARRANTY

A. Provide manufacturer's standard 10 year warranty against defects in workmanship.

1.07 MAINTENANCE

A. Extra Materials: Provide for future repair use by Owner.
   1. Minimum 4 sf per 50 lf of each color material.

1.08 SPECIAL INSTRUCTIONS

A. Do not deliver components to project site until spaces are ready for installation.

1.09 ENVIRONMENTAL CONDITIONS

A. Installation spaces must be maintained at normal occupancy temperature and humidity levels for minimum 72 hours prior to and continuously following installation.

1.010 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
   1. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

B. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Solid Surface
   1. Solid Surface
      a. Formica, Solid Surfacing
      b. Or approved equal by: Dupont, Corian; Wilsonart, Solid Surfacing.

B. Material Selections: refer to 3.04 Finish Schedule for quantity of colors/materials, manufacturer’s may differ.

C. No cracked, chipped, broken, stained, or defective material will be accepted.
   1. Materials fabricated to thickness and size shown on drawings.
      a. All sizes to be field verified.

D. Color Match Differences: Minimal.

E. Adhesives: Use manufacturer's recommended adhesives, and installation instructions. See product fabrication manuals for application techniques and surface preparation.

2.02 FABRICATION

A. Field verify measurements.

B. Finished Surfaces: Uniform as chosen by A/E from full range with all edge profiles as shown on drawings.

C. Color and finish: To be selected by Architect from full range of colors and finishes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine cabinets upon which countertops will be installed. Coordinate with cabinet specification section to assure that cabinets are set to the following tolerance or better.
1. Verify that cabinets are level to 1/8 in. in 10 ft .
2. Review manufacturer's Fabrication and Installation Check List.

B. Examine walls upon which base will be installed.
1. Verify wall is flat and acceptable for base application.
2. Review manufacturer's Fabrication and Installation Check List.

C. Coordinate with responsible entity to correct unsatisfactory conditions.

D. Commencement of work by installer is acceptance of conditions.

3.02 INSTALLATION

A. Install fabricated items according to material manufacturers printed instructions.

B. Set all items square and true with edges of face joints smooth, even, neat and tight against other materials.

3.03 PROTECTION, REPAIRING AND CLEANING

A. Replace damaged and defective work.

B. Clean according to manufacturer's directions. Use no acids or harsh abrasives.

3.04 FINISH SCHEDULE

SS-1 Help Desk	To be selected from manufacturer's full line
SS-2 Horizontal Surfaces	To be selected from manufacturer's full line
SS-3, Partial Height Wall cap	To be selected from manufacturer's full line

END OF SECTION 06 61 18

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SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Batt Insulation.

B. Vapor Retarder.

C. Insulation Accessories.

D. Under Slab Insulation.

1.03 RELATED WORK

A. Section 04 20 00, Unit Masonry

B. Section 07 27 26, Fluid Applied Membrane Air Barriers

C. Section 09 29 00, Gypsum Board (Sound Attenuation)

1.04 SUBMITTALS

A. General: Submit each item in this article according to the Conditions of the Contract and Division 1 Specification Sections.
   1. Manufacturer's Data: Submit manufacturer's data for each type of insulation required. Include data substantiating that the materials comply with specified requirements, including GreenGuard Certification.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver material to the site in unopened packages, with identification labels intact.

B. Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

C. Protect plastic insulation against ignition at all times.

D. Remove damaged materials from site.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.

1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 INSULATION TYPE 1: BATT INSULATION

A. Batt Insulation:
1. Unfaced Fiberglass batts per ASTM C665, Type I. Thickness as indicated on Drawings.
   a. Provide batt insulation that is a GreenGuard Indoor Air Quality Certified, low-emitting product.
   b. Manufacturers: CertainTeed, Guardian, Knauf, Owens Corning, or approved equal.

B. Vapor Retarder:
1. Class II, tested in accordance with ASTM E 96.
2. 4 mil clear polyethylene.

C. Vapor Retarder Tape: As recommended by vapor retarder manufacturer.

2.02 INSULATION TYPE 2: TAPERED POLYISOCYANURATE

A. See Section 07 54 23, Thermoplastic Olefin Roofing.

2.03 INSULATION TYPE 4: UNDER-SLAB INSULATION

A. Install below all slab on grade conditions at restrooms and shower rooms.
B. Under-slab insulation shall be minimum 1 inch thick extruded polystyrene closed cell rigid foam board with continuous skins on both sides:
1. Styrofoam “High Load 100” Square Edge by Dow Chemical Company.
2. FoamulaR 1000 by Owens Corning
3. Or approved equal with a minimal compressive strength of 75 PSI.

C. UNDER-SLAB VAPOR RETARDERS
1. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint tape.

2.04 SPRAYED POLYURETHANE FOAM SEALANT

A. Single-component polyurethane foam sealant for sealing cracks, gaps around openings and joints between other materials so as prevent air infiltration and water penetration. Provide products that have a VOC content of less than 250 g/l.

1. Manufacturers:
   a. OSI, Green Series, “Pro Foam II Minimally Expanding Sealant”.
   b. Dow, “Great Stuff Gaps and Cracks.
   c. Soy Seal for Gaps & Cracks.
   d. Or approved equal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which insulation work is to be performed. Do not proceed with insulation work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean substrates of substances harmful to insulations or vapor barriers, including removal of projections, which might puncture vapor barriers.

3.03 INSTALLATION

A. General
   1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding.
   2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.
   3. Apply a single layer of insulation to required thickness, unless otherwise shown or required to make up total thickness.
   4. Supply and install manufacturer recommended construction tape over all joints in rigid insulation per manufacturer’s instructions.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Batt Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft.
   2. Spray Polyurethane Foam Sealant: Apply according to manufacturer's written instructions.

3.04 INSTALLATION OF VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.05 PROTECTION

A. Protect installed insulation and vapor barriers from physical abuses, by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

END OF SECTION 07 21 00

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SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. Exposed-fastener, lap-seam perforated metal wall panels.

B. Related Sections:

1. Division 05 Section "Cold-Formed Metal Framing" for support framing, including girts, studs, and bracing.
2. Division 07 Section "Sheet Metal Flashing and Trim" for field-formed flashings and other sheet metal work not part of metal wall panel assemblies.

1.03 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete wall system.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.05 SUBMITTALS

A. Submit in accord with the general requirements of this contract.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal-faced composite wall panel and accessory.

C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Flashing and trim.
   b. Anchorage systems.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: Minimum 10 x 10 inches.
2. Trim and Closures: 10 inches long. Include fasteners and other exposed accessories.
3. Accessories: 10-inch- long Samples for each type of accessory.
4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

F. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Wall panels and attachments.
2. Girts or sub-framing.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

I. Maintenance Data: For metal wall panels to include in maintenance manuals.

J. Warranties: Samples of special warranties.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, metal wall panel installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels.

2. Provide in place mock up with all finish conditions for Architect review. Acceptable mock up construction may become part of the finished construction.
3. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store metal wall panels horizontally vertically on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.09 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.010 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures, including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

1.011 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finish:
a. 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Aluminum Metal Plate
1. Aluminum Material: Tension-leveled,
2. 70% Fluoropolymer PVDF painted finish, 3003-H14 manganese alloy.
3. Thickness: 0.080 inch.
4. Weight: Less than 2 lbs per sf.

C. Aluminum Tapered Rib
1. Formed with raised, trapezoidal ribs.
2. Material:
a. Aluminum sheet, .040 inch thick; smooth.

3. Exterior Finish:
a. 70 percent; 3-coat fluoropolymer.

D. Panel Sealants:
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.02 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.

C. Zee Clips: 0.079-inch nominal thickness.

D. Base or Sill Angles and Channels: 0.079-inch nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated or required for a complete installation.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- wide flange.

1. Nominal Thickness: As required to meet performance requirements, or as indicated.
2. Depth:
   a. As indicated or required for a complete installation.
   b. Custom sizes are required.

3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements.

H. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous metal framing members to substrates.

2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

2.04 EXPOSED-FASTENER, LAP-SEAM METAL WALL PANELS:

A. General: Provide factory-formed, metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for complete installation.

B. Tapered-Rib-Profile, Exposed-Fastener Metal Wall Panels: Formed with raised, trapezoidal ribs.

1. Basis-of-Design Product: Centria Architectural Systems Profile BR5-36 Ecoscreen Perforated Screenwall.
2. Subject to compliance with the requirements, comparable products by one of the following may be provided; submit for approval:

a. AEP-Span.
b. Architectural Metal Systems.
c. Berridge Manufacturing Company.
d. Butler Manufacturing Company
e. Copper Sales, Inc.
f. Englert, Inc.
g. Fabral.
h. McElroy Metal, Inc.
i. Metal Sales Manufacturing Corporation.
j. Metecno-Morin.
k. Petersen Aluminum Corporation.

3. Material: Aluminum sheet, .040 inch thick; smooth.
   a. MP-1: Perforated Panel where indicated on Drawings.
      1) Free Area: 30 percent; 1/8-inch diameter holes spaced at 7/32 inch, on-center, staggered
   b. Exterior Finish: 70 percent; 3-coat fluoropolymer.
   c. Color: Custom color as selected by Architect
   d. Interior Finish: Manufacturer's standard.

4. Ribs: 1-1/2 inch deep unsymmetrical ribs spaced at 7.2 inches o.c.
   a. Corners: BOD Centria MicroSeam Corners:
      1) Mitered Corners: Structurally-bonded horizontal interior and exterior trimless corners matching metal wall panel material, profile, and factory-applied finish, fabricated and finished by metal wall panel manufacturer.
      2) Welded, riveted, fastened, or field- fabricated corners do not meet the requirements of this specification.

5. Panel Coverage: 36 inches.

2.05 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.

C. Flashing and Trim: Formed from 0.032-inch- thick zinc coated (galvanized) steel sheet or aluminum- zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

D. Panel Sealants:

1. Joint Sealant: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.
    a. Non-staining type meeting ASTM C-1248.

2. Color: Custom color to match composite wall panel finish as selected by A/E.

E. Sub-girts and/or Z-furring:
1. Galvanized steel, minimum 20 gage, dimensions as indicated on drawings. Furring Channel: Provide Hat, C, U or Z type as recommended by manufacturer.
2. Flat Strap: At least 14 gage thick

F. Panel Fasteners: Stainless steel fasteners suitable for attaching to specified substrate. Minimum 3/4 inch length, with heads/integral washers a minimum of 7/16 inch diameter.

G. Pre-finished Moldings: Manufacturer's standard line of extrusions; finish to match panel, to profile required on Drawings.

2.06 FINISHES

A. Comply with NAAMM's - Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) resin system.
1. Three-Coat Fluoropolymer: AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' installation instructions.
2. Custom color as selected by Architect.

C. Field Touch-Up Materials: As recommended by coating manufacturer for field application.

2.07 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. As applicable, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate non-moving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by metal wall panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.08 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.03 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal wall panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
7. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing.
8. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

B. Fasteners:

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.

6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

3.04 ACCESSORY INSTALLATION

A. General: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.05 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13

SECTION 07 53 23

ETHYLENE-PROPYLENE-DIENE-MONOMER ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. The work under this section includes all labor, material, equipment and related services necessary to install fully-adhered black EPDM membrane, associated system components including metal flashing, all roof related construction and insulation.

1.03 RELATED WORK

A. Rough Carpentry, Section 06 10 00.

B. Flashing and Sheet Metal, Section 07 62 00.

1.04 REFERENCES

A. ANSI/SPRI – American National Standards Institute/Single Ply Roofing Institute.

B. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate

C. ASTM C1289-13e1– Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

D. ASTM D4637 - Vulcanized Rubber Sheet used in Single Ply Roof Membrane.

E. NRCA - Roofing and Waterproofing Manual.

F. UL - Fire Hazard Classifications.

1.05 TECHNICAL SUBMITTALS AND OTHER DOCUMENTS

A. Submit in accordance with the General Conditions of the Contract.

B. At (or before) the preconstruction meeting and prior to start of work, submit the following for approval:
   1. One (1) copy of a list of all materials used on the project, identified by manufacturer's name, size, thickness, type or grade.
   2. Electronic copies of insulation supplier's shop drawings showing the layout of the tapered insulation. Shop drawings shall show actual locations and sizes of all roof drains and other pertinent rooftop equipment.

a. Roof Drain Verification: Submit an electronic drawing indicating location of coordinated drain and scupper locations. Since the Project includes a tapered insulation systems, the Prime Contractor shall setup a meeting between the roofing contractor, plumbing contractor and other contractors as required to coordinate the final drain location. A final roof drain and scupper drawing shall be submitted to the A/E for review and approval after all locations are established. All penetrations shall be reviewed such that they do not impede water flow. Saddles and crickets may be required to transfer water around such obstructions.

b. Tapered Insulation Drawing: Submit an electronic copy of insulation supplier's shop drawings showing the layout of the tapered insulation. Shop drawings shall show actual locations and sizes of all roof drains and other pertinent rooftop equipment.

i. Tapered insulation layout drawing submittal shall state the average R-value to be achieved by the new roof system prior to approval of the system.

ii. The Contractor tapered insulation drawing shall be submitted to the AE for approval after drain locations are established.

iii. Roofing Contractor and supplier shall not scale the bid documents to establish the drain layouts.

iv. Roofer shall verify that the submitted and approved tapered insulation drawing layout starts at the established drain bowl.

v. Tapered insulation installed contrary to the low point of the drain, over flow or scupper locations shall be cause for rejection of the work and therefore shall be removed, at no cost to the project, and re-installed to start at the drain bowl.

3. Membrane Supplier Installation Instructions: Contractor shall submit specified amount of manufacturer’s current paper-print installation and detail manual to be used for on-site inspection/verification of work performed.

a. Submit: One (1) copy of the membrane supplier’s most current version, complete edition paper-copy installation and detail 3-ring or spiral bound manual. Partial submittals taken from within the bound manual are not acceptable.

b. Submit: Web-site information to allow access to membrane supplier’s most current installation and detail manual.

4. Material List: Submit an electronic copy of a list of all materials intended for use on the project, to include roofer and all other sub-contractor composite system materials, starting at the roof deck and identified by manufacturer's name, size, thickness, type or grade. List shall be submitted on Roofing Contractor's letterhead stationery. Submit product data sheets as required.

a. Contractor shall state the following at the bottom of the material list submittal: “<u>New products installed on this project do not contain asbestos</u>”.

5. Membrane Supplier Warranty Acknowledgement: Upon receiving the Contract Offer from the Owner, Contractor shall immediately notify the membrane supplier of intent to purchase the product and to obtain the warranty as specified by this Section.

a. Submit: an electronic copy of the Contractors dated notification letter sent to the membrane supplier.

b. Submit: an electronic copy, on membrane supplier letterhead, stating acknowledgement of such notice and agreement to provide the warranty required by this Section. The letterhead acknowledgement shall include the date such letter was issued, Owner Project title, Project number, Section number(s), membrane supplier representative signature and be addressed to the Roofing Contractor.

6. Contractor And Worker Qualification : Submit an electronic copy of the membrane suppliers current written documentation stating the Contractor is an ”approved Contractor applicator” in

good standing, for the work specified herein shall to be submitted to Owner at the preconstruction meeting. Document shall be up to date, indicate Contractor name, certification status, year of issue and duration of such status.

a. Submit: an electronic copy of the membrane supplier's certificate of successful completion (if available from membrane supplier) of training for each roofer employed on this project shall be submitted to Owner at the preconstruction meeting. Document shall be up to date, indicate worker name, certification status, year of issue and duration of such status.
b. Submit: an electronic copy of a list of all workers to be employed on this project. The list shall indicate each workers name and trade. Project supervisor and main contact person shall be identified.

7. Roof Guarantee and Warranty
   a. Submit one (1) original guarantee as required herein. (Refer to GUARANTEE article in Part 1 of this Section).

8. Membrane Supplier Roof Warranty
   a. Submit one (1) of the original membrane suppliers warranty of all membrane warranties required herein. (Refer to GUARANTEE article in Part 1 of this Section).

9. Miscellaneous Metal Warranty:
   a. Submit one (1) original of manufacturer warranty as required by Specification Section.

10. Recycled Materials: Submit an electronic copy of a materials recycle plan to Owner for review. Include recycle business name, address, contact, and phone number where all recycled roofing material removed by this project will be delivered. Refer Specification Section 01 74 19, Recycling.

11. Safety Report: Submit and electronic copy of a written report to be given to the Owner Representative at the preconstruction meeting, describing in detail the Contractors implementation of specific OSHA regulations, Contractor's worker safety program methods/means, roof perimeter safety and identification of the "watch person" required at all roof levels. Identify fire extinguisher and their locations, all equipment/operators on roof/ground in setup/storage area and travel routes used while performing the work.

C. MSDS Data:
   1. Submit and electronic copy of all MSDS paperwork for each product used on this project.

D. Commissioning
   1. The project will be commissioned by a separate 3rd party commissioning agent.
   2. See Section 01 91 13 for all commissioning requirements including construction verification checklists, functional performance testing, meetings and on-site verification.

E. During construction, maintain at least one (1) copy of the following at the project site:
   1. These Contract Documents (specifications, drawings and any addenda).
   2. All approved submittals.
   3. The latest version of the manufacturer's handbook or cut sheets showing technical information and application techniques for all primary roofing system materials.
   4. Material Safety Data Sheets (MSDS) for all materials used on this project.

F. After the completion of the project, and prior to final payment, submit:
   1. An Electronic and three (3) copies of a fully dimensioned as-built roof plan showing all seam and patch locations, actual locations and sizes of roof drains, vents, fans, etc.

2. The original and one electronic copy of all roof guarantee/warranty documents.
3. The following information shall be included on all guarantees, warranty and other submittal documents:
    a. Street address where work was performed, building name, Owner Project number and total sq. ft. of all roof areas.

G. Contractor On-Site Approved Documents:
1. Contractor shall maintain at least one (1) copy each of the construction set specification and drawings, addenda, value enhancement, "Request for Information" (RFI), "Construction Bulletin" (CB) and "Change Order" (CO) documents and all other approved signed submittals on site throughout construction.
2. Contractor shall maintain at least one (1) copy of the latest version of the membrane supplier's handbook including details and technical information concerning application techniques for all primary roofing system materials required by the work.
3. Contractor shall maintain at least one (1) copy of the Material Safety Data Sheets (MSDS) manual for all materials including those used on this project.
4. The Contractor is required to take digital photo records. Provide digital camera photos throughout the project as required by these specifications and/or requested by Owner. Contractor shall take multiple digital camera photos of the following to be submitted electronically, via e-mail to Owner. Cell phone photos are not acceptable.
    a. Contractor shall take and submit digital camera photos' of the various difficult watertight locations and mechanical fastening that will be hidden from view or otherwise concealed beneath the completed work. Multiple photos shall be taken of the entire installation starting at the roof deck and continuing throughout the roof system installation as it progresses in layers, as required per specification.
    b. Contractor shall take and submit digital camera photos of all changes to the scope of work to include existing conditions as the work takes place in its various stages of the new Work as it takes place throughout its various stages.
    c. Provide digital camera photos of the completed work. Photos shall include the various metal flashing details, transitions and penetration height changes and in general an over-all view of the field of all roof areas. Photos shall be identified by the roof area where photos are taken.

1.06 QUALITY ASSURANCE

A. Contractor shall be recognized by the manufacturer of the EPDM membrane system as an "approved" or "authorized" applicator of the roof membrane system and all associated products and components specified herein.
1. Contractor shall have been in business for a minimum of three (3) years and within the past three (3) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of similar size and scope of the work specified in this section. Backup documentation/verification may be requested by the Owner.
2. Roofing Contractor shall notify the membrane supplier in writing of their intent to obtain all system material and send application for the warranty for work required herein. Letterhead documentation shall be sent to the membrane supplier and include a current date, indicate the Owner Project Number, bid document technical Section(s), indicate in full the composition of roof system to be install per bid documents and be signed by the Roofing Contractor Representative.
3. Membrane supplier shall provide Roofing Contractor with a current date written documentation reply stating the receipt of Contractor request including warranty application and statement that the Roofing Contractor is an "approved and authorized Contractor applicator" in good standing, for the work specified herein. A copy of this letterhead documentation shall be submitted to Owner at the preconstruction meeting. Such document shall include a current date, acknowledgement the Owner Project Number, bid document

technical Section(s), include the roofing Contractor business name, certification status, year of issue and duration of such status.

4. Site visit: Roofing Contractor shall notify membrane supplier of start date and arrange for membrane supplier to meet with the on-site foreman on the 1st or 2nd day after start of the Work. Notify the Owner concerning the membrane suppliers visit so the Owner Contact may be present. A minimum of 1 visit is required.
5. Roofing Contractor on-site Foreman shall be approved by the membrane supplier and shall remain on-site throughout the duration of the project.
6. Contractor workers employed on this project shall be recognized by the supplier of the roof membrane system as "approved" or "authorized" applicator(s) and within the past two (2) years, the worker shall be able to document the successful completion of a minimum of three (3) projects of similar size and/or scope of the Work as specified in this Section.
7. All roofers by trade, and employed on this project shall have a certificate of successful completion of training for the system to be installed. Undocumented roofers shall not be allowed to perform the work required herein pertaining to the physical placement/installation of any and all of the roof system components specified herein.
8. Membrane supplier certificate of successful completion of training for each roofer employed on this project shall be submitted to Owner. Document shall be up to date, indicate worker name, certification status, year of issue and duration of such status.
9. Contractor shall provide a list of all workers to be employed on this project. The list shall indicate each of the workers by name and their construction trade including the Project foreman and Contractor main office contact person.
10. Labors, sheet metal workers or other non-roofer employees shall not be allowed to perform the actual installation of any part of the membrane suppliers warranted roof system required by this Section without manufacturer documentation of proper training, as required herein.

B. Provide all equipment recommended by the manufacturer for proper installation of the materials specified.

C. Contractor shall perform work required using details provided within the specifications, on the drawings or as required by the membrane supplier for a proper watertight installation and to allow issuance of warranties required herein.

D. All system components not specifically identified herein but required by the membrane supplier for the roof system installed by the Work required in the Project Manual shall be provided and included in the membrane supplier watertight warranty as required herein. System components required by the Work in the Project Manual but otherwise not warranted by the membrane supplier shall be upgraded to be membrane supplier specific products at the time of bid such that they are covered by the warranty required herein.

E. Changes or variations to the roof system composition as required herein shall be approved by the Owner, in writing. Changes provided by the Contractor without Owner written approved shall be cause for rejection of the Work in its entirety.

F. Roofing installations shall comply with fire resistive rating as defined in the Wisconsin Commercial Building Code. Required rating on these roofs: U.L. Class A.

G. Prior to the start of construction, it is required that the Contractor's superintendent or foreman attend the preconstruction/preinstallation meeting(s).

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Make no deliveries to the project site until ready to install or approved storage is provided. The State will not accept delivery nor will the State be responsible for any materials or equipment stored on the premises.

B. Deliver materials in original unopened containers of packaging clearly labeled with manufacturer's name, brand name, instructions for use, all identifying numbers and U.L. labels.

C. Deliver materials in sufficient quantity to allow continuity of work. Materials used on the job must be stored in such a manner as not to create a nuisance or hazard.

D. Materials used on the job must be stored in such a manner as not to create a nuisance or hazard.

E. Store materials on clean, raised platforms, with breathable, weather protective covering when stored outdoors. Provide continuous protection from materials against weathering and moisture absorption. Factory applied "shrink-wrapping" is not considered to be an acceptable weather protective covering. Improper storage practices will be grounds for rejection of questionable materials.

F. Store primers, coatings, sealants and similar materials between 60 degrees and 80 degrees Fahrenheit.

G. DO NOT store materials in a manner which will overload any portion of the building.

H. Handle all materials in a manner which will not damage the material. All damaged materials shall be removed from project site.

I. Select and operate material handling equipment and store materials as not to damage existing construction or applied roofing, and without overloading the building structural system.

1.08 JOB CONDITIONS

A. Apply roofing in dry weather. All roofing materials installed during rain shall be removed and replaced with dry materials at the Contractor's expense.

B. DO NOT apply roofing unless authorized by the Project Representative when the ambient temperature is below 32 degrees Fahrenheit. Under no circumstances will any seaming, flashing or adhesive activities be allowed when the ambient temperature is below 20 degrees Fahrenheit, or the wind chill factor is below 0 degrees Fahrenheit.

C. Install all rooftop mounted equipment in a watertight manner and repair any damage to sheet metal or other components related to connection and protection of the roof system.

D. Prevent materials from entering and clogging roof drains and conductors. Remove roof drain plugs when no work is taking place or when rain is forecast.

E. Protection of surfaces:
   1. Take every precaution to prevent water leakage, or debris falling into the building interior, or other such occurrences. Contractor is responsible for any and all damage to the building interior or its contents that occur as a direct cause of the Work and due to the Contractors methods and mean practice to accomplish the Work required herein.
   2. Provide special protection or avoid heavy traffic on completed work. Temporary walkways and work platforms shall be provided as necessary.
   3. Wall surfaces shall be protected with tarpaulins or other suitable cover to prevent damage, staining or discoloration that might result from operations such as removal, disposal, or removing of equipment or materials to the roof surface. Windows, doorways, walkways, etc. may require special protection measures.

F. Disposal of materials:
   1. All materials to be disposed of shall be loaded directly into trucks by means that will prevent damage to existing or new surfaces and to control pollution. Free-fall of debris from heights over 15' will not be allowed.
   2. Contractor is responsible for any charges, such as landfill fees, incurred for disposal of materials.

1.09 GUARANTEE

A. Elastic Sheet Manufacturer's Warranty: Provide the elastic sheet manufacturer's NDL ("No Dollar Limit")/Total System" warranty covering defects in material and workmanship of the membrane and other system components supplied by the manufacturer for a period of ten (10) years from the date of installation.

   Provide written five (5) year guarantee warranting all roofing and flashing required under contract, to be watertight and free from defects in materials or workmanship for period of time, as stipulated in guarantee form.

   Contractor shall perform a minimum of two (2) roof system inspections during the term of this guarantee. The first inspection shall be approximately two (2) years after installation date on five (5) year guarantee with final inspection performed within last 6-months of five (5) year guarantee

   It is recommended that the Contractor take digital photos of the finished work for their files and future reference.

B. Elastic Sheet Manufacturer's Material Warranty: Provide the elastic sheet manufacturer's warranty covering defects the membrane material for a period of twenty (20) years from the date of installation.

PART 2 - PRODUCTS

2.01 GENERAL

A. Products used in this installation shall be compatible with one another and the membrane intended for use.

B. Use new materials only; salvaged or used materials are unacceptable.

C. Unapproved manufacturer and/or supplier products installed on the Project shall be cause for rejection of the roof system in its entirety and shall be completely replaced at no cost to the Project.

2.02 MEMBRANE MATERIALS AND SUPPLIERS

A. Membrane: ASTM D4637, Type I; black, non-reinforced, 60 mil EPDM (Ethylene Propylene Diene Monomer) elastomer manufactured and supplied by:
   1. Carlisle SynTec Systems; Manufacturer.
   2. Firestone Building Products; Manufacturer.
   3. GenFlex LLC: Supplier - Membrane manufactured by Firestone Building Products.
   4. Johns Manville; Manufacturer.

5. Mule-Hide Products Co. Inc.; Supplier - Membrane manufactured by Carlisle SynTec Systems.
6. Versico Roofing Systems; Supplier - Membrane manufactured by Carlisle SynTec Systems.

B. Manufacturer shall have had membrane in production and use on roof systems for a minimum of ten (10) years.

C. All associated products required by the manufacturer and membrane supplier for proper, complete and warranty specified installation of the specified membrane shall be approved and provided by the approved membrane manufacturer.

D. Uncured Flashing: 60 mil, uncured EPDM elastomer as recommended and supplied by the membrane manufacturer.

E. Cured Flashing: ASTM D4637, Type I; black, non-reinforced, 60 mil EPDM elastomer as recommended and supplied by the membrane manufacturer.

F. Perimeter Securement Strip: ASTM D4637, Type II; reinforced, 60 mil EPDM elastomer as recommended and supplied by the membrane manufacturer.

2.03 INSULATION

A. Insulation Type 2: Tapered Polyisocyanurate, factory tapered ¼”/foot. Thickness as indicated on drawings: ASTM C1289-13e1, Type II, Class 1, Grade 2; rigid board insulation with felt or fibrous mat facing on both sides. Maximum size = 48" x 96"; thickness = 1-1/2”.

1. Average R Value: As indicated on drawings.

B. Tapered insulation board shall have a start thickness at the perimeter of the roof drain of 1/2”.

1. Roof drain sump of 1/2” and shall not exceed a maximum slope of 3/4” within the sump area.
2. “Cricket” and “saddle” tapered board shall be factory supplied and tapered as required and/or specified to properly direction water flow to the nearest drain or scupper.
3. On-site fabricated “cricket” or “saddle” tapered insulation installations are not acceptable and shall be cause for rejection of the Work.

C. Maximum board size = 48” x 48”; maximum board thickness (including fill boards) = 2-1/2”. Insulation system design and layout drawing provided shall indicate a minimum of two (2) layers to allow for staggering of insulation joints in both directions.

D. For mechanically attached boards, maximum size = 48" x 96"; for adhered boards, maximum size = 48” x 48”. Thickness = As required by construction drawings. Insulation system design and layout drawing provided shall indicate a minimum of two (2) layers to allow for staggering of insulation joints in both directions.

2.04 VAPOR RETARDER

A. Vapor Retarder: Membrane supplier’s approved self-adhered vapor retarder with a perm rating of .5 or less directly adhered to the thermal barrier mechanically attached to the steel roof deck. Thermal barrier shall be attached to the steel deck with a minimum of eight (8) fasteners per 4x8 board or manufacturer’s requirements, whichever is more conservative.

2.05 ROOF BOARDS

A. Roof Boards
   1. Roof Board Underlayment: Georgia Pacific, DensDeck Roof Board, thickness as indicated on dawings.
   2. Roof Cover Board: DensDeck Prime Roof Board, thickness as indicated on dawings.

2.06 AUXILIARY MEMBRANE ROOFING MATERIALS

A. Bonding Adhesives, Cements, Tapes, Sealants and Accessories:
   1. Foam and solvent based adhesives and related prepping and cleaning agents required for the installation of a fully-adhere system membrane, seams, membrane flashing, membrane to insulation, insulation to insulation and deck shall be approved and supplied by the approved membrane provider.
   2. Adhesives for splicing shall be butyl based.
   3. Water-base adhesives: These products are not an acceptable for use in cold climate.
   4. Asphalt: is NOT an acceptable insulation adhesive.

B. Plumbing Vent Flashing: Premolded boot with stainless steel drawband clamp as recommended and supplied by the membrane manufacturer.

C. Termination Bar: ASTM B209, Series 3000, Temper H-14; minimum 0.10" thick, 1.25" wide aluminum with reverse bend for sealant application along top edge shall be approved and supplied by the membrane provider.

D. Fasteners:
   1. Fasteners shall be approved and supplied by the membrane provider.
   2. For Fastening Perimeter Securement Strip: Polymer coated screw and plate as recommended and supplied by the membrane manufacturer.
   3. For Fastening Membrane to Wood: 1-1/4" galvanized roofing nails through 1" metal discs.
   4. For Fastening Termination Bar to Concrete or Masonry: Zinc alloy expansion shield with hardened steel pin.

E. Pourable Sealer (if required): 2-part polyurethane sealer intended for use by the manufacturer to seal pitch pans and other penetrations.

F. Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A or O; FS TT-S-00230C, Type II, Class A; one-part polyurethane base, elastomeric joint sealing compound such as Sika Chemicals "Sikaflex 1a", Sonneborn-Contech "Sonolastic NP1" or Tremco "Vulkem 116" or “Dymonic".

G. Other products, not specifically described, but required for a complete and proper warranted system installation as required by this section shall be selected by the Contractor to be included in the Work, identified on a materials list and subject to the approval of the Architect/Engineer..

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine the areas and conditions under which work in this section will be installed. Bring to the Project Representative's attention any conditions detrimental to the proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

B. Proceeding with the work shall signify the Contractor's acceptance of the substrate being covered by this Work.

C. General Contractor to call a meeting between the roofing contractor and plumbing contractor to coordinate the final drain location. Tapered insulation drawing shall be re-submitted to the AE after drain locations are approved by all, in writing. Tapered insulation installed contrary to the low point of the drain, over flow or scupper locations shall be cause for rejection of the work.

D. Approved tapered insulation drawing layouts shall be reviewed by the Contractor installing the work in this section prior to start of such work, and before ordering the materials, to assure that the tapered insulation layout will correspond with the exact location of new and/or existing roof drains and primary through-wall and/or roof edge drain scupper locations.

E. Tapered insulation systems that are not installed such that they drain directly and positively to the roof drain shall be removed and installed correctly by the roofing Contractor at no additional cost to the project.

3.02 SUBSTRATE PREPARATION

A. Plan work and take whatever action is necessary to prevent dirt and debris from entering the building during the Work required by this section.

B. An existing bituminous vapor retarder, if found to be present, may remain if well adhered.

C. Remove existing stone ballast and stockpile on the ground for reuse.

D. All vertical surfaces to receive new flashing materials shall be thoroughly cleaned of existing adhesives, sealants, bituminous materials, etc.

E. Verify that wood blocking, curbs and nailers are securely anchored and that roof openings and penetrations are in place and set and braced. Verify that roof drains are properly clamped into position.

F. The membrane supplier shall approve of all mechanical fasteners used to secure all roof system components.

G. Contractor shall take multiple digital photos to be submitted electronically to the Owner showing the various locations and types of mechanical fastening that will be hidden from view or otherwise concealed beneath the completed roof system.

H. Verify that the substrate is clean, dry and free from sharp projections and depressions and that all surfaces and site conditions are ready to receive new materials. Bottom flanges (ribs) of steel deck shall be void of moisture and other debris.

3.03 INSTALLATION OF VAPOR RETARDER

B. Vapor Retarder Over Steel Deck:
   1. A vapor retarder is required over the entire metal roof deck and be tape sealed at membrane lap, perimeter and all penetrations.
   2. Minimum lap requirements:
      a. Sheeting lapped minimum 1'-0"
      b. Turned up at the perimeter and penetrations a minimum 4".
      c. Provide "duct" tape type seal at all laps, perimeter and all penetrations.

3.04 INSTALLATION OF NEW ROOF SYSTEM

A. Install all nailers and wood blocking in accordance with Section 06 10 00, Rough Carpentry.

B. Install insulation as follows:
   1. Repair all damage to vapor retarder before installation of first layer of insulation.
   2. Loose lay tapered insulation in accordance with the approved shop drawings.
   3. Loose lay multiple layer(s) of polyisocyanurate insulation.
   4. Stagger all joints a minimum of 6" in both directions between insulation layers.
   5. Install insulation boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeters of roof areas and around penetrations and projections.
   6. Provide: Sumps around all roof drains using tapered insulation as required or detailed. Unless otherwise indicated, sump shall be 48” x 48”. Insulation shall have a constant, gradual slope from the perimeter of the sump to the drain bowl. Severely sloped sumps will be rejected.
   7. For cold weather installation of mechanically fastened roofing system: Prepare screw/plate/insulation to receive application of a minimum 6” x 6” piece of manufacturer peel-and-stick over each screw/plate mechanical fastener to entomb the application and aid in preventing direct condensation/moisture contact with the screw/plate.
   8. Standing water shall be diverted by use of saddles or cricket. Ponding water is defined as standing water on the surface of the roof membrane after 72 hours of reasonable drying weather, after a rain.
   9. Fully-adhered insulation over mechanically fastened insulation over metal deck: Fasten first layer of insulation per manufacturer recommendations over existing or specified vapor retarder, if required, and adhere additional layers in solvent bases adhesives as recommended by membrane supplier. Metalic mechanical fastener plates are acceptable for use in the system. Plastic or other plate materials are not acceptable.
   10. Mechanical Fasteners: Shall be sized to be long enough to fasten into the upper flute of the metal deck only, with a maximum 3/4" penetration unless membrane supplier requires additional penetration, in writing. No fasteners shall be installed that could be long enough to penetrate the lower flute of the metal deck. Fasteners installed that are longer than stated herein shall be cause for rejection of the Work, removal of such fasteners and repair of the metal deck, to the Owners satisfaction.
   11. Exposed to Interior Fasteners: Shall be color coordinated to match the interior color of the metal deck and submitted for Owner review and written approval. Un-approved or incorrect colored fasteners shall be cause for rejection of the Work or be painted to match the color of the metal deck.
   12. “New Construction Fully-Adhered Systems” Requiring Mechanical Fastening To Metal Deck: The first layer of insulation (Min. 1-1/2”) only shall be mechanically fastened over existing or specified vapor retarder, if required, over metal deck. Additional layers of insulation shall be fully-adhered over the first layer in membrane suppliers approved adhesives to encapsulate the mechanical fastener and its fastener plate. Metalic mechanical fastener plates are acceptable for use in the system. Plastic or other materials plates are not acceptable.

C. Install membrane as follows:
   1. Install membrane in accordance with the manufacturer's recommendations and the following:
   2. Use largest membrane panels practical to minimize field seams; where necessary, lap all seams in direction of flow.
   3. Unroll membrane over the insulation and position without stretching. Allow to relax approximately 30 minutes or more, per membrane supplier’s instructions, prior to seaming.
   4. Restrain membrane at the roof perimeter, at higher walls and around all curbed penetrations using perimeter securement strip.

5. Prior to seaming, thoroughly clean membrane of excess dirt, dust, talc, etc. Scrub sheets with warm soapy water and rinse with clean water to insure clean surfaces.
6. When using primers and adhesives, mix all materials by stirring proper lengths of time as recommended by the manufacturer. Consult manufacturer's literature for application techniques regarding use of rollers or brushes.
7. All field seams shall be minimum 3". Seams may be made using either adhesives or tapes. After seaming, roll seams with a 2" wide steel roller, using positive pressure. ROLL PERPENDICULAR TO SEAM ONLY.
8. Termination Bar: Restrain membrane at the roof perimeter, at higher walls and around all curbed and other penetrations base flashing using mechanically fastened continuous perimeter securement strip/metal termination bar, per manufacturer's instructions.
9. Cold Weather Application: Contact membrane supplier for written adhesive application temperature restrictions.

D. Install flashing as follows:
1. Apply flashing to seal membrane to vertical elements, at all T-seams and at other appropriate locations in accordance with the manufacturer's recommendations and the following:
a. Cured flashing shall be used over the waterdam portion of the roof edge/fascia at all roof perimeters.
b. Uncured flashing shall be used on mechanical equipment curbs, other penetrations and T-seams. (Cured flashing may be substituted for uncured flashing where a minimum of 95% adhesion is obtained.)
c. Totally bond (95 to 100%) all flashing to its substrate and round all exposed corners.
d. Use a minimum 6" x 6" patch of uncured flashing over T-seams. (A T-seam is defined as two field seams which cross to form a "T".)
e. Forming of uncured flashing may be assisted with use of a hot air blower; take care not to overheat or "burn" material.
f. Mechanically fasten top edge of flashings as detailed.
g. Thoroughly clean and apply sealant to all field fabricated seams in the membrane and flashing systems in accordance with the manufacturer's detailed specifications. Sealant shall be applied at the end of each day.
h. Flash plumbing vents as detailed. Extend standard plumbing vent stacks as necessary to provide heights of 8" to 12" above the finished roof surface. No extensions shall be shorter than 4" (consult Project Representative for approved methods).

E. Roof drain installation:
1. Complete installation of roof drains on a daily basis. Temporary installation at drain bowl assemble shall not be allowed. Clamping rings and sealant shall be applied to assure a water tight installation at the end of each work day.

3.05 CLEANING

A. Repair or replace defaced or disfigured finishes caused by work of this Section. In areas where finished surfaces are soiled by asphalt or any other source of soiling caused by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.

B. Rod and Clean Drain: When complete and roof is free of debris, Contractor shall rod and clean all drain bodies and piping to the first elbow to be clean and free of previous asphalt and coal tar system seepage, re-roofing debris and all other debris that may impede proper drainage.

C. All drains shall be made to be fully operable and free flowing and maintained in such condition throughout construction and after final drain bowl strainer re-installation.

END OF SECTION 07 53 23

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Metal Counter Flashing.

B. Exposed Metal Trim/Fascia/Copings.

C. Miscellaneous Sheet Metal Accessories.

1.03 RELATED WORK

A. Division 04, Masonry.

B. Section 06 10 00, Rough Carpentry for Wood Blocking, Nailers.

C. Section 07 92 00, Joint Sealants:

D. Division 22: Plumbing

E. Division 23: HVAC

1.04 PERFORMANCE REQUIREMENTS

A. General: Manufacture and install copings, fascia, and scuppers to resist thermally induced movement and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. FMG Listing: Manufacture and install copings, fascia, and scuppers that are listed in FMG's "Approval Guide" and approved for Windstorm Classification, Class 1-60. Identify materials with FMG markings.

C. Thermal Movements: Provide manufactured copings, fascia, and scuppers that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.05 REFERENCES

A. Referenced Standards Recommended practices and details as set forth by the 1993 Edition of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) in the "Architectural Sheet Metal Manual" are incorporated by reference made a part of this work.
   1. AISI – American Iron and Steel Institute.
   2. ASTM 240 Type 304 Stainless Steel
   3. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   4. ASTM B32 - Solder Metal.
   5. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
   6. ASTM C920 – Elastomeric Joint Sealants.
   7. ASTM D2244 – Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
   8. ASTM D4214 – Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
   9. NRCA - Roofing and Waterproofing Manual.
   10. SMACNA - Architectural Sheet Metal Manual.

1.06 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Shop Drawings showing profiles, joint treatment, fastening methods, gauge and finish of materials.
   2. Actual samples of pre-finished sheet metal showing the exact color(s) and texture(s) available for selection from manufacturer's full range.

1.07 GUARANTEE

A. Manufacturer's Warranty: Provide the sheet metal manufacturer's standard twenty (20) year warranty stating at a minimum that the metal finish will not chalk in excess of an eight (8) rating, or fade in excess of a five (5) rating, when tested in accordance with ASTM D2244 and ASTM D4214.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

B. Recycled Content of Aluminum Materials: Provide aluminum materials containing the maximum possible amount of postconsumer and preconsumer recycled aluminum content.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to requirements, provide products of one of the following:
   1. Cheney Flashing Company.
   2. Hickman, W. P. Company.
   3. Metal-Era, Inc.
   4. MM Systems Corporation.

5. Perimeter Systems, a division of Southern Aluminum Finishing Co.
6. Petersen Aluminum Corp.

2.02 METAL COUNTER FLASHING

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.

B. Minimum 22 gauge stainless steel or as indicated on drawings.

2.03 EXPOSED METAL TRIM, FASCIA, COPINGS, SCUPPERS

A. Aluminum Sheet: ASTM B 209, alloy and temper recommended by manufacturer for use and finish indicated, finished as follows:
1. Aluminum: Coping, fascia and trim: 0.080 inch thick; Scupper: 0.063 inch thick.
2. Copings: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, mitered corner units, and end cap units.
   a. Acceptable Manufacturer: Econosnap, or approved equal.
   b. Corners: Mechanically clinched and sealed watertight.
   c. Anchor Plates: Concealed, galvanized steel sheet, 12 inches wide, 0.028 inch thick, with integral cleats.
   d. Coping dimensions as indicated in drawings.
3. Surface: Smooth, flat finish.
4. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat. Color as selected by Architect.

2.04 ACCESSORIES

A. Fasteners: Where not specified, size fasteners to suit conditions. No dissimilar metals allowed.

B. Blind rivets: 1/8" copper "pop" rivets.

C. Solder: As specified by manufacturer.

D. Flux: As specified by manufacturer.

E. Self-Adhering, High-Temperature Sheet Flashing: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing Inc.; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.

e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

F. Flexible Flashing: 0.045" EPDM.

G. Other products, not specifically described, but required for a complete and proper installation of the work in this section shall be selected by the Contractor subject to the approval of the A/E.

2.05 SEALANT:

A. Meets ASTM C-920, Type M, Grade NS, Class 25, use T, NT, M, G, A, O.

B. Federal Specification TT-S-00227E;

C. CRD C 506, Type II, Multi-part polyurethane base, elastomeric joint sealing compound;
1. Color: Selected by A/E from manufacturer's full range of colors.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to be covered by sheet metal. Report any improper defective surfaces to Contractor in writing. Beginning of sheet metal work over surfaces: Presumed as acceptance of surfaces as satisfactory by sheet metal sub-contractor.

3.02 FABRICATION

A. Fabricate sections as detailed. Form sections true to shape, accurate in size, square and free from distortion or defects. Do not "punch" metal at brake points.

B. Form all pieces in lengths of 8'-0" or 10'-0" where practical. Sections less than 3' long are unacceptable unless that section comprises the entire run.

C. Unless detailed otherwise, hem exposed edges on underside 1/2"; fabricate vertical faces with bottom edge formed outward 3/4" at 30 degrees and hemmed to form drip.

D. Miter and seam inside and outside corners using rivets and multi-part polyurethane sealant. Outside corners shall be prefabricated with outside face of section broken at corner; seam at corner is unacceptable. Pieces shall be a minimum of 18" in length, in both directions from the corner.

E. Utilize a minimum 4" back dam and 1 ½" end dams.

F. Metal Counter Flashing:
1. Formed in 8-foot minimum sections, lap end joints 3 inches.
2. Do not seal joints; make continuous at angles; overlap base flashing minimum of 3 inches.

3.03 INSTALLATION

A. General: Install copings, fascia, and scuppers according to manufacturer's written instructions. Anchor copings and scuppers securely in place and capable of resisting forces specified in performance requirements. Use fasteners, separators, sealants, and other miscellaneous items as required to complete manufactured roof specialty systems.
1. Install with provisions for thermal and structural movement.
2. Torch cutting is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

1. Underlayment: Where installing exposed-to-view components of manufactured roof specialties directly on cementitious or wood substrates, install a course of polyethylene underlayment.

C. Installation to have seams and lines as established by the approved shop erection drawings.

D. Coping/Scuppers: Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.

E. Minimize all exposed fasteners, utilize cleated seams whenever possible.

F. Anchor to resist uplift and outward forces according to performance requirements.

G. Install level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil-canning, buckling, or tool marks.

H. Install to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.

I. Expansion Provisions: Provide for thermal expansion of exposed copings and scuppers. Space movement joints at a maximum of 12 feet with no unplanned joints within 18 inches of corners or intersections.

J. Fasteners: Use fasteners of type and size recommended by manufacturer but of sizes that will penetrate substrate not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

K. Details should be per SMACNA ARCHITECTURAL SHEET METAL MANUAL recommended details.

L. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior and exterior wall faces, over cants or tapered edge strips, and under roofing membrane.

3.04 WORKMANSHIP

A. Make all work weather and watertight throughout; provide allowances for material expansion and contraction.

B. Sections shall be uniform, accurately fitted so as to line up straight and true and rigidly secured in place, without kinks or buckles. Joints at corners and angles shall be smooth, tight and neatly mitered and seamed.

C. Unless detailed otherwise, lap all vertical joints between adjacent sections a minimum of 2".

D. Where metal is hooked to a continuous cleat, crimp metal to cleat along entire length.

E. Repair or replace all damaged or defective work.

F. Soldering:

1. Rivet pieces prior to soldering.

2. Soldering shall be done with heavy soldering coppers of blunt design, properly tinned before using. Coppers shall weigh not less than 10 pounds per pair. Use of a gas torch is not allowed.

3. Follow manufacturer's recommendations for cleaning, tinning and soldering metal.

4. Soldering shall be done slowly to heat sheet metal thoroughly and to sweat solder completely through full width of seam. Whenever possible, soldering shall be done in flat position; seams on slopes shall be soldered a second time.

5. Clean all flux from metal after soldering is completed.

3.05 COUNTERFLASHING RECEIVER:

A. Install new receiver as detailed or where required.

B. Notch and lap joints 3" between sections.

C. Apply sealant at the joint between the receiver and the masonry wall where receiver is not part of a thru-wall flashing; DO NOT APPLY SEALANT between masonry and thru-wall flashings.

3.06 COUNTERFLASHING:

A. Fasten counterflashing to receiver with stainless steel sheet metal screws 24" O.C.

B. Notch and lap joints 3" between sections; bayonet joints are unacceptable. Do not fasten joints between sections.

C. Counterflashing shall be creased longitudinally just enough to provide a spring action that will hold bottom edge firmly against flashing.

3.07 WALL FLASHING: (FOR THOUGH-WALL FLASHINGS FOR MASONRY CAVITY WALLS.)

A. Install flashings in accordance with Division 4.

3.08 MISCELLANEOUS FLASHINGS:

A. Install appropriate flashings at all exhausts, vents and penetrations not specifically called out but required.

B. Remount and secure all rooftop equipment. Use threaded fasteners.

3.09 CLEANING

A. Clean exposed sheet metal of roofing materials, mortar, hand marks, other foreign materials.

B. Remove temporary protective coverings and strippable films as copings and scuppers are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

C. Replace items that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 62 00

SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Miscellaneous Joints.

B. Floor Joints (interior).

C. Wall Joints (exterior).

1.03 RELATED WORK

A. Division 4, Masonry.

B. Section 07 62 00, Sheet Metal Flashing and Trim.

C. Section 08 11 13, Steel Doors and Frames.

D. Section 08 41 13, Aluminum-Framed Entrances and Storefronts.

E. Section 09 29 00, Gypsum Board.

1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for initial selection: Manufacturer's color charts.

C. Samples for final selection: Custom color range of actual material for selection.

D. Samples for exterior mockup selection: Custom color range of actual material installed in mockup for selection.

E. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Field-Adhesion Test Reports: For each sealant application tested.

G. Warranties: Sample of special warranties.

1.05 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit quantity required by joint sealant manufacturer of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Retain subparagraph below if generic test data are acceptable.
   6. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
   1. Locate test joints where indicated on Project or, if not indicated, as directed by A/E.
   2. Conduct field tests for each application indicated below:
      a. Each kind of sealant and joint substrate indicated.
         1) Existing masonry.
         2) Existing metal panel.
         3) Where new work abuts materials listed above.

   3. Notify A/E seven days in advance of dates and times when test joints will be erected.
   4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
      a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
         1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
   5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.07 PROJECT CONDITIONS

A. Examine the joint surfaces and backing, and their anchorage to the structure, and the conditions under which the joint sealer work is to be performed. Do not proceed with the joint sealer work until unsatisfactory conditions have been corrected.

B. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient temperature variations, install sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range.

1.08 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.

1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, or custom colors where indicated.

2.02 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
      c. May National Associates, Inc.; Bondaflex Sil 290.
      d. Pecora Corporation; 301 NS.
      e. Sika Corporation, Construction Products Division; SikaSil-C990.
      f. Tremco Incorporated; Spectrem 1.

B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Corning Corporation; NS Parking Structure Sealant.
      b. May National Associates, Inc.; Bondaflex Sil 728 NS.
      c. Pecora Corporation; 311 NS.
      d. Tremco Incorporated; Spectrem 800.

C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dow Corning Corporation; 799.
      b. GE Advanced Materials - Silicones; UltraGlaze SSG4000 or UltraGlaze SSG4000AC.
      c. May National Associates, Inc.; Bondaflex Sil 200 GPN or Bondaflex Sil 201 FC.
      d. Polymeric Systems, Inc.; PSI-631.
      e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
      f. Tremco Incorporated; Proglaze SSG or Tremsil 600.

D. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Tremco Incorporated; Spectrem 4TS.

E. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Pecora Corporation; 898.

2.03 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. BASF Building Systems; Sonolac.
   b. Bostik, Inc. Chem-Chal 600.
   c. Pecora Corporation; AC-20+.
   d. Tremco Incorporated; Tremflex 834.

2.04 PREFORMED JOINT SEALANTS

A. A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured lowmodulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

2.05 SEALANT ACCESSORIES

A. Primer: When required, as recommended by the Sealant Manufacturer.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

D. Joint Sealant Backing:

1. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
2. Closed Cell Back-up (Backer Rod): ASTM C 1330, Type C.
   a. Tremco "Closed Cell Backer Rod”.
   b. Sonneborn "Sonofoam".
   c. W.R. Meadows “Kool-Rod”.

3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings, moisture and other substances which would interfere with bond of sealant. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous or glazed joint surfaces as recommended by sealant manufacturer.

B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

3.03 SEALANT APPLICATION, GENERAL

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Set joint filler units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants.

1. Do not leave voids or gaps between the ends of joint filler units.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Apply compound with a gun having proper size nozzle or with a knife, as required. Use sufficient pressure to fill all voids and joints solid. Remove excess sealant and leave surfaces smooth, neat and clean. Upon completion sealant shall have a smooth, even finish and all joints shall be weathertight. All work shall be in accordance with manufacturer's printed instructions.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a

continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations. Refer to Section 09 29 00 for product.

H. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed and cured sealant joints as follows:
   a. Perform 5 tests for the first 1000 feet of joint length for each kind of exterior sealant and joint substrate.
   b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
   a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 PROTECTION

A. Cure sealants in compliance with manufacturer's instructions and recommendations. Advise the Contractor of procedures required for the cure and protection of joint sealers during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at the time of Substantial Completion.

3.06 JOINT-SEALANT COLOR SCHEDULE

1. Provide different sealant colors, as selected by A/E from manufacturer's full range of colors, at the following joint locations, and as specified in related Sections:
    a. Existing face brick.
    b. Burnished Block.
    c. Mortar joints.
    d. Metal Panels.
    e. Aluminum-framed entrances and storefronts.

END OF SECTION 07 92 00

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Hollow Metal Frames.

1.03 RELATED WORK

A. Joint Sealants: Section 07 92 00.

B. Flush Wood Doors: Section 08 14 16.

C. Door Hardware: Section 08 71 00.

D. Glass and Glazing: Section 08 80 00.

E. Painting: Section 09 90 00.

F. Building in of anchors and grouting of frames in masonry construction is specified in Section 04 20 00.

G. Electrical: Division 26, for conduit in frames for door hardware.

H. Access Control Systems: Division 28

1.04 REFERENCES

A. Comply with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Fire-Rated Doors: Comply with NFPA 80 "Standard for Fire Doors and Windows." and have been tested, listed, and labeled in accordance with ASTM E 152 "Standard Methods of Fire Tests of Door Assemblies" by a nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.

C. ANSI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames

D. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings

E. ANSI A250.5 Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors

F. ANSI A250.6 Hardware on Steel Doors (Reinforcement --Application)

G. ANSI A250.8 Nomenclature for Standard Steel Doors and Steel Door Frames

H. ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

I. ANSI/DHI A115 Specifications for Hardware Preparations in Standard Steel Doors and Frames

J. ANSI/DHI A115.1G Installation Guide for Doors and Hardware

K. SDI-Steel Door Institute

L. ASTM E119 Methods for Fire Tests of Building Construction and Materials.

M. ASTM A240/A240M Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel

N. ASTM A366 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

O. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements

P. ASTM A569 Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality

Q. ASTM A591 Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for light Coating Mass Applications

R. ASTM A620 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Drawing Quality, Special Killed

S. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process

T. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

U. ASTM E2074-00 Methods of Fire Tests of Door Assemblies.

V. NFPA 80: Fire Doors and Windows.

W. NFPA-101-94: Life Safety Code.

X. NFPA 251: Fire Tests of Building Construction and Materials.

Y. NFPA 252: Fire Tests of Door Assemblies.

Z. UL 9: Fire Tests of Door Assemblies.

AA. UL 10B: Fire Tests of Door Assemblies.

BB. UL 263: Fire Tests of Building Construction and Materials.

CC. American Welding Society

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Manufacturer's technical product data substantiating that products comply with requirements.
   2. Shop Drawings for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
      a. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings.
      b. Indicate coordination of glazing frames and stops with glass and glazing requirements.
      c. Submittal to include fully coordinated installation of Detail 4A715 to provide 90 degree angle of hold open door.
   3. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.
   4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.
   1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Construction Manager; otherwise, remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 inch spaces between stacked doors to promote air circulation.

1.08 PROJECT CONDITIONS

A. Examine the openings and conditions under which hollow metal work is to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected.

PART 2 - PRODUCTS

2.01 MANUFACTURERS, HOLLOW METAL

A. Amweld Building Products

B. Ceco Door Products

C. Curries Company

D. Kewaunee Corporation

E. Mesker Door, Inc.

F. Steelcraft

G. Or approved equal.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008 or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flamespread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Steel: Commercial quality, level, cold-rolled steel conforming to ASTM A366, free of scale and surface defects. Commercial quality hot rolled and pickled steel conforming to ASTM A569 may be used as option for interior frames. Standard hollow metal frame gauges are as follows (Bullet Resistant must meet specified resistance level):
   1. Interior Frames: 16-gage.
   2. Exterior Frames: 14-gage.
   3. Flush Doors: 16-gage (exterior), 18-gage (interior).

4. Rough Bucks and Stiffeners: 12-gage.
5. Miscellaneous Trim: 16 gage.

2.03 FABRICATION, GENERAL

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Fabricate doors to a maximum tolerance of 1/16 inch from a straight edge when laid on face of door in any direction, including diagonal.

E. Provide proper Underwriters' Laboratory (UL) labels. Labeled doors shall have equal labeled frames.

F. Clearances
1. Edge clearances shall be provided as follows:
   a. Between doors and frame, at head and jambs - 1/8 inch.
   b. At door sills:
      1) Where no threshold is used - 3/8 minimum.
      2) Where threshold is used - 1/4 inch maximum between door & threshold.

G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

H. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of hollow metal work. Coordinate rabbet width between fixed and removable stops with type of glazing and type installation indicated.

2.04 HOLLOW METAL FRAME FABRICATION

A. Provide metal frames of the types and styles indicated on the drawings or schedules and complying with SDI for materials and construction requirements.

B. Provide metal frames for doors, transoms, sidelights, borrowed lites, and other openings, as shown on drawings.

C. Provide integral channel frames, sub frames and stiffeners to structure where indicated or required for fastening and stiffening frames.

D. Provide steel spreader temporarily attached to feet of both jambs for welded frames.

E. Completely clean all frames by degreasing process, followed by one coat rust inhibitive primer equal to withstand a salt spray test (5% solution) of 70 hours. Thoroughly prime all surfaces without runs, smears, or bare spots, and under and inside all removable stops.

F. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

2.05 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Interior Frames: Fabricated from cold-rolled steel sheet.
   1. Fabricate frames with mitered or coped corners.
   2. Fabricate frames as face welded unless otherwise indicated.
   3. Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
   4. Frames for Wood Doors: 0.053-inch-thick steel sheet.
   5. Frames for Borrowed Lights: Same as adjacent door frame.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

2.06 FRAME ANCHORS

A. Jamb Anchors:
   1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
   2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
   3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
   4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inchdiameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
   1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
   2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

2.07 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

D. Cut-Off Stops:
   1. Angled stop terminates 6-inches above the floor, closed at a 45 degree angle.
   2. See Door Schedule for locations.

2.08 STEEL FINISHES

A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
   2. Ensure primer is compatible with finish coats scheduled.

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
   1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
   3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
      a. At fire-protection-rated openings, install frames according to NFPA 80.
      b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
      c. Install frames with removable glazing stops located on secure side of opening.
      d. Install door silencers in frames before grouting.
      e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
      f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
      g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
      a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions\.
1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

D. Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
4. Install fire-rated frames in accordance with NFPA Std. No. 80.
5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with self-tapping screws.
6. Fill heads of fasteners with body putty, grind smooth and touch-up prime.

E. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

F. Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

G. Install glazing in strict accordance with fire resistant glazing material manufacturer’s specifications. Field cutting or tampering is not permissible.

3.04 ADJUSTING AND CLEANING

A. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

END OF SECTION 08 11 13

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Wood Doors.

1.03 RELATED WORK

A. Section 08 11 13, Hollow Metal Doors & Frames

B. Section 08 71 00, Door Hardware

C. Section 08 80 00, Glazing

1.04 REFERENCES

A. Reference Standards: Section 1300 of the Architectural Woodwork Institute (AWI). Door types specified in Part 2 below are AWI reference designations.

B. Doors: Obtained from a single manufacturer.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract
   1. Manufacturer's product data, specifications and installation instructions for each type of wood door.
   2. 8" x 10" wood door sample with finish. For each color range, contractor to submit a minimum of (4) four samples representing light to dark variation for A/E selection.
   3. Color and finish to be chosen from manufacturer’s full range.

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect wood doors during transit, storage and handling to prevent damage, soiling and deterioration. Comply with the "on-site care" recommendations of National Wood Window and Door Association (WDMA) pamphlet "Care and Finishing Wood Doors" and with manufacturer's instructions.
   1. Provide protective coverings for doors at the factory prior to shipping. Use heavy paper cartons or poly bags and mark with identification required for proper installation.

B. Deliver and store within enclosed building only after humidity contributing work is completed and relative humidity is less than 50%. Stack doors laid flat, level and off floor, in dry, clean, well ventilated space.

C. Do not drag doors across one another.

1.07 WARRANTY

A. Submit in duplicate manufacturer's written warranty per NWWDA Standard Door warranty but extending for life of installation for interior solid core doors.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
   1. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

B. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

C. Low- Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the weatherproofing system shall contain no added urea-formaldehyde resins.
   1. Laminating Adhesives used to fabricate on-site and shop applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Algoma Hardwoods, Inc.; Algoma, Wisconsin; (920) 487-5221.

B. Eggers Industries; Two Rivers, Wisconsin: (920) 793-1351.

C. Marshfield Door Systems; Marshfield, Wisconsin: (800) 869-3667.

D. Oshkosh Architectural Door Company; Oshkosh, Wisconsin: (920) 233-6161.

E. VT Industries; Holstein, Iowa; (800) 827-1615.

2.02 MANUFACTURED UNITS

A. Door Construction General: WDMA I.S.1-A Performance Grade:
   1. Heavy Duty unless otherwise noted.

B. Non-labeled Interior Wood Veneer Solid Core Doors: AWI type PC-5/7, Custom Grade.
   1. Core: Particleboard or agri-fiber: ANSI A208.1, Grade LD-2.
   2. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

C. Labeled Interior Wood Veneer Solid Core Doors: AWI FD.
   1. Edge Banding: Laminated.

2. Color: Factory finishes with edge seal. Custom Colors to match A/E's finish control samples.
3. Provide mineral core blocking at closers.

D. Dutch Door, Non-labeled Interior Wood Veneer Solid Core Doors: AWI PC-5/7, Custom Grade.
1. Same construction as above.
2. Factory fabricated shelf and wood brackets for jobsite installation.

E. Structural-Composite-Lumber-Core Doors:
1. Structural Composite Lumber: WDMA I.S.10.
a. Screw Withdrawal, Face: 700 lbf.
b. Screw Withdrawal, Edge: 400 lbf.

F. Veneered-Faced Doors For Transparent Finish
1. Interior Solid-Core Doors:
a. Grade: Premium, with Grade A faces.
b. Species: Red Oak to match existing, confirm.
c. Cut: Plain sliced (flat sliced).
d. Match between Veneer Leaves: Slip match.
e. Assembly of Veneer Leaves on Door Faces: Balance match.
f. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
g. Exposed Vertical Edges: Same species as faces or a compatible species.
h. Core: Particleboard, glued wood stave or structural composite lumber.
i. Construction: Five plies. Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.

G. Light Frames
1. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.
a. Wood Species: Same species as door faces.
b. Profile: Flush rectangular beads.

2.03 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, ADA requirements and hardware templates.
1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

C. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."

2.04 FACTORY FINISHING

A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Finish doors at factory.

C. Transparent Finish:
1. Grade: Premium
2. Finish: AWI conversion varnish system.
3. Sheen: Satin.

D. Existing painted wood doors to receive paint.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine doors and installed door frames before hanging doors.
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Verify that door frames are of type required for door and are installed as required for proper installation of doors.

D. Do not install doors in frames which would hinder the operation of the doors.

3.02 INSTALLATION

A. Do not install in improperly installed frames.

B. Hardware: For installation, see Division 08 Section "Door Hardware."

C. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

F. Fit for width by planing. For height, saw, taking not over 1/2 inch first from bottom, then not over 1/2 inch from top. Bevel lock and hinges edge 1/8 inch in 2 inches.

G. Provide 3/32 inch clearance between door and frame and 3/8 inch clearance between bottom of door and finish flooring.

H. Seal all job site cut surfaces with stain and two coats of varnish.

I. Install fire-rated doors in corresponding fire-rated frames in accordance with Wisconsin Administrative Code.

J. Install Dutch shelf per manufacturer’s written instructions.
1. Brackets shall be attached with screws and glue.

3.03 ADJUST AND CLEAN

A. Replace or re-hang doors which are hingebound and do not swing or operate properly.

B. Refinish or replace job finished doors damaged prior to Substantial Completion.

END OF SECTION 08 14 16

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SECTION 08 31 13

ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED WORK

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. This section includes the following:
   1. Access doors and frames.

B. Related sections include the following:
   1. Division 23 Section "Duct Accessories" for duct access doors.

1.03 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
   1. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items with concealed framing, suspension systems, piping, ductwork, and other construction. Show the following
      a. Method of attaching door frames to surrounding construction.
      b. Ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, and special trim.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain doors and frames through one source from a single manufacturer.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
   1. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints", Second Edition, January 7, 1997. For applications on ferrous metal substrates.
   2. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Access Doors:
      a. Bar-Co, Inc. Div.; Alfab, Inc.
      b. Cesco Products.

c. J. L. Industries, Inc.
d. Karp Associates, Inc.
e. Milcor Limited Partnership.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets: ASTM A 569/A 569M, Commercial Steel (CS), Type B; free of scale, pitting, and surface defects; pickled and oiled; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M.

B. Cold-Rolled Steel Sheets: ASTM A 366/A 366M, Commercial Steel (CS), or ASTM A 620/A 620M, Drawing Steel (DS), Type B; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified nominal thickness according to ASTM A 568/A 568M. Electrolytic zinc-coated steel sheet, complying with ASTM A 591/A 591M, Class C coating, may be substituted at fabricator's option.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B, with A60 zinc-iron-alloy (galvannealed); stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924/A 924M.

D. Stainless Steel: Type No. 304 stainless steel with No. 4 satin polish.

E. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.03 PAINT

A. Shop Primers: Provide primers that comply with Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Metallic-Coated Steel: Organic zinc-rich primer complying with SSPC-Paint 20 and compatible with topcoat.

D. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

2.04 ACCESS DOORS AND FRAMES

A. Flush Access Doors and Trimless Frames: Fabricated from metallic-coated steel sheet.
1. Locations: Various locations and surfaces, assembly to be manufactured for specific applications.
2. Sizes: 18” x 18” or as shown in drawings.
3. Door: Sheet metal, gauged to door size, minimum 20 gauge metal set flush with surrounding finish surfaces.
4. Frame: To be manufactured specifically for the surrounding material for flush/integral installation, minimum 16 gauge metal flange.
a. Drywall bead for gypsum board.
b. Fire Rated doors to be place in fire rated assemblies or as noted on drawing.
1) All fire rated doors to maintain at least a minimum of the hour rating of the assembly into which it is placed.
2) Fire doors shall have automatic closure, be self latching, and contain interior latch release.

c. Other as needed.

5. Hinges:
   a. Spring-loaded concealed pin type.

6. Latch:
   a. Screwdriver-operated cam latch.
   b. Key operated security lock.

2.05 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

D. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge trim for gypsum board securely attached to perimeter of frames.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

F. All access doors to be fabricated and properly installed in such a manner as to maintain the fire rating of the assembly into which it is placed.

G. UL listed for use in fire rated partitions if required by the application.

2.06 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.07 METALLIC-COATED STEEL FINISHES

A. Galvanizing of Steel Shapes and Plates: Hot-dip galvanize items indicated to comply with applicable standard listed below:
   1. ASTM A 123/A 123M, for galvanizing steel and iron products.
   2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited to the organic coating to be applied over it. For metallic-coated surfaces, clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
   1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel, complying with SSPC-Paint 20.

C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and pre-treating.

D. Stainless Steel: Type No. 304 stainless steel with No. 4 satin polish.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install according to manufacturer's instructions.
   1. Doors to be installed plumb/level/square as surfaces require.
   2. Maintain even gap between frame and door.

B. Stainless steel access panels are to be installed for use in toilets, showers, similar wet areas and in any space in the Autopsy Suite proper.

3.02 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

C. Remove all packaging material upon completion.

END OF SECTION 08 31 13

SECTION 08 33 00

COILING DOORS AND GRILLES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Coiling Counter Door (Manual)

1.03 SUBMITTALS

A. Submit in accordance with general conditions of this contract.
   1. Shop Drawings.
   2. Manufacturer's product data, roughing-in diagrams, and installation instructions for each type and size of overhead coiling door.

1.04 QUALITY ASSURANCE

A. Furnish each coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation.

PART 2: PRODUCTS

2.01 COILING COUNTER DOOR-MANUAL

A. General: Coiling Counter Door: Wayne–Dalton Coiling Wood Counter Doors or approved equal..
   1. Mounting: Overhead Structure with:
      a. Drywall over 16 gauge minimum steel studs or wood stud jambs.
   2. Operation:
      a. Manual push-up.

2.02 COILING WOOD COUNTER DOORS

A. Coiling Wood Counter Doors: Wayne Dalton Wood Rolling Counter Shutters.

B. Curtain:
   1. Double rabbeted wood slats 1-3/4 inches high by 1/2 inch thick.
   2. Material:
      a. Red oak.

B. Guides:
   1. Aluminum guides with wool pile lining.

C. Brackets: Metal plates with permanently sealed ball bearings designed to enclose ends of coil and provide support for counterbalance pipe at each end. Plated fabricated of:
   1. Steel 3/16 inch thick minimum.

D. Counterbalance: Curtain is coiled on a pipe of sufficient size to carry door load with a deflection not to exceed 0.033 inch per foot of door span and to be correctly balanced by helical springs, oil tempered torsion type. Cast iron barrel plugs are used to anchor springs to tension shaft and pipe.

E. Hood: Provide intermediate support brackets as required. Hood fabricated of:
1. Wood matching slats where exposed. Hook concealed by acoustical ceiling tile, see drawings.

F. Finish: Clear finish as specified in Section 09 90 00.
1. Stainless steel #4 finish.

G. Locking
1. Provide cylinder lock at jambs or in center of bottom bar.

PART 3: EXECUTION

3.01 EXAMINATION

A. Verify that openings are prepared with headers level, jambs plumb, floor level without projections, and ready to receive rolling door.

B. Begin installation only when openings conform to specification requirements.

3.02 INSTALLATION

A. Install per approved shop drawings,

3.03 ADJUSTING

A. After installation, adjust for proper operation.

END OF SECTION 08 33 00

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Aluminum Frames.

B. Hardware.

C. Glazing.

D. Accessories for a Complete Installation.

1.03 RELATED WORK

A. Section 07 92 00, Joint Sealants.

B. Section 08 71 00, Door Hardware: For door hardware to be installed under this section.

C. Section 08 80 00, Glass and Glazing.

D. Electrical: Division 26 and 28, for electrical connections, conduit and wiring in frames for door hardware.

1.04 QUALITY ASSURANCE

A. Installer shall be an authorized representative of the door manufacturer for both installation and maintenance of type of units required for this Project.

B. Installer: Not less than 2 year's experience in the installation and service of entrance doors of the same manufacturer.

C. Fenestration must comply with a minimum testing performance requirements for an AAMA/NWWDA 101/1.S.2 HC-40 rating. The recognized standard for performance ratings of windows is AAMA/NWWDA 101/1.S.2.

D. Comply with the manufacturers requirements and the following. In case of conflict, comply with the most stringent.

1. NAAMM-Metal Finishes Manual, National Association of Architectural Metal Manufacturers.
2. ASTM B221- Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wires, Shapes and Tubes.
3. ASTM B244 – Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals With Eddy-Current Instructions.
4. NFPA 80-Fire Doors and Windows.
5. NFPA 252 – Fire Test for Doors Assemblies.
6. UBC Standar4d 7 – 2 - Fire Test of Doors Assemblies: Positive pressure testing.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract
   1. Manufacturer's product data and standard details for doors, including fabrication, finishing, hardware, accessories and other components of the work. Include roughing-in diagrams, wiring diagrams, parts lists, and maintenance instructions.
   2. Furnish templates, diagrams and other data to fabricators and installers of related work as needed for coordination of installation.
   3. Shop Drawings: Indicate anchors, joint system, expansion provisions, hardware, and other components not included in manufacturer's standard data. Include glazing details.
   4. Samples
      a. Frame Color: Two 10-inch extrusions with finish, properly labeled.
      b. Glass: Two 8 x 8 -inch square samples of each glass type indicated, properly labeled.
      c. Corner of Frame: Sample to include fit, finish and tolerance of frame corner joint.
   5. Owner's Manual: Submitted prior to Substantial Completion. Include recommendations for maintenance, repair.

1.06 INSULATED GLASS, GLAZING, ENTRANCE/STOREFRONT INSTALLATION WARRANTY

A. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
   1. Warranty Period: 10 years from date of Substantial Completion.

1.07 MANUFACTURER/FABRICATOR AND INSTALLER QUALIFICATIONS

A. Fenestration systems must be fabricated by a firm experienced in production of systems similar to those indicated, whose work has resulted in a record of successful in-service performance during the immediate past three years. The fabricator should have sufficient production capacity to produce required components without causing delays in the work.

B. Fenestration systems must be installed by an experienced installer, having completed installations of fenestration similar in design and extent to those required for the project whose work has resulted in construction with a record of successful in-service performance during the immediate past three years.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

B. Recycled Content of Aluminum Materials: Provide aluminum materials containing the maximum possible amount of postconsumer and preconsumer recycled aluminum content.

C. Recycled Content of Steel Materials: Provide steel materials manufactured domestically using the electric arc furnace method and containing the maximum possible amount of postconsumer and preconsumer recycled steel content.

PART 2 - PRODUCTS

2.01 MAUFACTURERS

A. Exterior Basis-of-Design Product: Subject to compliance with requirements, provide Trifab 451T (Exterior conditions) with thermal break by Kawneer North America; an Alcoa company.
   1. Types of Kawneer Aluminum Storefront Systems include:
      a. Type 1: Trifab® VG 451T Storefront System – 2" x 4-1/2" nominal dimension; Thermal; Glazing application as indicated on drawings; Stick Fabrication.

B. Interior Basis-of-Design Product: Subject to compliance with requirements, provide aluminum-framed sliding door Series 990 by Kawneer North America; an Alcoa company.
   a. Type 2: Series 990 Sliding Doors Trifab® VG 451 Storefront System – 1-3/4" x 4-1/2" nominal dimension; Non-Thermal; Fully Glazed; Stick Fabrication.
   b. Openings 220e and 220d, OXXO, rough opening height 10'-2", V.I.F. with adjacent operable partition head height. Approximate rough opening width 14'-0", V.I.F. with adjacent operable partition pocket dimensions.

C. Or comparable product by one of the following:
   1. CMI Architectural
   2. EFCO Corporation.
   3. TRACO.
   4. Tubelite.
   5. Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.
   6. YKK AP America Inc.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308/B 308M.
   5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPCSP COM and prepare surfaces according to applicable SSPC standard.
   1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
   2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
   3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.03 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
   1. Construction: Thermally improved at exterior condition.
   2. Glazing System: Retained mechanically with gaskets on four sides.
   3. Glazing Plane: As indicated.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

F. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

2.04 GLAZING SYSTEMS

A. Glazing: As specified in Division 08 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.05 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch thick, extruded aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
2. Door Design: As indicated.
    a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.
3. Glazing Stops and Gaskets: As specified in Division 08 Section "Glazing".

B. Entrance Door Hardware: As specified in Division 08 Section "Door Hardware" and as below.

2.06 ENTRANCE DOOR HARDWARE

A. General: Provide entrance door hardware sets indicated in Division 08 Section "Door Hardware".

B. Weather Stripping at Exterior Doors: Manufacturer's standard replaceable components.
1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC.
2. Sliding Type: AAMA 701, made of wool, polypropylene, or nylon woven pile with nylonfabric or aluminum-strip backing.
3. Weatherstripping Finish: To match door and frame finish unless noted otherwise.

C. Weather Sweeps at Exterior Doors: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.

D. Silencers: BHMA A156.16, Grade 1.

E. Hardware: See Section 08 71 00 for hardware to be supplied by Section 08 71 00 for installation under this section.

F. All hardware shall be secured to aluminum door and frame members with a drill-and-tap screw fastener. Stripping of threads or other means of hardware attachment shall be cause for rejection of the entire assembly without additional cost to the Owner.

G. Hardware:
1. One pair of stainless steel tandem rollers per sliding panel.
2. Stainless steel roller track.
3. Adams Rite 1847 Stainless Steel Deadlock.
4. Thumbturn, interior.
5. No exterior pull.
6. Extruded pull with slide operator interior.

2.07 ACCESSORY MATERIALS

A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."

B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30-mil (0.762-mm) thickness per coat.

2.08 GLASS

A. Glass: See Section 08 80 00 for glass to be supplied and installed under this section.

2.09 GLAZING ACCESSORIES

A. Glazing Sealant: One-part silicone similar to Pecora 860, Sonneborn Omniplus or Tremco Spectrum 2.
1. Comparable means both quality and color options.

B. Setting Blocks: 70-90 Shore "A" durometer, sized to accommodate size of glass used, compatible with glazing sealant.

C. Spacers: Compatible with sealant used.

D. Primer, Sealers, Cleaners: As recommended by glass manufacturer.

E. Aluminum Stops: Pierced and/or fixed stop, finish to match aluminum framing.
1. Equal to Kawneer #069-190, or #169-114 and 069-113.

2.010 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
4. Physical and thermal isolation of glazing from framing members.
5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
6. Provisions for field replacement of glazing from interior.
7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using shear-block system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weather stripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.011 ALUMINUM FINISHES

A. High-Performance Organic Finish: Factory applied, baked-on, fluoropolymer finish complying with AAMA 2605, 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   1. Basis of Design: Permafluor ™ Architectural Finishes
   2. Color: Custom as selected by Architect.
   3. 70% Fluoropolymer PVDF painted finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:
   1. Comply with manufacturer's written instructions.
   2. Do not install damaged components.
   3. Fit joints to produce hairline joints free of burrs and distortion.
   4. Rigidly secure nonmovement joints.
   5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
   6. Seal joints watertight unless otherwise indicated.

B. Metal Protection:
   1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
   2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 08 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

H. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation.

3.03 ERECTION TOLERANCES

A. Install aluminum-framed systems to comply with the following maximum erection tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; ¼ inch over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.

B. Diagonal Measurements: Limit difference between diagonal measurements to 1/8 inch.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: [Owner will engage] a qualified independent testing and inspecting agency to perform field tests and inspections.

B. Testing Services: Testing and inspecting of representative areas to determine compliance of installed systems with specified requirements shall take place as follows and in successive phases as indicated on Drawings. Do not proceed with installation of the next area until test results for previously completed areas show compliance with requirements.
   1. Water Spray Test: Before installation of interior finishes has begun, a minimum area of 75 feet by 1 story of aluminum-framed systems designated by Architect shall be tested according to AAMA 501.2 and shall not evidence water penetration.

C. Repair or remove work if test results and inspections indicate that it does not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

E. Aluminum-framed assemblies will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

3.05 ADJUSTING

A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.

1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3- second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch, measured to the leading door edge.

END OF SECTION 08 41 13

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Door Hardware.

1.03 RELATED SECTIONS

A. Finish Carpentry: Section 06 20 00.

B. Hollow Metal Doors and Frames: Section 08 11 13.

C. Flush Wood Doors: Section 08 14 16.

D. Aluminum-Framed Entrances and Storefronts: Section 08 41 13.

E. Electrical: Division 26 and 28 Sections for electrical connections including conduit and wiring for automatic entrance door operators and access control devices.

1.04 REFERENCES

A. Federal Specifications (FS)
   1. FF-H-106a Hardware, Builders'; Locks and Door Trim-Standard Finishes for Builders Hardware.

B. National Fire Protection Association, Inc. (NFPA), Battery March Park, Quincy, MA 02269.
   1. NFPA 80 - Standard for fire doors and windows.
   2. NFPA 101 - Code for safety to life from fire in buildings and structures.

C. Underwriter's Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062.
   1. Building Materials Directory.

D. Hardware shall be in strict accord with Wisconsin Administrative Code Chapter Comm. 69 - "Barrier Free Design".

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Five (5) copies of a detailed, vertical type hardware schedule for approval.
      a. List and describe each opening separately. Include doors with identical hardware, except hand, in a single heading. Include door number, room designations, degree of swing, and hand.
      b. List related details. Include dimensions, door and frame material, and other conditions affecting hardware.

c. List all hardware items. Include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details.
d. Resubmit four (4) copies of the corrected schedule when required.
e. Determine keying requirements, as directed by the Owner's Representative and submit five (5) copies of a detailed keying schedule for approval; resubmit four copies (4) of the corrected schedule when required.
f. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.

2. Samples of hardware items as may be required. Identify each sample and indicate the location of subsequent installation in the project.
3. Provide a copy of the approved hardware schedule and all pertinent templates or template information to each fabricator of material factory-prepared for the installation of hardware.

1.06 QUALITY ASSURANCE

A. Manufacturers and product numbers listed herein establish a standard of quality. Similar items by other manufacturers may be accepted by prior written approval by the architect in accord with the General Conditions of the Contract. Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Supplier: Hardware Supplier: The hardware supplier shall be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI's continuing education program (CEP).

C. Items of hardware not definitely specified herein but necessary for completion of the Work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required. Include such nuances as strike type, strike lip, raised barrel hinges, mounting brackets, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.

1.07 REGULATORY REQUIREMENTS

A. Furnish UL listed hardware for all UL labeled openings in conformance with requirements for the class of opening scheduled.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware to the job site in the manufacturer's original containers marked to correspond with the approved hardware schedule for installation location.

B. Store hardware in dry surroundings and protect against loss and damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Refer to the Hardware Schedule at the end of this Section.

2.02 ACCESSORIES

A. Furnish all necessary hardware accessories such as wood or machine screws, bolts, nuts, anchors, toggle bolts, and other fasteners, each of the type, size, material and finish for its intended purpose and each according to the material to which the hardware is being applied.

B. Keying system will be determined by the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's recommendations and instructions.

B. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the fire rating.

C. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

D. Remove, cover or protect hardware after fitting until paint or other finish is applied. Permanently install hardware after finishing operations are complete.

E. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors.

F. Deliver one complete set of installation and adjustment instructions, and tools with the hardware.

G. Coordinate security system electrical requirements at doors indicated to have such system.

H. Coordinate all Owner Furnished Contractor Installed hardware.

I. Furnish and install temporary keyed-alike cores as required by Architect and Public Works Project Manager to secure the building or portions of the building.

3.02 ADJUSTING

A. At final completion, adjust and test all hardware for function and performance and leave in good operating condition.

3.03 CLEANING

A. Clean all hardware to restore the original finish.

3.04 PROTECTION

A. Protect the finished installation until acceptance of the project.

3.05 HARDWARE SCHEDULE

A. A. Manufacturers

1. Hinges	Hager Hinge Co.	HAG
a. Approved Equals:	Stanley	
	McKinney	
2. Lockset	Best Access Systems	BES

a. Approved Equals:	Provide 7-pin BEST cylinder cores to match existing. Coordinate with Best Access Systems for keying of project, No Substitutions. Best Access Systems is indicated in this specification as a basis of design; Marshall Best Security Corporation to accept genuine Best Access System provided cylinder core is an acceptable equal.	
3. Door Closers	LCN	LCN
a. Approved Equals:	No substitutions.	
4. Kickplate	Rockwood Mfg. Co	ROC
5. Electric Strikes	Von Duprin	VON
a. Approved Equals:	HES Folger Adams	
6. Door Position Switch	GE	GE
7. Clothes Hook	see 10 28 00	
8. Exit devices	Von Dupring	VON
a. Approved Equals:	No substitutions.	

B. Hardware Sets:

SET AL1

1	EA	SVR EXIT DEVICE	QEL3327A-NL x LBR	313	VON DUPRIN
1	EA	SVR EXIT DEVICE	3327A-DT x LBR	313	VON DUPRIN
1	EA	CYLINDER	AS REQUIRED	613	BEST
1	EA	THRESHOLD	413S	MIL	HAGER
2	EA	DOOR POSITION SWITCH	1078	GRY	GE
1	EA	DOOR CORD	TSB-C	BLK	SECURITRON

EXISTING HINGES AND CLOSERS TO REMAIN; REPLACE SEALS AS NEEDED. CONTRACTOR TO REMOVE EXISTING PUSH/PULLS AND PATCH DOOR AS NEEDED.

SET AL2

1	EA	CONTINUOUS HINGE			
1	EA	RIM EXIT DEVICE	33A-NL	313	VON DUPRIN
1	EA	CYLINDER	AS REQUIRED	613	BEST
1	EA	CLOSER	4100 SCUSH	695	LCN
1	EA	THRESHOLD	413S	MIL	HAGER
1	EA	DOOR POSITION SWITCH	1078	GRY	GE
1	EA	ELECTRIC STRIKE	9600	613	HES

SEALS BY DOOR SUPPLIER

SET AL3

1	EA	RIM EXIT DEVICE	33A-NL	313	VON DUPRIN
1	EA	CYLINDER	AS REQUIRED	613	BEST
1	EA	THRESHOLD	413S	MIL	HAGER
1	EA	DOOR POSITION SWITCH	1078	GRY	GE
1	EA	ELECTRIC STRIKE	9600	613	HES

EXISTING HINGES AND CLOSERS TO REMAIN; REPLACE SEALS AS NEEDED. CONTRACTOR TO REMOVE EXISTING PUSH/PULLS AND PATCH DOOR AS NEEDED.

SET 1A

	EA	HINGES	AS REQUIRED	612	
1	EA	STOREROOM LOCK	9K37D x 15D	612	BEST

1	EA	CLOSER	4110	691	LCN
1	EA	WALL STOP	409	612	ROCKWOOD
1	EA	DOOR POSITION SWITCH	1078	GRY	GE
1	EA	ELECTRIC STRIKE	1006 LB		HES

SET 2A

	EA	HINGES	AS REQUIRED	630	
1	EA	DEADBOLT	L460BD	630	SCHLAGE
			x LIGATURE RESISTANT TRIM		
1	EA	OCCUPANCY INDICATOR	L283-414	630	SCHLAGE
1	EA	CYLINDER	AS REQUIRED	626	BEST
1	EA	PULL	BF105HD	630	ROCKWOOD
1	EA	PUSH PLATE	70C	630	ROCKWOOD
1	EA	CLOSER	4110 SCUSH	689	LCN

SET 3A

	EA	HINGES	AS REQUIRED	612	
1	EA	CLASSROOM LOCK	9K37R x 15D	612	BEST
1	EA	DUTCH DOOR BOLT	630-4	612	ROCKWOOD
1	EA	WALL STOP w/HOLDER	MDH30U (AT HEAD)	612	DELTANA

SET 3B

	EA	HINGES	AS REQUIRED	612	
1	EA	CLASSROOM LOCK	9K37R x 15D	612	BEST
1	EA	DUTCH DOOR BOLT	630-4	612	ROCKWOOD
2	EA	WALL STOP	409	612	ROCKWOOD

SET 3C

	EA	HINGES	AS REQUIRED	612	
1	EA	CLASSROOM LOCK	9K37R x 15D	612	BEST
1	EA	WALL STOP	409	612	ROCKWOOD

SET 3D

	EA	HINGES	AS REQUIRED	612	
1	EA	CLASSROOM LOCK	9K37R x 15D	612	BEST
1	EA	OVERHEAD STOP	100S	612	GJ

SET 3E

1	EA	CLASSROOM LOCK	9K37R x 15D	612	BEST

SET 4A

	EA	HINGES	AS REQUIRED		
1	EA	STOREROOM LOCK	9K37D x 15D	612	BEST
1	EA	CLOSER	4110	689	LCN
1	EA	WALL STOP	409	612	ROCKWOOD

SET 4B

1	EA	STOREROOM LOCK	9K37D x 15D	612	BEST

SET 5A

1 EA DOOR POSITION SWITCH

EXISTING HARDWARE TO REMAIN

SET 6A

	EA	HINGES	AS REQUIRED	612	
1	EA	PRIVACY LATCH	9K30L	612	BEST
1	EA	WALL STOP	409	612	ROCKWOOD

SET 7A

	EA	HINGES	AS REQUIRED		
1	EA	RIM FIRE EXIT	99L-BE-F	612	VON DUPRIN
1	EA	CLOSER	4010	691	LCN
1	EA	WALL STOP	409	612	ROCKWOOD

SET 8A

2	SET	BARN DOOR HDWR	HBP200A	AL	PEM
2	SET	BRACKET	2812	AL	PEM
2	EA	LOCKING PULLS	LP3301 DBD-ADA	630	ROC
2	EA	CYLINDERS	AS REQUIRED	626	BES

Provide correct track for stacked pairs, see plan, and all accessories for a complete installation. Provide for doors to be locked in the open as well as the closed position.

EXTERIOR GATES

Provide all components required for complete operation similar to: Spring Hinge LB4390C-350 630 BOM, Storeroom lock to match interior locksets. Provide a bottom latch for typically inactive gate and for active gate.

END OF SECTION 08 71 00

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Glass in Steel and Wood Doors

B. Glass in Aluminum-Framed Entrances and Storefronts.

1.03 RELATED WORK

A. Hollow Metal Doors and Frames: Section 08 11 13.

B. Flush Wood Doors: Section 08 14 16.

C. Aluminum-Framed Entrances and Storefronts: Section 08 41 13.

1.04 REFERENCES

A. Reference Specification: "Glazing Manual", by Flat Glass Marketing Association.

B. Materials: Conform in all respects to the "Safety Standard for Architectural Glazing Materials", 16CFR 1201, issued by the Consumer Product Safety Commission.

C. AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)
1. Aluminum Storefront and Entrance Manual.
2. Structural Sealant Glazing Systems (A Design Guide) Aluminum CW Series No. 13.

D. AMA WSG.1 Window Selection Guide.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, whether glazing is for use in fire doors or other openings, whether or not glazing passes hose-stream test, whether or not glazing has a temperature rise rating of 450 deg F, and the fire-resistance rating in minutes.

F. All materials used for this project shall be from the same batch run and manufacturer.

G. Water Penetration Resistance, nor uncontrolled water leakage; tested as per ASTM E331

H. Thermal Transmittance Resistance: Maximum "U" factor in accordance with Wisconsin Enrolled Commercial Code; as tested by AAMA 1503.1

I. Condensation Resistance; Condensation Resistance Factor (CRF) to be minimum 56/frame and 50/glass, with 30 percent inside relative humidity, and 68 degree F temperature.; as tested by AAMA 1530.1.

J. Sound Transmission Resistance; Sound Transmission Class (STC) for typical application to be minimum of 32; AS tested by ASTM E4134.

K. Fenestration must comply with a minimum testing performance requirements for an AAMA/NWWDA 101/1.S.2 HC-40 rating. The recognized standard for performance ratings of windows is AAMA/NWWDA 101/1.S.2.

L. All performance testing must be conducted by an independent, impartial, third party, AAMA certified testing laboratory.

M. Polyurethane thermal barriers shall be tested as per AAMA TIR A8-90 and AAMA Draft #13 of AAMA's Dry Shrinkage & Composite Performance Thermal Cycling Procedure for validation testing at differential temperatures. At the conclusion of the tests, the shrinkage shall be equal to or less than the prescribed 0.10%.

N. Use of poured and de-bridged polyurethane thermal beak assemblies will require window manufacturer's prior adoption and continued use of the procedures and quality control features outlined in AAMA's Quality Assurance processing guide For Poured and De-bridged Polyurethane Thermal Barriers.

1.06 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

1.07 INSULATED GLASS WARRANTY

A. Provide insulating glass manufacturer's written guarantee as per Sections 08 41 13.

1.08 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract
   1. Manufacturer's product data.
      a. Provide data for visible light transmittance, reflectance, U-value, shading coefficient, solar heat gain coefficient and light to solar gain.
   2. Two samples of each type glass specified.

1.09 DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store to avoid damage. Scratched glass will be rejected.

1.010 PROJECT CONDITIONS

A. Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

1.011 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

   1. Provide safety glazing labeling.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

   1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.

6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 1 (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated and free of tong marks.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Comply with requirements for safety glass in the International Building Code.

C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

2.03 INSULATING GLASS

A. Glass Type GL-13: Low-e-coated, tinted insulating glass PPG Industries, Inc.; Solar Control, Low-E, Solarban 60:
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Tinted float glass, heat-strengthened float glass or fully tempered float glass as required by conditions and codes.
   a. Outdoor lite: Atlantica
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass, heat-strengthened float glass or fully tempered float glass as required by conditions and codes.
   a. Solarban 60 Low-E Coating: Sputtered on third surface.
6. Visible Light Transmittance: 52 percent minimum.
7. Winter Nighttime U-Factor: 0.29 maximum.-
8. Summer Daytime U-Factor: 0.28 maximum.
9. Solar Heat Gain Coefficient: 0.31 maximum.
10. Shading Coefficient: 0.35
11. Outdoor Visible Light Reflectance: 10 percent.
12. Provide safety glazing labeling.
13. Glass: Clear float.
14. Silicone Coating Color: Atlantic Waters; 2-1964 (match to Atlantica/Solarban 60).

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.
4. Dehydrated Interspace Content: Air.
5. Thickness: 1 inch typical; provide 5/8 inch thick unit at storefront entrance.

2.04 GLASS TYPE SCHEDULE

A. Glass Products indicated below are based on proprietary products of Viracon, PPG, SAFTI FIRST Serious Materials and Bendheim. Products from any of the above listed manufacturers that meet the design criteria of the glass specified below are acceptable.
   1. GLT 1: Clear float glass.
      a. Thickness: 1/4".

   2. GLT 4: Tempered, clear float glass.
      a. Thickness: 1/4".

   3. GLT 13: Refer to above.

2.05 GLAZING ACCESSORIES

A. Glazing Sealant: One-part silicone similar to Pecora 860, Sonneborn Omniplus or Tremco Spectrum 2.
   1. Comparable means both quality and color options.

B. Setting Blocks: 70-90 Shore "A" durometer, sized to accommodate size of glass used, compatible with glazing sealant.

C. Spacers: Compatible with sealant used.

D. Primer, Sealers, Cleaners for Fire-Rated Glazing: As recommended by fire-rated glazing manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until conditions are satisfactory.

3.02 PREPARATION

A. Field Measurement
   1. Measure size of frame to receive glass.
   2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces
   1. Remove protective coatings from surfaces to be glazed.
   2. Clean glass and glazing surfaces to remove dust, oil and contaminants.

3.03 INSTALLATION

A. Install glass in accordance with glass manufacturer's recommended instructions.

B. Provide weathertight installation.

C. Fire-rated glazing insulated glazing units shall be glazed into the appropriate fire-rated framing with an approved glazing compound (polysulfide sealant or closed cell PVC tape) as supplied by the installer.

D. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.

1. Provide a minimum air space of 1/8 inch between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.

3.04 CLEANING

A. Remove excess glazing compound from installed glass.

B. Remove labels from glass surface as soon as installed.

C. Wash and polish both faces of glass.

D. Remove debris from work site.

3.05 PROTECTION

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

END OF SECTION 08 80 00

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Gypsum Board and Gypsum Board Assemblies (Metal Studs)

B. Acoustical Batt Insulation.

C. Trim and Accessories.

1.03 RELATED WORK

A. Section 06 10 00, Rough Carpentry

B. Section 09 90 00, Painting

1.04 REFERENCES

A. Referenced Specifications: The more stringent requirement of this section or referenced specification applies.
   1. "Using Gypsum Board for Walls and Ceilings", The Gypsum Association - GA-201-85.
   2. "Recommended Specifications for the Application and Finishing Gypsum Boards", The Gypsum Association - GA-216.

B. Fire Rated Assemblies: Provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL, or tested in accordance with ASTM E119 for type of construction shown.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Manufacturer’s product data including acoustic sealant.
   2. Texture finish sample.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the project site with manufacturer's labels intact and legible.

B. Handle materials with care to prevent damage.

C. Deliver fire-rated material bearing testing agency label and required fire classification numbers.

D. Storage
   1. Store materials inside under cover, stack flat, off floor.
   2. Stack wallboard so that long lengths are not over short lengths.
   3. Avoid overloading floor system.

4. Store adhesives in dry area, provide protection against freezing at all times.

1.07 PROJECT CONDITIONS

A. During cold weather, maintain temperature range between 55 degrees F. to 70 degrees F. for 24 hours before, during, and after gypsum board and joint treatment applications.

B. Ventilation
1. Provide ventilation during and following adhesive and joint treatment applications.
2. Use temporary air circulators in enclosed areas lacking natural ventilation.
3. Protect installed materials from drafts during hot, dry weather.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Georgia Pacific.

B. LaFarge.

C. National Gypsum Company.

D. United States Gypsum Company.

E. Dietrich Industries.

F. Chicago Metallic.

G. Certainteed Gypsum

H. American Gypsum

I. Reef Industries

J. Fry Reglet Architectural Metals

K. Or approved equal.

2.02 MATERIALS

A. Gypsum Board: ASTM C 36, long edges tapered; in lengths as long as practical to keep number of end joints to absolute minimum.
1. Regular Gypsum Board.
2. Abuse-resistant Gypsum Board: USG Fiberock AR.
3. Water Resistant Wallboard: 5/8-inch thick.
4. Fire Code Board: Type "X" or Fire code "C".
5. Embedded Glass Reinforced Gypsum Sheathing. 1/4" or as shown on drawings.
   a. Certainteed “ProRoc 14” Flex” or approved equal.
6. Cementitious Backer Board: Aggregated, Portland cement board with woven, glass fiber, mesh facing; complying with ANSI A118.9.
   a. Manufacturer: USG, Durock Interior Tile Backer Board.
   b. Thickness: 1/2 inch or 5/8 inch as shown on drawings.
7. Or approved equal.

B. Metal Studs/Resilient Furring Channels.
   1. Unless indicated otherwise, use 25-gage for partitions up to 12'-0" high, use 20-gage for partitions over 12'-0" high.
   2. Unless indicated otherwise, use 20-gage studs at door jambs, head.
   3. Track gauge shall be same gauge as nested studs.
   4. All exterior non-structural metal framing, including but not limited to Z furring and studs shall be 16 ga. Galvanized.

C. Compressible U-shaped fire rated track at fire rated walls as indicated on drawings.
   1. CEMCO Fire Management Products (FAS Track)
      a. 25 gauge minimum ceiling runner, 3 inch legs minimum with 1-1/2 inch slots.
      b. 1-1/4 inch intumescent strip affixed to the top of both legs.
   2. Or approved equal.

D. Suspension System
   1. Chicago Metallic 640 system.
      a. Hanger Wire: 8-gage, annealed.
      b. Carrying Channels: 1-1/2 inch cold rolled steel.
      c. Screws: USG 1-inch type S.
      d. Furring Channels: USG metal furring channel, attached with USG furring channel clips.

   2. Chicago Metallic 650 System, complying with UL Design No. D502.
      a. Hanger clips: 18 gauge galvanized steel.
      b. Hanger wire: No. 12 SWG galvanized steel.
      c. Carrying Channels: 16 gauge 1 ½ inch cold rolled.
      d. Furring Cross Channel: 16 gauge 7/8 inch where required.
      e. Wall Molding: 26 gauge steel channel 1 11/16 inch deep with 15/16 inch flanges.
   3. Or approved equal.

E. Accessories
   1. Metal Trim: USG No. 200-A or approved equal.
   2. L-shaped Metal Trim USG No. 801-B.
   3. Metal Reveal Molding: Fry Reglet DRM-625-75.
   4. Metal Reveal Molding: Fry Reglet DRM-625-200.
   5. Metal ‘Z’ Reveal Molding, 1/4” wide: Fry Reglet DRMZ-625-25.
   6. Metal ‘Z’ Reveal Molding 5/8” wide X 1/2” deep Fry-Reglet DRMZ- 625-50.
   7. Expansion Joints: USG No. 093.
   8. Drywall Screws for Metal Framing: 1" Type S-12 or Type S bugle head.
   9. Outside Corner Reinforcement: USG No. 104, 1-1/8" x 1-1/8" corner bead.
   10. Acoustical Sealant: Equal to Tremco “Tremflex 834” or Pecora “Acoustic and Insulation Sealant”, low VOC formulation.
      a. VOC content less than 50 g/l.
   11. Sound Attenuation Blanket: U.S. Gypsum Thermafiber, 3” for an STC of 49
   12. Or approved equals.

F. Drywall Finishing Accessories
   1. Joint Compounds: Ready mixed type, or approved equal.
   2. Joint Reinforcement: USG Perf-A-Tape, or approved equal.

G. Texture Finish Materials
   1. Ceilings: USG Spray Fine Sand Texture Finish, or approved equal.
   2. Walls (Painted Only): Heavy Roller existing and installed surfaces.

PART 3 - EXECUTION

3.01 METAL STUDS

A. Attach metal runners at floor and at ceiling or structural elements above with suitable fasteners located 2 inches from each end, spaced 16 inches on center.

B. Position studs vertically, engaging floor and ceiling runners. Splice studs with 8-inch nested lap, one positive attachment per stud flange. Place studs in direct contact with all door frame jambs, abutting partitions, partition corners, existing construction elements.

C. Anchor studs adjacent to door frames, partition intersections, and corners to ceiling and floor runner flanges with USG metal lock fastener tool.

D. Provide double studs at jambs and head of each door frame. Securely anchor studs to jamb and head anchor clips at metal door frames by bolt or screw attachment. Over metal frames, place a cut-to-length section of runner horizontally with web-flange bent at each end; secure with one positive attachment per flange. Position a cut-to length stud (extend to ceiling runner) at vertical board joints over door frame header. Place an additional track-to-track stud 6 inches from double jamb studs on both sides of framed openings.

E. At curved surfaces, space studs and framing members 8 inches on center maximum.

3.02 GYPSUM BOARD

A. Follow Gypsum Association's recommendations for installation procedures.

B. Cut wallboards by scoring and breaking or sawing; scribe neatly at wall projections.

C. Apply first to ceilings then to walls.

D. Maintain a 5/8” space between floor and bottom edge of gypsum board.

E. Locate wallboard joints at openings so that no end joint aligns with edge of opening.

F. Set fasteners with heads slightly below surface of wallboard. Avoid breaking face paper.

G. Provide water resistant wallboard at rooms/areas with high humidity.

3.03 CEILING SUSPENSION SYSTEM

A. Suspend carrying channels with 8-gage hanger wires spaced 48 inches on center, within 6 inches of ends.

B. Install carrying channels 48 inches on center and within 6 inches of walls. Provide 1 inch clearance between channel ends and abutting walls, partitions.

C. At splices, interlock flanges, overlap ends 12 inches, and secure with 16-gage double standard tie wire at each end.

D. Erect furring channels at right angles to carrying channels, spaced 24 inches on center and within 6 inches of walls. Provide 1-inch clearance between channel ends and abutting walls, partitions.

E. Secure to carrying channels with clips, or, saddle tie with 16-gage double standard tie wire. At splices nest channels at least 8 inches, securely wire tie at each end.

F. Install additional cross reinforcing to restore lateral stability of suspension system at openings that interrupt carrying or furring channels.

G. Apply wallboard of maximum practical length with long dimension at right angles to furring channels. Position and stagger end joints over channel web. Fit ends and edges closely, but not forced together.

H. Fasten board to channels with 1-inch Type S screws spaced 12 inches on center in field of board, along abutting ends, edges.

I. Comply with UL Design No. D502 requirements at fire rated assembly.

3.04 EXPANSION JOINTS

A. At Ceilings: 50'-0" on center each way maximum.

B. At Walls: 30'-0" on center maximum.

C. Provide continuous from each door jamb to top of partition.

D. Provide at intersections with exposed masonry construction.

3.05 SINGLE LAYER/ERECTION

A. Position all ends, edges over framing members, except when edge joints are at right angles to framing members, or when end joints are back-blocked. Apply wallboard horizontally or vertically on walls to minimize the number of joints.

B. Attach wallboard to metal framing supports by power driven screws. For vertical application space screws 12 inches on center in field of board, 8 inches on center staggered along vertical abutting edges. For horizontal application space screws 12 inches on center in field, along abutting end joints.

3.06 MULTI-LAYER WALLBOARD ERECTION

A. Base Layer: Erected as specified for "Single Layer Erection".

B. Joints in face layer to fall at least 10 inches from parallel joints in base layer.

C. Apply face layers with adhesive in accordance with wallboard manufacturer's printed instructions. Provide sufficient number and spacing of fasteners to hold top layer tight with bottom layer until adhesive dries.

3.07 JOINT TREATMENT APPLICATION

A. Mix joint compound in accordance with manufacturer's recommendations.

B. Apply compound in thin uniform layer to all joints, angles to be reinforced. Apply reinforcing tape centered over joint, seated into compound. Follow immediately with thin skim coat or embed tape. Fold and embed tape in interior angles to provide true angle.

C. When embedding coat is thoroughly dry, apply second coat of compound, filling board taper flush with surface. Cover tape, feather out slightly beyond tape.

D. On joints with no taper, cover tape, feather out at least 10 inches on either side of tape.

E. When second coat is thoroughly dry, spread finish coat evenly over and extend slightly beyond second coat. Feather to a smooth, uniform finish.

F. Over taped edges, do not allow finish coat to protrude beyond plane of surface. Apply finish coat to cover tape, taping compound at taped angles to provide true angle. When necessary, sand between coats and follow with final coat to provide level 4 smooth surface ready for decoration.

G. Do not abrade adjacent face-paper surfaces.

3.08 FINISHING FASTENERS

A. Apply compound to fastener depressions. Follow with minimum of two additional coats leaving depressions level with surface.

B. Do not abrade adjacent face-paper surfaces.

3.09 FINISHING BEAD AND TRIM

A. Mechanically fasten outside corner reinforcement per manufacturer's instructions.

B. Apply first coat to beads, trim. Properly feather out from ground to plane of surface. Embed flanges of corner reinforcement with compound.

C. When embedding coat is thoroughly dry, apply second coat in same manner as first-coat, extending compound slightly beyond onto face of board.

D. When second coat is thoroughly dry, apply finish coat extending compound slightly beyond second coat, properly feathering from ground to plane of surface. Sand finish coat as necessary to provide a level 4 flat smooth surface, ready for decoration.

E. Do not abrade adjacent face-paper surfaces.

3.010 ACOUSTIC SEALANT

A. Apply sealant at intersections of wallboard and adjacent materials to form a complete seal to air and noise.

3.011 TEXTURE FINISH

A. Apply texture finish in accord with manufacturer's printed instructions.

B. Provide uniform texture over entire surface.

3.012 ADJUST AND CLEAN

A. Ridging
   1. Sand ridges to reinforcing tape without cutting through tape.
   2. Fill concave areas on both sides of ridge with topping compound.
   3. After fill is dry, blend in topping compound over repaired area.

B. Fill cracks with compound and finish smooth and flush.

END OF SECTION 09 29 00

SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Acoustical Board.

B. Suspension Systems.

1.03 RELATED WORK

A. Fire Suppression: Division 21.

B. Heating, Ventilating and Air Conditioning: Division 23.

C. Electrical: Division 26.
D. Acoustical Treatment 09 84 13

1.04 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
1. Manufacturer's product specifications and installation instructions for each acoustical ceiling material and suspension system required, including certified laboratory test reports.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size and thickness as applicable, legible and intact.

B. Store materials in original protective packaging to prevent soiling, physical damage or wetting.

C. Store cartons open at each end to stabilize moisture content and temperature.

1.06 PROJECT CONDITIONS

A. Do not install interior acoustical ceilings until space is enclosed and weatherproof. Complete installation of damp materials before beginning work.

B. Maintain humidity of 65 - 75 percent in areas where acoustical materials are to be installed 24 hours before, during, and after installation.

C. Maintain a uniform temperature in the range of 55 to 70 degrees F. prior to and during installation of materials.

1.07 EXTRA MATERIALS

A. In accord with General Conditions of the Contract, deliver extra materials equal to a minimum of 50 square feet of each type of acoustical material supplied.

B. All cartons shall be new, unopened, packaged with protective covering for storage, and identified with appropriate labels.

PART 2 - PRODUCTS

2.01 BOARD TYPE: ACT-1

A. Lightly textured nodular lay-in panels, ¾" thick x 2' x 2', Reveal edge (tegular), White. UL Classified Noise Reduction Coefficient (NRC) .60, Ceiling Attenuation Class (CAC) 35, Light Reflection Coefficient .82, "BioShield", 15 year warranty against sag, 82% recycled content.

B. Celotex Brand, "Cashmere".

C. Or approved equal by Armstrong World Industries, Ecophon Certainteed, or USG.

2.02 BOARD TYPE: ACT-2

A. Armstrong, Ceramaguard 608, Fine Fissured, 2'x2'x5/8", square edge, UL Classified Noise Reduction Coefficient (NRC) .55, Light Reflection Coefficient .82. superior resistance to sagging in high humidity conditions including standing water and outdoor applications.

B. Or approved equal.

2.03 INTERMEDIATE DUTY SUSPENSION SYSTEM TYPE 1 AND TYPE 2

A. Armstrong, "Prelude ML, 15/16" Exposed Tee".
   1. Material: Hot-dipped, galvanized steel.
   2. Surface Finish: Baked polyester paint.
   3. Coordinate with Acoustical Panel-2 requirements and provide where heavy duty required, see 09 84.13.

B. Or approved equal by Chicago Metallic, National Rolling Mills, Donn/USG.

E. Conform to all requirements of ASTM C-635 intermediate structural classification.

F. Provide flat white finish, 15/16" face.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities, and dampness that would affect quality and execution of work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Do not begin installation until sufficient materials to complete a room are received.

B. Install materials in accordance with manufacturer's printed instructions, governing regulations, fire resistance rating requirements, and industry standards applicable to work.

C. Measure each ceiling area and establish layout of acoustical units to balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders, and comply with reflected ceiling plans wherever possible.

D. Symmetrically locate grid layout in each space. Coordinate work with other trades so that lighting fixtures, grilles, and other ceiling fixtures work with grid layout.

E. Do not use universal splices or other splices which would obstruct passage of recessed lighting fixtures through grid openings or limit fixture relocation upon flanges of ceiling grids.

F. Support suspension system from structure above, not from ductwork, metal deck, equipment or piping.

G. Space hangers not more than 6 inches from ends and not more than 4 feet on center.

H. Install edge moldings at the perimeter of each acoustical ceiling area and at locations where edge of units would otherwise be exposed.
   1. Secure moldings to building construction by fastening with screw anchors into the substrate, through holes drilled in vertical leg. Space holes not more than 3 inches from each end and not more than 16 inches on center along each molding.
   2. Level moldings with ceiling suspension system, to a level tolerance of 1/8 inch in 12 feet.
   3. Miter corners of moldings accurately to provide hairline joints, securely connected to prevent dislocation. Cope exposed flanges of intersecting suspension system members, so that flange faces will be flush.
   4. Furnish additional tees for supporting grilles, diffusers and light fixtures. Refer to the reflected ceiling, HVAC and electrical plans for locations.
   5. Provide tegular edge at walls, other abutting vertical surfaces.
   6. Field paint cut edges to match surface color and sheen.

I. Arrange acoustical units and orient directionally-patterned units, if any, in manner shown on reflected ceiling plans.

3.03 CLEANING

A. Clean exposed surfaces of acoustical ceilings, trim, edge moldings, and suspension members to comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

B. Remove work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

3.04 PROTECTION

A. Provide required protection for the acoustical ceilings, including temperature, humidity limitations and dust control so that the work will be without damage and deterioration at the time of acceptance by the Owner.

END OF SECTION 09 51 00

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SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Resilient Base.

B. Resilient Flooring.

C. Accessories.

D. Subfloor Preparation.

1.03 RELATED WORK

A. Selective Structure Demolition: Section 02 41 19.

1.04 QUALITY ASSURANCE

A. Provide each type of resilient flooring and accessories from a single manufacturer, including recommended primers, adhesives, sealants, and leveling compounds.

B. Installers Qualifications: Installer experienced (minimum of 2 years) to perform work of this section who has specialized in the installation of work similar to that required for this project and who is acceptable to the product manufacturer.

C. Materials: For each type of material required for the work of this Section, provide primary materials which are the products of one manufacturer. Provide secondary materials which are acceptable to the manufacturer of the primary materials.
   1. Comply with applicable regulations regarding VOC (volatile organic compound) content of adhesives.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Manufacturer's technical data for each type of resilient flooring and accessory.
      a. Data indicating adhesive and accessories meet VOC requirements.
   2. Manufacturer's standard color charts in form of actual sections of resilient flooring, including accessories, showing full range of colors and patterns available, for each type of resilient flooring required.
   3. Submit samples of metal edge strips.
   4. Two copies of manufacturer's recommended maintenance practices for each type of resilient flooring and accessory required.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened containers with labels indicating brand names, colors and patterns, and quality designations legible and intact.

B. Store and protect materials in accordance with manufacturer's recommendations.

1.07 PROJECT CONDITIONS

A. Maintain minimum temperature of 65 degrees F and maximum temperature of 90 degrees F in spaces to receive resilient flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. Subsequently, maintain minimum temperature of 55 degrees F in areas where work is completed.

B. Store resilient flooring materials in spaces where they will be installed for at least 48 hours before beginning installation.

C. Install resilient flooring and accessories after other finishing operations, including painting, have been completed.

D. Do not install resilient flooring over concrete slabs until they have been cured and are sufficiently dry to achieve bond with adhesive as determined by resilient flooring manufacturer's recommended bond and moisture test.

E. Close areas to traffic and to other work until flooring is firmly set. Tile shall have 72 hours with no traffic.

F. Where solvent based adhesives are used, provide safety sparkproof fans when natural ventilation is not adequate.

1.08 WARRANTY

A. Provide current, detailed manufacturer’s warranty for each flooring product as applicable including limited wear, defect and conductivity.

B. Provide manufacturer's standard one-year warranty against defects in manufacturing and workmanship of resilient flooring products. Provide manufacturer's standard limited wear warranty/conductivity warranty as specified under each product as applicable.

1.09 EXTRA MATERIALS

A. Deliver stock of extra materials to Owner. Furnish extra materials from same manufactured lot as materials installed and enclosed in protective packaging with appropriate identifying labels.
   1. Furnish one box for each type, color, pattern and size installed.

1.010 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 RESILIENT FLOOR

A. Shaw Hard Surface® is used as the basis of design. Armstrong, or approved equal.

B. RF-1 Product:
1. Style Name/Number: Grain + Pigment
2. Color: to be selected from manufacturer's full range. See installation pattern note below.
3. Construction: High Performance Luxury Vinyl Tile.
4. Direct glue down
5. Overall Thickness: 2.5mm.
6. 20 mil wear layer.
7. Nominal Dimensions: 7"x48"
8. 10 year limited commercial wear warranty and 10 year under bed warranty.
9. Class III printed film vinyl plank
10. Added antimicrobial: Flor Sept ™
11. Finish: ExoGuard ™
12. Backing Class: Commercial Grade.
13. Slip Resistance/ASTM D2047: >0.65 (wet/dry).
14. Static Load Limit/(Modified ASTM F970: 1500 psi.
15. Passes ASTM F1914 Residual Indentation <8%
16. Passes ASTM F137 Flexibility
17. Passes ASTM G21 0: Fungi free.
18. Passes ASTM F 1514 Resistance to Heat.
19. Passes ASTM F 1515 Resistance to Light.
20. Passes ASTM F 925 Resistance to Chemicals.
21. Passes ASTM 648, Radiant Flux, > 0.45 watts/cm^2 NFPA Class 1
22. Passes ASTM E662, Smoke Density, < 450.

C. Installation pattern to be provided by Architect with a pattern containing (3) materials/colors in rooms: Resource Center 205, Office 210, Workarea 212, Flexible Employment and Training 220, Conference 200 and Family Multi-Purpose Overflow 217. All other rooms to receive (1) material/color.

2.02 RF-3 STAIR

A. Roppe raised design floor tread and stringer, complete installation, #80/#81 rib design with riser.
1. ADA compliant nose with contrasting color. #40/#41 heavy duty abrasive strip.
2. Colors to be selected from manufacturer's full range.

2.03 RESILIENT WALL BASE

A. General: Rubber, cove base, top set, roll stock.
1. Height: 4"
2. Colors to be selected by architect.

B. Manufacturers: Armstrong (colors to be selected from manufacturers' full range) or approved equal by:
1. Flexco.
2. Freudenberg Building Systems, Nora.
3. Johnsonite.
4. Roppe.

2.04 ACCESSORIES

A. Adhesives: Waterproof, stabilized type as recommended by flooring manufacturer to suit material and substrate conditions; equal to HENRY GreenLine GL33High-Performance VCT Adhesive, low VOC type.

B. Resilient tile flooring adhesive Basis of Design: Shaw 4100 or S150 per manufacturer's recommendation to meet 10 year warranty.
   a. VOC content: <0.5 grams/liter
   b. Refer to manufacturer's installation instructions

C. Adhesive for Wall Base: W.W. Henry "595 Cove Base Adhesive", zero-VOCs; W.F. Taylor "2035 Cove Base Adhesive" or "2040 Premium Cove Base Adhesive", GreenGuard certified; PL Adhesives & Sealants "Cove Base Adhesive"; Bostik Findley, Durabond "D-740 Multipurpose Wall Adhesive".
   1. Low-VOC type: VOC content less than 100 g/l.

D. Adhesive for stair treads and risers per manufacturer's recommendation.

E. Concrete Slab Primer: Non-staining, low-VOC type, equal to W.F. Taylor Co. "Envirotec Healthguard" #2006, as approved by flooring and underlayment manufacturers.

F. Patching, Leveling, Underlayments: The leveling materials must be portland cement based and provide a minimum 3,500 PSI compressive strength (ASTM C 109) and sufficient bond to existing subfloor surface.
   1. Ardex, Laticrete, Duralox, Mapei, or equivalent, approved by flooring manufacturer.

G. Metal Edge Strip: Similar to Ceramic Tile Company CTC1132CTA.

PART 3 - EXECUTION

3.01 EXAMINATION

A. The subfloor must be prepped to meet meets the requirements as described in the manufacturer's installation instructions.

   1. Rough up smooth epoxy surfaces to accommodate resilient flooring manufacturer's installation requirements.

B. A clean non-burnished concrete surface free from any paint, wax, oil, grease, and film forming curing compounds, silicate penetrating curing compounds, sealing, hardening or parting compounds is required. The surface should not have any alkaline salts, laitance, mold, mildew, residual adhesive, chemical adhesive removers or anything that may prevent appropriate products bonding to it. If not then the general contractor should provide the mechanical means to remove them. This could be dustless diamond grinding (DiamaBrush), bead-blast or similar with a suitable HEPA vacuum attachment. Review and comply with all relevant local, state and federal regulations.

C. Clean out and fill or repair any dormant saw cuts and cracks with an appropriate product following the manufacturers written usage instructions. For any expansion (moving) joints, use an industry standard expansion joint assembly.

D. When required, use a leveler following the manufacturers written instructions. The surface should be free of dust, solvents, paint, wax, varnish, oil, grease, asphalt, old adhesives, and other extraneous materials that may interfere with the bond. These should be completely removed by mechanical means only. Dustless diamond grinding or bead blasting are the preferred method to remove contaminates and bond breakers, as it also helps to level the concrete.

E. Perform mat bond tests in each major area (1 per ~1,000 sq. ft.) This should consist of the proposed subfloor preparation, mitigation and leveling or smoothing products. Do not proceed with installation until all the results of the bond test are acceptable.

F. Prime the subfloor prior to using a suitable leveler, as approved by the resilient flooring manufacturer.

G. Vacuum floors immediately prior to installing the flooring to remove all loose particles. If required, only use water based sweeping compounds. Do not use any wax or oil based compounds that leave behind a residue that may interfere with the adhesive bond.

H. Perform moisture tests on concrete subfloors to determine if surfaces are sufficiently cured and dry as well as to ascertain presence of curing compound. Do not use curing compounds on concrete subfloors.

I. Do not allow resilient flooring work to proceed until subfloor surfaces are satisfactory. Indicate adverse conditions of any type by letter.

3.02 PREPARATION

A. Comply with ASTM F 710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring, and manufacturer's recommendations for surface preparation. Remove substances incompatible with resilient flooring adhesive by method acceptable to manufacturer.

1. Concrete floors with steel troweled (slick) finish shall be properly roughened (sanded) to ensure suitable adhesion.
2. Concrete floors with curing, hardening and/or breaking compounds shall be abraded with mechanical methods only to remove compounds.
    a. Do not use chemicals for removal.
    b. Do not use wax or oil based sweeping compounds.

B. Sand or grind subfloors to remove mortar, paint, other surface irregularities.

C. Where filling, patching, leveling is required of thickness exceeding 1/8-inch apply latex type underlayment in two or more applications. Apply compound in accordance with manufacturer's printed instructions.

D. Remove all debris, sand, and other materials which would result in lack of adhesion and/or star cracking.

3.03 INSTALLATION

A. Areas of the flooring that are subject to direct sunlight through doors or windows should have them covered using blinds, curtains, cardboard or similar for the time of the installation and 72 hours after the installation to allow the adhesive to cure. Note: These areas should be installed using wet adhesives only.

B. Install resilient flooring, including but not limited to the following, in accordance with the manufacturer’s installation instructions.

1. Do not mix manufacturing batches of a color within the same area.
2. Do not install resilient flooring over building expansion joints.
3. Do not install defective or damaged resilient flooring.
4. Layout resilient flooring to provide ~equal size at perimeter. Adjust layout as necessary to reduce the amount of resilient flooring which is cut to less than half full width.
5. Lay resilient flooring with arrows in the same direction (excluding borders).
6. Install resilient flooring without voids at seams. Lay seams together without stress.
7. Cut/scribe resilient flooring neatly at perimeter and obstructions.
8. Extend resilient flooring into reveals, closets, and similar openings.
9. Remove excess adhesive immediately.

C. Install reducer strips at exposed edges.

D. Prevent all traffic for a minimum of 12 hours and rolling loads for 72 hours to allow the adhesive to cure. If required, after 12 hours protect the flooring from damage during construction operations using Masonite, plywood or a similar product, ensuring first that the flooring surface is free of all debris. Lay panels so that the edges form a butt joint and tape the joint to prevent both movement and debris entrapment underneath them. Inspect immediately before covering and after removal for final acceptance.

3.04 WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and other permanent fixtures in rooms or areas where base is required.

B. Install base in lengths as long as practicable, with preformed corner units, or fabricated from base materials with mitered or coped inside corners. Cut no shorter than full wall length.

C. Tightly bond base to substrate throughout length of each piece, with continuous contact at horizontal and vertical surfaces.
   1. On masonry surfaces, or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
   2. Adhesive shall cover a minimum of 90 percent of ribbed back of base.
   3. Leave 1/4 inch uncovered space at top edge of base to prevent oozing.
   4. Roll base firmly, roll back toward starting point.

3.05 CLEANING

A. Perform following operations immediately upon completion of resilient flooring.
   1. Have the flooring cleaned no sooner than 72 hours after the installation using the method approved by the manufacturer’s maintenance recommendations.
   2. Touch-up and repair any minor damage to eliminate all evidence of repair. Remove and replace work which cannot be satisfactorily repaired.

3.06 PROTECTION

A. Protect flooring against damage during construction period to comply with resilient flooring manufacturer's directions.

END OF SECTION 09 65 00

SECTION 09 67 16

EPOXY FLOORING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Epoxy Flooring.

B. Preparation of Existing Substrate.

C. Accessories.

1.03 RELATED WORK

A. Cast-in-place Concrete: Section 03 30 00.

B. Joint Sealants: Section 07 92 00.

C. Plumbing for floor drains.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer or applicator that has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.

B. Single-Source Responsibility: Obtain epoxy component of flooring materials, including primers, resins, hardening agents, and finish or sealing coats, from a single manufacturer. Obtain ceramic-coated quartz aggregate from primary manufacturer of that product.

1.05 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.

1. Product Data: Submit manufacturer's technical data application instructions and general recommendations for decorative quartz epoxy flooring specified herein.
2. Samples for initial selection purposes in form of manufacturer's color charts showing range of standard colors available.
    a. Submit 2-1/2" x 4" samples in color and quartz aggregate combination for final selection by A/E. Provide samples from full color range.
3. Material certificates signed by manufacturer certifying that the decorative quartz epoxy flooring submitted complies with requirements specified herein.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Comply with epoxy resin composition flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect work.

B. Lighting: Permanent lighting will be in place and working before installing decorative quartz epoxy flooring.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Dex-O-Tex, Crossfield Products Corp:
   1. Crown Polymers.
   2. Dur-A-Flex.
   3. Micor.
   4. RBC Industries, Inc.
   5. Tennant Company.
   6. Or approved equal.

B. Epoxy Floor type:
   1. Decorative Quartz Epoxy Flooring with integral base,
      a. Decor-Flor Broadcast, 1/8" thick, by Dex-O-Tex.
      b. Color: As selected by architect from manufacturers full line.

2.02 PROPERTIES

A. Low VOC, 100% solids type.

B. Grout Coat: 100% cyclo-aliphatic epoxy.

C. Finish Coat: 100% cyclo-aliphatic epoxy.

D. Physical Properties: Provide flooring system that meets or exceeds the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.

   1. Compressive Strength

a. Complete System (ASTM C-109): 8,556 psi.
b. Resin Component (ASTM D-695): 12,900 psi.

2. Surface Hardness (ASTM D-2240): Durometer D 85.

3. Aggregate Hardness (Moh's Mineral Scale): 6 1/2-7.

4. Indentation Characteristics (MIL-D-3134):
a. Para. (4.7.4.2.1-Steadily Applied Load): 0.005 indentation.

5. Impact Resistance (MIL-D-3134): 0.011 indentation.
a. Para. (4.7.3): No cracking, loss of bond.

6. Adhesion (ACI Comm. 503.1-92): 345 psi. (100% failure in concrete).

7. Water Absorption (MIL-D-3134): Less than 1%.

8. Abrasion Resistance (ASTM C-501): 19 Wear Index (H-22 Wheel).

9. Tensile Strength (ASTM D-638): Resin Component, 4,400 psi.

10. Elongation (ASTM D-638): Resin Component, 19.6%.

2.03 SUPPLEMENTAL MATERIALS

A. Waterproofing Membrane: Type recommended by manufacturer of epoxy resin composition flooring system for type of service and floor condition indicated.
1. Equal to “Chem-Inert SC” membrane by Dex-O-Tex.

B. Anti-Microbial Additive: Incorporate antimicrobial chemical additive to control growth of most bacteria, fungi, algae and actinomycetes.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where decorative quartz epoxy flooring is to be installed and notify the A/E of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.

B. Concrete Surfaces: Power scarify as required to obtain optimum bond of flooring to existing concrete.
1. Remove sufficient material to provide a sound surface, free of laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminates.
2. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

C. Materials: Mix epoxy resin components when required, and prepare materials according to flooring system manufacturer's instructions.

3.03 APPLICATION

A. General: Apply each component of decorative quartz epoxy flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.

B. Waterproofing Membrane: Apply waterproofing membrane throughout area to receive epoxy flooring according to manufacturer's directions.

C. Broadcast Coats: Apply liberal application of clear epoxy resin mixture, allow to self-level, broadcast (by hand or spray machine) ceramic coated quartz aggregate, allow to set to hardness, sweep off excess unbonded aggregate and repeat process to achieve total nominal thickness of 1/8".
   1. Provide (2) coats to achieve total thickness indicated.

D. Grout Coat: After quartz filled broadcast coats have cured sufficiently, apply grout coat of type recommended by flooring manufacturer.

E. Finish Coats: After grout coat has cured sufficiently, apply finish coats of type recommended by flooring manufacturer to produce finish matching approved submittal sample and mockup and in number of coats and spreading rates recommended by manufacturer.
   1. Finished floor shall be uniform in color, free of trowel marks and achieve thickness as indicated.

F. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches, unless otherwise indicated.
   1. Follow manufacturer's printed instructions and details including taping, mixing, priming, troweling, sanding, and top-coating of cove base.
      a. Cove shall be trowel applied without ponding or ripples.
   2. Provide zinc termination strip and sealant.

3.04 CURING, PROTECTION AND CLEANING.

A. Cure decorative quartz epoxy flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process.
   1. Close application area for a minimum of 24 hours.

END OF SECTION 09 67 16

SECTION 09 84 13

ACOUSTICAL TREATMENT

PART 1:GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

B. Acoustical Ceiling Panels.

C. Installation Accessories.

1.03 RELATED WORK

A. Gypsum Board, Section 09 29 00 for Acoustic Insulation and furring.
B. Acoustical Ceilings 09 51 00.

1.04 REFERNECES

A. Reference Standards: Conform to all governing laws, building codes, and the following performance criteria:
   1. Fire Performance Characteristics: acoustic planks with surface burning characteristics as determined by testing panel components in accordance with ASTM E84 test procedures. ASTM E 84 testing must be performed by an independent testing organization acceptable to authorities having jurisdiction.
   2. Panels will be finished with Fire retardant clear lacquer. ASTM E-84 Classification, Class "A" Flame Spread: 25 or less Smoke Developed:450 or less
   3. Acoustical Performance Characteristics: Provide acoustic planks with acoustical absorption characteristics which have been determined by testing fully assembled production material (using 96-112kg/cu.m. (6 - 7lb/cu.ft.) density fiber glass insulation) in accordance with ASTM C 423 (Type A and F25 mounting method as defined by ASTME-795) by a testing organization acceptable to authorities having jurisdiction.

1.05 SUBMITTALS

A. Submit in accordance with T General Conditions of the Contract.
   1. Product Data: Manufacturer's catalog information edited to indicate specific products and related accessories to be provided for this Project.
   2. Maintenance Data: Recommended procedures for normal cleaning and removal of stains. Include precautions in use of cleaning materials that may be detrimental to surfaces.

1.06 QUALITY ASSURANCE

A. Manufacturer & Installer: Firm manufacturing the specified product shall have adequate capacity required for projects listed and have successfully completed similar projects for a period of not less than five years. The Installer should be approved by the manufacturer as qualified to perform work required.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect products against damage during delivery and handling.

B. Store all items in a clean, dry storage area.

C. Maintain temperature in storage area above 40 degrees F. without excessive humidity.

1.08 PROJECT CONDITIONS

A. Install under same temperature, humidity conditions that will normally exist when building is occupied.

B. Maintain temperature of all areas to receive acoustical wall treatment at 70 degrees F. for 72 hours before, during and 48 hours after application.

C. Remove material from packaging and allow to acclimatize in area of installation 24 hours before application.

1.09 GUARANTEE

A. Furnish to the Owner, the manufacturers written guarantee covering the products supplied against defects in materials and workmanship under normal operating conditions for a period of one year from the date of shipment. Submit certificates of compliance showing warranty period by dates for each project completed to the Owner.

PART 2:PRODUCTS

A. MATERIALS
1. Acoustic Panels: AP-1
a. Decoustics SOLO 8 Acoustic Planks
i. Description: Decoustics SOLO 8 "No added formaldehyde" Acoustic PLANKS, as manufactured by:
Decoustics Limited
61 Royal Group Crescent
Woodbridge, Ontario
Canada, L4H 1X9

b. Furnish and deliver Decoustics SOLO 8 "No added formaldehyde" Acoustic planks as described in this section for installation in areas as shown on drawings meeting or exceeding the following requirements:
i. Decoustics Solo 8 acoustic planks shall be comprised of a single piece "no added formaldehyde" MDF core of 16mm (5/8") thickness faced with a real wood veneer. The structure is perforated by means of "V" routing on 8mm (5/16") centers and intersecting perforations of 8mm (5/16") diameter on staggered 16mm (5/8") centers.
ii. Veneer to be: Beech, clear matte Finish lacquered to match Architects sample.
iii. Unless otherwise specified, veneer will be quarter cut, slip matched. Veneer will not be sequenced. Clear lacquer finish to 30% sheen.
iv. Provide solid trim/edge as indicated on drawings.

c. Solo planks of 192mm (7 9/16") shall be installed by installed by means of Decoustics supplied clips and a tongue and groove connection on hardwood blocking or metal furring. Solo 8 plank clips must be located at a maximum of 600mm (23 5/8") on center. If necessary, formaldehyde free acoustically absorptive material of adequate thickness required to meet the acoustic absorption requirements shall be installed between furring or horizontal wood blocking prior to panel installation. The Solo 8 planks shall be supplied with a black facing on the back side to prevent fiber glass insulation color from "reading" through, and shall be site fabricated to sizes required and neatly fitted to adjacent materials. Trim perimeter as detailed. Installer shall provide for

shimming and adjustment as required to maintain consistent alignment of joints and of finished panel faces.

d. Solo 8 “no added formaldehyde” Acoustic Planks shall have noise reduction coefficient values of the following:

		Frequency (Hz)							
Description	**Thickness**	125	250	500	1000	2000	4000	NRC	SAA
*Solo 8-25**	*1 5/8 (41mm)*	*0.1*	*0.45*	*1.03*	*0.96*	*0.51*	*0.51*	*0.75*	*0.73*
*Solo 8-50**	*2 5/8 (67mm)*	*0.36*	*0.97*	*1.15*	*0.92*	*0.7 1*	*0.69*	*0.95*	*0.95*
*Solo 8**5/8*	*(16mm)*	*0.09*	*0.12*	*0.37*	*0.82*	*0.68*	*0.40*	*0.50*	*0.50*

** Type A Mounting (with 1” (Solo 8-25), or 2” (Solo 8-50) fiber glass backer)*

*** Type F25 Mounting (1” (25mm) furring/airspace - no backer)*

a. Or approved equal product of the following manufacturers:
   i. Armstrong
   ii. Capaul
   v. Panel Solutions, Inc.
   vi. Quiet Solutions by Acoustic Associates.

2. AP-2
   a. Decoustics Linear Wood Lay-in Grille Ceiling
   b. Species to match AP-1
   c. 3 ¼” blade height x 59 ¼”
   d. Linear wood solid no-added urea formaldehyde fire rated MDF core with a natural wood veneer laminated to all visible surfaces.
   e. Coordinate heavy duty 15/16” T-bar grid requirements with ACT grid.
   f. Or approved equal.

2.04 ACCESSORY PRODUCTS

A. Splines/Clips: Aluminum, designed for concealed use, all types required for starts and intermediate fastening.

PART 3:EXECUTION

3.01 INSTALLATION

A. See that substrate is acceptable for the successful completion of the work of this Section prior to starting work.

B. Conform to manufacturer's installation details. All fastening devices shall be concealed in completed installation. Wall panels shall be securely affixed by means of splines/clips attached vertically to smooth wall or furring strips. Splines shall engage vertical kerfs on the edges of the wall panels. Apply adhesive where necessary, blocking where necessary. Field cut edges shall be covered by means of on-site fabric wrapping.

C. Prior to final inspection and/or occupancy of the building by the Owner, review installation and replace all damaged panels, leaving installation complete and ready for occupancy by the Owner without further work.

END OF SECTION 09 84 13

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SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Painting and finishing of interior and exterior exposed items and surfaces throughout Project.

B. Refinishing of existing surfaces as indicated on Drawings, including removal of paint and finishes, preparation, painting and finishing.

C. Field painting of exposed bare and covered pipes and ducts and hangers, conduits, uni-strut, exposed steel and iron work, all metal fabricated Section 05 50 00 items, and primed metal surfaces including but not limited to, hollow metal work, equipment installed under mechanical and electrical work.

D. "Paint" as used herein means all coating systems materials including primers, emulsions, enamels, stains, sealers and fillers, and other applied material whether used as prime, intermediate or finish coats.

E. Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas.

F. Following categories are not included as part of field-applied finish work.
   1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified.
   2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces in concealed areas and generally inaccessible areas.
   3. Finished Metal Surfaces.
   4. Operating Parts.

1.03 RELATED WORK

A. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

B. Examine the Contract Documents and be familiar with all their provisions regarding painting. All surfaces that are left unfinished by the requirements of other Sections shall be painted or finished as part of this Section.

1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract:
   1. Paint: Submit a list of specified products with corresponding name of manufacturer, identifying name and number of proposed products along with manufacturer's written instructions for use of each product.

2. If manufacturer to be used is different from that of color chips furnished, prepare and submit two approximately 6 inch square, properly labeled samples of each color and sheen required on properly prepared paint-out cards or hardboard.

3. Stain: Two, 6 inch square properly labeled samples of each color and sheen required on actual wood for project.

4. Prepare and repaint an area of each designated interior surface to requirements specified herein, with specified paint or coating showing selected color, gloss/sheen, texture and workmanship to MPI Repainting Manual standards for review and approval by Owner and A/E. When approved, interior surface shall become acceptable standard of finish quality and workmanship for similar on-site repainting work.

1.05 QUALITY ASSURANCE

A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.
a. For areas to be renovated, comply with requirements in "MPI Maintenance Repainting Manual".

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to site until having received all written approvals of submitted information and samples.

B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label.

C. Store materials not in actual use in tightly covered containers.

D. Take all precautions to ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

E. Remove rags and waste from storage areas daily.

1.07 PROJECT CONDITIONS

A. Apply water-base paints only when temperatures of surfaces to be painted and surrounding air temperatures are between 50 and 95 degrees F.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. and 95 degrees F.

C. Do not apply paint when relative humidity exceeds 85%; at temperatures less than 5 degrees F. above the dew point; or to damp or wet surfaces.

1.08 SEQUENCING AND SCHEDULING

A. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto newly-painted surfaces.

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 gal. of each material and color applied.

1.010 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.
2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints", Second Edition, January 7, 1997. For applications on ferrous metal substrates.
3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. AFM Safecoat.

B. Benjamin Moore & Co.

C. Cabot.

D. ICI/Dulux.

E. PPG Architectural Finishes, Inc.

F. Sherwin Williams Company.

G. U-C Coatings Corp.

H. Target Coatings

I. Diamond Vogel Paint

J. Or approved equal.

2.02 MATERIALS

A. Use the materials of the same manufacturer for each system.

B. Sherwin Williams systems are called out in the system schedules to establish quality and dry mil thickness of finished installation for all systems. A different manufacturer may be used for color selection. Any manufacturer noted above may be used as long as quality and color requirements are met.

1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.

D. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Non-flat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

2.03 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

2.04 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based): MPI #107.

2.05 LATEX PAINTS

A. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).

B. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).

C. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).

D. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).

2.06 EQUIPMENT

A. Provide all brushes, rollers, ladders, scaffolding, and other equipment of any kind to properly execute each type of work.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates:
   1. Gypsum Board: 12 percent.
   2. Concrete: Must be cured a minimum of 45 days.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Perform preparation and cleaning procedures in accord with paint manufacturer's instructions and as specified for each particular substrate condition.
   1. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations.
      a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

2. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning.
3. Remove dirt, rust, scale, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

B. New wood: Prepare substrate and apply finish according to manufacturer's recommendations. Apply to smooth clean surfaces only.

C. Gypsum Board: Fill minor irregularities with patching material and sand to smooth level surfaces taking care not to raise nap of paper.

D. Existing Ferrous Metal
1. Spot remove failed, damaged or rough existing paint to bare metal by means of stripping as indicated above. If existing metal surface is not smooth, sand or wire brush.
a. Sand edges of existing paint to a feather edge.
2. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.

E. Ferrous Metal
1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.
2. Where not galvanized, shop coat of primer will exist on surface. If prime coat is not smooth, sand to bare metal and re-prime.

3.03 APPLICATION

A. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

B. Do work under adequate illumination and dust-free conditions.

C. Apply paints according to manufacturer's written instructions.
1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. Materials
1. Do not open containers until required for use.
2. Stir materials thoroughly and keep at uniform consistency during application.

F. Coats
1. Number specified is minimum.
2. Touch up suction spots between coats.
3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
5. Refinish surfaces affected by refitting work.

3.04 COLOR SEPARATION

A. An average of one or two wall colors will be used per room. Ceilings generally will be a different color than walls. Finished closets will usually be same as adjoining rooms.

B. Job painted metal items such as diffusers, grilles and registers will generally be same color as adjacent surface.

C. Hardwood generally will be the same color stain throughout.

3.05 CLEANING

A. During the progress of this work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing.

B. Provide "wet paint" signs to protect newly-painted finishes. Remove temporary protective wrappings, after completion of painting operations.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 SCHEDULE OF INTERIOR WORK

A. In addition to obvious surfaces, the following do not require painting or finishing.
1. Do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) acoustic materials, finished mechanical and electrical equipment including light fixtures and distribution cabinets.
2. Painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
4. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated.
5. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plate.
6. N/A indicates system not applicable to this Project.

B. Walls and Ceilings
1. Paint all rooms listed on Room Finish Schedule. Paint patched walls from 90 degree corner and patched ceilings complete.

2. Do not apply next coat until previous is thoroughly dry.
3. Provide final coat which is solid and even in color, free from runs, laps, sags, brush marks, air bubbles and excessive roller stipple and worked into crevices, joints and similar areas.

C. Wood:
1. Apply finishes to all areas as shown on drawings.
2. Apply per manufacturer's instructions.

D. Electrical Panel Box Covers and Doors
1. Remove, paint and reinstall after paint is dry.

E. Other Unfinished and Primed Surfaces

1. Provide specified finish on exposed surfaces. This includes prime coated mechanical units, piping, pipe covering, conduit, and interior duct surfaces visible behind grilles.

F.	Material	Type	Number and Type of Coating
1.	IPS 4 - Wood	Stain (Satin)	One coat "Sherwood Wiping Stain", 2 coats "Wood Classics Fast Dry Varnish".
2.	IPS4A – Wood	Epoxy	One coat "Premium wall and wood primer" Two coats "Pro Industrial Pre-Catalyzed Epoxy"
3.	IPS 6 – Gypsum Board (Foodservice Restrooms/shower rooms)	Epoxy-Gloss	One coat "ProMar Primer" Two coats "Pro Industrial Pre-Catalyzed Epoxy".
4.	IPS 7 - Gypsum Board	Latex-Eggshell Zero-VOC	One coat "Harmony Interior Latex Primer", Two coats "Harmony Interior Latex Eggshell".
5.	IPS 8 – Concrete	Latex-Eggshell Zero-VOC	One coat "Harmony Interior Latex Primer", Two coats "Harmony Interior Latex Eggshell".
6.	IPS 9 – Concrete Block	Latex-Eggshell	One coat "Loxon Block Surfacer", Two coats "Harmony Interior Latex Eggshell".
7.	IPS 9A – Concrete Block Restrooms/Shower Rooms	Epoxy-Gloss	One Coat "ProMar Primer" Two coats "Pro Industrial Pre-Catalyzed Waterbased Epoxy".
8.	IPS 13 - Ferrous Metal Metal (Unprimed)	Epoxy -Semi-gloss	One coat "Pro Industrial Pro-Cryl Primer", Two coats "Pro Industrial Pre-Catalyzed Waterbased Epoxy".
9.	IPS 14 - Ferrous Metal (Primed)	Epoxy -Semi-gloss	One coat "Pro Industrial Pro-Cryl Primer", Two coats "Pro Industrial Pre-Catalyzed Waterbased Epoxy".
10.	IPS 15 - Copper/Alum (Finished Rooms Only)	Latex-Flat	One coat "DTM Acrylic Primer Finish", two coats "ProMar 200 Interior

			Latex Flat".
11.	IPS 16 - Galvanized (Finished Rooms Only)	Latex-Flat	One coat "DTM Acrylic Primer Finish", two coats "ProMar 200 Interior Latex Flat".

3.08 SCHEDULE OF EXTERIOR WORK

A. General

1. Paint or finish other new, unfinished and primed surfaces noted on drawings.
2. Provide aggregate in quantity as recommended by manufacturer and mix according to manufacturer's written instructions.

B.

Material		Type	Number and Type of Coating
1.	EPS 1 - Ferrous Metal (i.e., hollow metal, exposed plates, angles, bolts, etc.)	Acrylic-Semi Gloss	One coat "Kem-Kromik Universal" primer, two coats "DTM Acrylic".
2.	EPS 2 - Galvanized Metal (i.e., hollow metal, equipment housings, etc.)	Acrylic-Semi Gloss	One coat "Pro-Cryl Univeral" primer, two coats "DTM Acrylic".
3.	EPS 4 – Wood Siding	Stain	Prime Coat all surfaces with Sikkens "Cetol 1" prior to installation, and two coats Sikkens "Cetol 23 Plus" translucent satin stain after installation.

3.09 PAINT COLOR SCHEDULE

Refer to A900 for paint color schedule, colors to be provided by Architect.

END OF SECTION 09 90 00

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SECTION 10 14 00

INFORMATION SPECIALTIES

PART 1: GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Accessibility Signage.

B. Pressure Sensitive Graphic Window Films.

1.03 REFERENCES

A. All signage shall be in strict accord with Wisconsin Enrolled Commercial Building Code.

1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Manufacturer's Literature: Materials description, colors, and application instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Provide protective coverings for identifying devices prior to shipping.

B. Handle and store to prevent damage and soiling.

PART 2: PRODUCTS

2.01 ADA REQUIRED ACCESSIBILITY SIGNAGE

A. All interior signage must have tactile/Braille lettering and raised pictograms. Braille must be integral to the sign. Taped on Braille is not acceptable.
   1. All Braille to be located at the bottom of the sign.
   2. When the word “accessible” is used on a sign or when the symbol for accessibility is used, the word accessible must be included in the Braille text.

B. Basis of Design: Interior Signs.
   1. 2/90 Sign Systems
      a. 6”x9” ADA Signage to meet ANSI A117.1
   2. Colors: 2, to be selected by Architect from Manufacturer’s full line.

C. Manufacturers
   1. ASI Sign Systems.
   2. Poblocki Sign Company
   3. Best Sign Systems Inc.
   4. 2/90 Sign Systems

5. Or approved equal.

2.02 PRESSURE SENSITIVE GRAPHIC WINDOW FILMS

A. Vinyl glass film, 50 micron
1. Basis of Design: 3M 7725-314 Dusted Crystal
2. Color and pattern to be selected by A/E
3. Clear release liner.
4. Pressure sensitive adhesive.
5. To give appearance of etched glass as chosen by A/E.
Application locations as indicated on drawings, See A700.

B. Manufacturers.
1. Metamark Signviny
2. 3M
3. Or approved equal.

PART 3: EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for the installation of identification devices.

C. Install devices plumb, level and true to line.

3.02CLEANING

A. Clean surfaces of identifying devices, dedication plaque and surrounding surfaces.

B. Remove protective Coatings, if any.

3.03SIGNAGE SCHEDULE

A. Provide ANSI A117.1 compliant signage at each door leading to an accessible restroom or shower room (i.e., all restrooms and all shower rooms). Provide graphic for shower, both gender symbols for unisex designation, accessible graphic and text indicating shower or restroom.

END OF SECTION 10 14 00

SECTION 10 22 26

OPERABLE PANEL PARTITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. Section Includes
   1. Movable flat panel partitions, fabric clad, single panels.
   2. Ceiling track with ceiling guards and all brackets, threaded rods and all materials needed to suspend the track from the steel structural support as detailed in the plans.

B. Related Sections
   1. Section 06 20 00, Rough Carpentry

1.03 WORK INCLUDED

A. Manually operated, continuously hinged panel partitions.

1.04 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.

B. Shop Drawings and Product Data:
   1. Submit Product Data describing partition operation, hardware and accessories, colors and finishes available.

C. Shop Drawings: Show location and extent of operable panel partitions. Include plans, elevations, sections, details, numbered panel installation sequence, attachments to other construction, and accessories. Indicate dimensions; weights; conditions at openings and for storage; and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, and direction of travel. Show blocking to be provided by others. Include the following:

D. Calculations: Calculate requirements for supporting operable panel partitions and verify capacity of carriers and track components to support loads; indicate deflection limits for partition and adjacent construction.

E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied powder coat color finishes.

F. Field Measurements: Verify operable panel partition openings and storage arrangements by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

G. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening and storage dimensions and proceed with fabricating operable panel partitions without field measurements. Coordinate construction to ensure that actual opening dimensions correspond to established dimensions.

1.05 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide operable panel partitions with the following fire-test-response characteristics, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: As follows, per ASTM E 84:
      a. Flame Spread: 25 or less.
      b. Smoke Developed: 450 or less.
   2. Fire Growth Contribution: Textile wall coverings complying with the acceptance criteria of UBC Standard 8-2.
   3. Sound Transmission Loss: ASTM E90; minimum STC of 52, +/- 1 STC, tested on 100 square foot opening.
   4. Limit installed track deflection under load to .10 inch.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building (defined as inside the weatherproofing system and applied on site) must not exceed the following requirements.
   1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7, 2005.
   2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in effect on October 19, 2000.

PART 2 - PRODUCTS

2.01 PRODUCTS AND MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Product: Kwik-Wall 2030 hinged pairs
      a. Partition with type 850 track/carrier system.
      b. Provide both top and bottom retractable seals on all panels including expandable closure panels. Top seal provide 1" clearance from the track and the bottom seal shall provide 2" clearance from the floor. Sweep type seals shall not be acceptable.
      c. Fabric Color/Pattern: Vinyl to be selected from manufacturer's full range.
      d. STC: Not less than 51.
   2. Modernfold, Inc. 931 with 860 track/carrier system (similar product to the Kwik-wall product mentioned above)
   3. Or approved equal.

B. Materials
   1. Steel Frame: Steel sheet, not less than 0.0478-inch nominal specified thickness for uncoated steel.
   2. Suspension Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for type of operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous

system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.

3. Panel Guide: Aluminum; finished with factory-applied, powder coat finish chosen from manufacturer's full range by A/E.
4. Head Closure Trim: As required for acoustical performance; primed for field finish.
5. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
6. Track Intersections, Switches, and Accessories: As required for type of operation, storage, track configuration, and layout indicated for operable panel partition, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.

C. Operable Panel Partitions

1. Panel Construction: Provide top reinforcement as required to support panel from suspension components and provide reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.
2. Faces are full height 18 gauge steel with gypsum backer board.
3. Glass fiber insulation at interior of panel.
4. Dimensions: Fabricate operable panel partitions, from manufacturer's standard sizes, to form an assembled system of dimensions indicated on Drawings and verified by field measurements.
5. Trim: Manufacturer's standard aluminum trim, finished as follows:
   a. Powder Coated, as selected by Architect from manufacturer's full range.
   b. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
6. Seals: General: Provide types of acoustical seals indicated that produce operable panel partitions complying with acoustical performance requirements and the following:
   a. Seals made from materials and profiles that minimize sound leakage.
   b. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended, closed, and in place.
   c. Vertical Seals: Deep-nesting, interlocking astragals mounted on each edge of panel, with continuous acoustical seal.
   d. Retractable top seals.
   e. Horizontal Bottom Seals: Mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
      1) Top and bottom seals to operate from the edge of the panel with a removable handle.
7. Finish Facing
   a. General: Provide finish facings that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
   b. Apply one-piece, seamless facings free from air bubbles, wrinkles, blisters, and other defects, with no gaps or overlaps. Horizontal butt edges are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
   c. Where facings with directional or repeating patterns or directional weave are indicated, mark facing top and attach facing in same direction.
   d. Match facing pattern 72 inches above finished floor.

e. Fabric Wall Covering: Manufacturer's Premium Custom, fabric, from same dye lot, treated to resist stains.

8. Steel Finish: Factory-applied, corrosion-resistant, protective coating, unless otherwise indicated.

2.02 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Comply with ASTM E 557, operable panel partition manufacturer's written installation instructions, Drawings, and approved Shop Drawings.

B. Adjusting

1. Adjust operable panel partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

C. Remove all packaging materials from premises.

END OF SECTION 10 22 26

SECTION 10 28 00

TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Commercial Toilet and Bath Accessories.

B. Coat Hooks.

1.03 RELATED WORK

A. Unit Masonry 04 20 00.

1.04 REFERENCES

A. All work of this section shall be in strict accord with Wisconsin Enrolled Commercial Building Code.

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Manufacturer's product data.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packaging with seals unbroken and bearing manufacturer's name and product.

B. Store all materials in secure place to prevent damage.

C. Remove all damaged materials from project immediately.

PART 2 - PRODUCTS

2.01 COMMERCIAL TOILET ACCESSORY MANUFACTURERS

A. American Specialties, Inc.

B. Bobrick Washroom Equipment, Inc.

C. Bradley Corporation.

D. Gamco.

E. McKinney/Parker.

2.02 MANUFACTURED COMMERCIAL UNITS

A. Grab Bars.
1. Bradley, Model SA70, Grab Bars, lengths as indicated in drawings.
a. Stainless steel closure plate, suicide resistant.
2. Or equal by approved manufacturer.

B. Toilet Paper Dispenser
1. Owner Furnished Contractor Installed

C. Paper Towel Dispenser – Kitchenettes Surface Mounted
1. Owner Furnished Contractor Installed

D. Mirrors, sizes as indicated on drawings.
1. Unbreakable stainless steel mirror, 20 gauge stainless steel, polished to a #8 architectural bright finish. Stretcher leveled for uniformity.
a. Bradley, B-748
b. Or equal by approved manufacturer

E. Warm-Air Dryers (DRYER):
1. Xlerator Hand Dryer
a. Or approved equal
2. Noise Reduction Nozzle
3. ADA Compliant Projection
4. Surface recessed
5. Operation: Electronic-sensor activated with timed power cut-off switch
a. Operation Time: 10 to 15 seconds
6. Cover Material and Finish: Steel, with black graphite epoxy finish
7. Electrical Requirements
a. 120 V, 13 A, 1500 W
b. Each hand dryer shall have a dedicated 20amp circuit

F. Recessed Shelf
1. American Specialties ASI0412
2. 8”x18” recess stainless steel
3. Location to be provided by AE
4. Install (1) in each shower

G. Soap dispensers
1. Owner Furnished Contractor Installed

H. Waste Receptacles
1. Owner Furnished Owner Installed, freestanding

I. Folding Shower Seat (FSS)
1. Impey SlimFold Shower Seat, blue
2. Install in Shower Room 118, confirm location with Owner and A/E

J. Anti-Ligature Shower Curtain, Track and Carrier
1. Cape Cod Systems Breakaway Shower Curtains
2. Mesh – Sure-Check, color to be selected by A/E from manufacturers full range
3. Optitrack cubical curtain track system
4. Optitrack Pop Out Carrier, CCSCE6026
5. Install (1) in each shower room.

K. Diaper Changing Station (DCS)
1. Koala Kare HDPE
a. Or approved equal
2. Horizontal unit that opens by folding down from stored position and with child-protection strap.
a. Engineered to support a minimum of 250-lb static load when opened
3. Operation: By pneumatic shock-absorbing mechanism
4. Stainless steel finish with HDPE interior in manufacturer's standard color
5. Liner Dispenser: Built in

L. Mop and Broom Holder Rack
1. American Specialties Inc. www.americanspecialties.com or equal. Model No. 8215-3.
2. Install (1) in Laundry Room 122.

M. Coat Hook
1. Cardea Solutions Anti-Ligature Hook, white.
2. Install (2) in each shower room and restroom. Location to be provided by A/E.

N. Coat Hook Laundry
1. A4Forty Coat Hook Rack 241-758-Stainless Steel-4 Hooks – 13 Inches
2. Install (4) Racks in Laundry Room 122.

O. Coat Hook (3)
1. Umbra Flip 3 Hook White: painted wood with (3) metal flip down hooks
2. Install (1) in each office, location to be provided by A/E.

2.03 FASTENERS

A. Provide all fastening devices including screws, bolts, anchors, and backplates.

B. Exposed fasteners shall match finish of accessories.

C. All exposed fasteners to have tamperproof heads.

2.04 FABRICATION

A. Fabricate all toilet and bath accessories of type 302 or 304 stainless steel with satin finish, unless otherwise specified or approved.

B. All accessories shall be by one manufacturer unless otherwise specified or approved.

C. Manufacturer's labels or imprinted name shall not be visible.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces and recesses to receive toilet and bath accessories for dimensions, plumbness, blocking, and other conditions that affect installation.

B. Do not proceed until conditions are acceptable.

3.02 INSTALLATION

A. Install toilet and bath accessories according to manufacturer's direction.

B. All accessories in any one space shall be of matching design and finish. If discrepancies are found, secure Architect's approval before proceeding.

3.03 ADJUSTING AND CLEANING

A. Adjust accessories for proper operation.

B. Replace damaged or defective items.

C. Clean and polish accessories after removing labels and protective wrapping.

D. Delivery service and parts manual in accordance with the General Conditions of the Contract Closeout.

END OF SECTION 10 28 00

SECTION 10 41 16

EMERGENCY ACCESS KEY BOXES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Emergency Access Key Boxes.

1.03 RELATED WORK

A. Section 06 10 00, Rough Carpentry.

B. Section 04 20 00, Unit Masonry.

1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Product Data: Manufacturer's catalog information and specifications edited to indicate specific access boxes or vaults and accessories to be provided for this Project. Include rough opening dimensions and certification of U.L. rating.

PART 2 - PRODUCTS

2.04 EMERGENCY ACCESS KEY BOX:
   1. 1/4" fully welded steel plate housing with 1/2" thick steel door with interior gasket seal and stainless steel hinge.
   2. Recessed/flush mount
      a. Install using only manufacturer supplied and approved methods and materials.
   3. Dimensions:
      a. 7"H x 7"W x 5"D exterior of box.
      b. 9-1/2" x 9-1/2" Recess Mount Flange.
   4. Box and lock to be UL listed.
      a. Lock to have 1/8" thick dust cover and be tamper resistant.
      b. Hardened steel pins and double action rotating tumblers, accessed by a biased cut key.
   5. Boxes shall have tamper switches monitored through METASYS.
   6. Color: To be chosen from manufacturer's full range.
   7. Manufacturer:
      a. Knox Box Series 4400.
      b. Emergency Access Systems Inc.
      c. Or approved equal.
   8. Contractor to coordinate with the Madison Fire Dept. for product ordering. The specific box is selected and ordered by the Madison Fire Dept.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all items in accordance with manufacturer's written instructions.

B. Prepare recesses in wall for access boxes.

C. Mount boxes at (6) six feet high or as shown on drawings. Install knox box in masonry pier at courtyard entrance gate.

D. Protect box from staining or damage from adjacent construction.

E. Replace any damaged components; touch-up is not acceptable.

END OF SECTION 10 41 16

SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Stainless Steel Fire Extinguisher Cabinets.

B. Fire Extinguishers

1.03 RELATED WORK

A. Rough Carpentry 06 10 00

1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Product Data: Manufacturer's catalog information and specifications edited to indicate specific extinguishers, cabinets and accessories to be provided for this Project. Include rough opening dimensions and certification of U.L. rating.

1.05 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
   1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.06 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure of hydrostatic test according to NFPA 10.
      b. Faulty operation of valves or release levers.
   2. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless-Steel Sheet: ASTM A 666, Type 304.

B. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.02 FIRE EXTINGUISHER CABINET

A. Basis of Design: Larsen Manufacturing, Architectural Series, Vertical Duo, clear acrylic door, #4 stainless steel.
   1. FX-1: Recessed

B. Products: Subject to compliance with requirements products by additional manufacturers that may be incorporated into the Work include the following; submit for approval:
   1. J. L. Industries, Inc., a division of Activar Construction Products Group.
   2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
   3. Potter Roemer LLC.

C. Cabinet Construction: Nonrated and rated same as adjacent structure.
   1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material. Provide factory-drilled mounting holes.

D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
   1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.

E. Cabinet Trim Material: Same material and finish as door.

F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

G. Accessories
   1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
      a. For FX-3: Kidde Fire Extinguisher Wall Hanger, model to accommodate extinguisher

   2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into face.
   3. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
      a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
         1) Location: Applied to cabinet glazing.
         2) Application Process: Decals.
         3) Lettering Color: Red.
         4) Orientation: Vertical

   4. Alarm: Manufacturer's standard alarm that actuates when fire protection cabinet door is opened and that is powered by batteries.

2.03 FABRICATION

A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum ½ inch thick.
2. Miter and weld perimeter door frames.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.04 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.05 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

2.06 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide Larsen's Manufacturing MP2, MP5 and MP5-A where indicated or comparable product by one of the following:
a. Amerex
b. Ansul, Sentry
c. Badger Fire Protection; a Kidde company.
d. J. L. Industries, Inc.; a division of Activar Construction Products Group.
e. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
f. Potter Roemer LLC.
g. Tyco
2. Valves: Manufacturer's standard.
3. Handles and Levers: Manufacturer's standard.
4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.

B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 1-A:10-B:C, 2.5-lb, 2-A:10-B:C, 5-lb and 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install all items in conformance with manufacturer's directions.

B. Prepare recesses in wall for fire extinguisher cabinets.

C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb. No gaps are allowed between cabinet edge and wall surface.

D. Mount fire extinguishers in cabinets or on wall brackets so the top of the extinguisher is not more than 4 feet above the floor.

E. Clean fire extinguisher cabinet and extinguisher of all dirt, residue, or smudges.

F. Replace any damaged components; touch-up is not acceptable.

G. Schedule: (1) Multi-Purpose 126, (1) Support Desk 130, (1) Resource Center 205. Architect to provide drawing with locations.

END OF SECTION 10 44 13

SECTION 10 51 13

LOCKERS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Lockers

1.03 RELATED WORK

A. Section 06 10 00, Rough Carpentry.

1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Shop drawings: Indicate installation details relating to anchoring, trim installation and relationship to adjacent surfaces, materials used, quantity and size required
   2. Samples: Indicate locker body, door colors.
      a. Provide 12” x 12” samples of colors and finishes on actual material being used.

B. Provide manufacturer’s written warranty.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle units to prevent damage.

B. Damaged units will be rejected and replaced at no cost to Owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Lyon Lockers:
   1. Standard Quiet Lockers
   2. Contact: John Cinto 608.239.8902

B. Or approved equal.

2.02 MATERIALS

A. Locker Box
   1. Triple Tier 18”x18”x24” lockers and Double Tier 48” high with 18”x18”x24”.
   2. Hinges: full loop design hinges, high security single point latches
      a. Hardware: chrome finish.
   3. Vented doors.
   4. One piece doors formed from 16-gauge prime, high grade class 1 steel. Integral full height 16-guage door strikes. 12-gauge door jambs.

5. Number Plates: 1-1/2" disc with black engraved number routed flush with locker door.
6. Locks: Master Lock 3670 at each door.
7. Legs: provide 6” closed style base.
8. Color to be selected from manufacturer’s full range of colors.

B. Ends and fillers:
1. Locker end, filler and back panels matching locker door cover, exposed sides, backs and intersections.

2.03 FABRICATION

A. Fabricate locker parts square and rigid without warp with the finished faces flat and free of scratches and chips.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify location of units.

3.02 INSTALLATION

A. Install lockers and accessories per approved plans and manufacturer’s instructions plumb rigid installation.

B. Lockers to be installed on a 2” x 4” or 2” x 6” base per design drawing supplied by manufacturer.
1. Base to extend from the wall 2” less than lockers.
2. All hardware and installation to be provided by manufacturer.

C. Anchor lockers to walls.

3.03 CLEANING

A. Wipe locker surfaces to remove fingerprints, smudges.

B. Clean adjacent surfaces soiled by locker installation work.

C. Replace adjacent surfaces damaged by locker installation work.

D. Remove all packaging materials.

END OF SECTION 10 51 13

SECTION 10 67 00

STEEL SHELVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Supply and install cantilever metal shelving system consisting of modular components to be field erected to provide a complete, functional storage system.

1.03 REFERENCES

A. American Society of Testing and Materials
   1. ASTM A240 - Chromium and Chromium Nickel Stainless Steel Plate and Strip for Pressure Vessels and General Applications.
   2. ASTM A653 - Steel Sheet, Zinc-Coated, (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   3. ASTM A1008 - Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy with Improved Formability.
   4. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
   5. ASTM B633 - Electrodeposited Coatings of Zinc on Iron and Steel.
   6. ASTM D522 - Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
   7. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   8. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

B. Federal Specifications (Fed Spec):
   1. Fed Spec AA-S-1048 - Shelving, Storage, and Display, Steel, Clip Type.

1.04 PERFORMANCE REQUIREMENTS

A. Storage shelving system shall be designed, fabricated, and installed such that:
   1. Shelves are cantilevered without front supports providing completely open, full width, useable shelves.
   2. Shelf lengths are provided to completely fit layout indicated on Drawings without voids, gaps, or wasted space.
   3. Shelves may be positioned at any height above base bracket. Systems with slots or holes that dictate shelf heights are not acceptable.
   4. Storage system shall be expandable using additional modular components.
   5. Storage system can be dissembled and re-erected in different location or configuration.
   6. Loading capacities for 48 inches shelf span.
      a. Shelf uniform load: 24 inches deep shelf: 120 pounds per square foot.

   7. Loading capacity for single shelf bracket:
      a. 24 inches long bracket: 395 pounds.

   8. Loading capacity for double shelf bracket:
      a. 24 inches long bracket: 198 pounds.

1.05 SUBMITTALS

A. Applicable provisions of Division 1 shall govern all work under this section.
   1. Product data for storage system components and accessories.
   2. List of components and quantities being provided.
   3. Shop drawings indicating layout of system, plans, elevations, dimensions, and installation details.
   4. Installation instructions.
   5. Copy of warranty.

1.06 QUALITY ASSURANCE

A. Manufacturer qualifications: Firm specializing in manufacture of cantilever shelving systems with 5 years minimum successful experience.

B. Sole source responsibility: All shelving system components shall be products of a single manufacturer.

1.07 WARRANTY

A. Provide Closeout Submittals: 10 years warranty for properly installed storage system to cover repair or replacement of defective or failed components.

PART 2 - PRODUCTS

2.01 A STORAGE SHELVING SYSTEM

A. Advance Tabco Wall Mounted Chrome Shelving System
   1. Wire shelving 18” deep.
   2. Brackets
   3. Posts (uprights)

B. Focus Shelving

C. Or approved equal.

D. Provide complete, cantilever shelving system consisting of modular shelves, uprights, shelf brackets, clamp assemblies, fasteners, and other components and accessories that can be field assembled;
   1. Galvanized steel shelves and zinc plated uprights and brackets.

E. Layout: Dimensions, number of tiers, location, spacing, and details shall be as indicated on Drawings and approved shop drawings.

F. Mounting method: Shelving shall be supported on cantilevered brackets attached to freestanding uprights.

2.02 SHELVES

A. Material/Finish: Chrome Wire.

B. 18-inches adjustable.

2.03 UPRIGHTS

A. Type: Wall mounted

B. Material/finish: Chrome

C. Length: per drawings.

2.04 BRACKETS

A. Material/Finish: Chrome

B. Size: 18 inches by as required to accommodate shelf depth.

C. Provide brackets with clamp assemblies designed to rigidly attach brackets to uprights.

2.05 ACCESSORIES

A. Fasteners: Provide fasteners as required for secure, rigid installation to meet performance requirements specified in Paragraph 1.3. Type, size and spacing shall be as recommended by manufacturer and indicated on approved shop drawings. Minimum fasteners shall be:

B. Anti-sway braces: Provide 1 inch by 6 gage steel straps to cross-brace freestanding shelving and meet performance requirements specified in Paragraph 1.3.

1. Finish:

a. For galvanized steel uprights: Zinc plated in accordance with ASTM B633 and chromate dipped.

C. Fasteners: Machine screws with nylon-locking hex nuts.

PART 3 - EXECUTION

3.01 INSPECTION

A. Prior to installation:

1. Inspect substrates to receive shelving and verify surfaces are smooth, plumb, and suitable for installation.
2. Inspect storage system components for damage. Do not install bent, dented, scratched, or otherwise damaged items.
3. Verify all required components are available.

3.02 INSTALLATION

A. Install shelving system in accordance with approved shop drawings and manufacturer's installation instructions.

B. Freestanding uprights: Attach foot brackets to uprights with clamp assemblies. Ensure bracket is perpendicular to upright. Ensure uprights are accurately positioned and plumb.

C. Anti-sway braces: Where indicated on approved shop drawings, install pair of anti-sway braces on backside of uprights. Attach braces 6 inches from top of upright. Attach bottom end of braces to adjacent upright forming an X.

D. Brackets: Insert shelf brackets in uprights and secure with clamp assemblies. Ensure brackets are accurately aligned so installed shelves will be level.

E. Shelves: Position shelves on brackets, align mounting holes, and anchor with fasteners of type, size, and spacing recommended by manufacturer.

F. Cleaning: Thoroughly clean and polish storage system components and protect from subsequent construction activities. Remove and replace damaged components.

1. Remove all packaging and shipping materials.

END OF SECTION 10 67 00

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SECTION 11 42 16

FOOD PREPARATION SURFACES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 WORK INCLUDED

A. Stainless Steel Kitchen Countertops

1.03 RELATED WORK

A. Plastic Laminate Casework, Section 06 41 16

B. Division 22, Plumbing

1.04 SUBMITTALS

A. Submit under provisions of Division 1, General Requirements.

B. Shop Drawings: Provide 1 original reproducible set, 1/2”=1’=0” scale elevations and 1/4”=1’-0” plans of countertops, showing cross sections, details, rough-in and anchor placement dimensions and tolerances and clearances required. Indicate relation to surrounding walls, ceilings, windows, doors and other building components. Show rough-in requirements. Show locations of all required framing, bucks, metal grounds, or reinforcements in walls and floors to adequately support the countertop and proper anchoring and support.

C. Samples: Provide the following samples:

1. 12” x 12” countertop samples.

1.05 QUALITY ASSURANCE

A. Coordination drawings: The supplier/installer shall coordinate the installation of all products under this section, including mechanical, plumbing and electrical items, which are provided by the supplier and installed by other contractors. Countertop manufacturer shall be responsible for generating layout drawings and distributing them to the mechanical, electrical and plumbing contractors for coordination and accurate locations of cutouts and service connections required by each discipline, prior to generating final shop drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products on the site in such a manner as to minimize the risk of damage, decay, deterioration or loss from theft.

B. All products shall be delivered to the job site in manufacturer's original unopened containers, crates or protective wrappings with the manufacturer's name and address clearly labeled thereon.

C. Accept products on site and inspect on arrival for damage.

D. Protect products from damage and soiling at all times. Keep products covered with polyethylene film or other suitable protective coverings. Protect installed countertops throughout construction period with corrugated cardboard completely covering the top and securely taped to edges. Mark cardboard in large lettering “No Standing”.

1.07 FIELD MEASUREMENTS

A. Verify field measurements shown on shop drawings or as instructed by manufacturer.

1.08 WARRANTY

A. Provide warranty under provisions of Division 1.

PART 2 - PRODUCTS

2.01 STAINLESS STEEL COUNTERTOPS

A. General:

1. Provide stainless steel countertops where shown on the drawings and as specified herein.

B. Stainless Steel Countertop:

1. Material: 14 gauge, type 304 stainless steel with No. 4 polished finish on all exposed surfaces and edges. Form tops with one inch lip and 1/2" return flange, and provide 16 gauge steel reinforcing channels applied to underside as required for rigidity and sound dampening. Form edges, flanges and curbs integrally with top from one sheet of metal.
2. Tops: Form tops with 1” lip and 1/2" return flange, die formed 3/16" high integral marine edges and provide 16 gauge stainless steel reinforcing channels applied to underside as required for rigidity and sound dampening. Form edges, flanges and curbs integrally with top, from one sheet of metal.
3. Sink tops: Provide seamless, die formed 3/16" high integral marine edges at sink tops. Unless otherwise noted, provide plain edges at all other tops. Coat underside of all with sound dampening material.
4. Sink bowls: All sink bowls are made from 16 gauge Type 304 stainless steel. Electrically weld stainless steel bowls to opening in top. Grind welds flush and polish to a satin finish to produce an integral unit with invisible joint line. Cover underside of sink bowls with sound dampening material.
5. Joints: Electrically weld all joints; grind smooth and polish.
6. Sound dampening material: Material shall be waterborne and non-flammable in its liquid state. Material to contain clay, which will act as a flame retardant. Material shall contain no volatile organic compounds (VOC). Film thickness of spray-applied product shall be approximately 20 mil.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all equipment rough-in conditions and requirements.

B. Coordinate with other trades for the proper and correct installation of plumbing and electrical rough-in, structural backing for items attached to walls, and for rough opening dimensions required for the installation of products in this section.

C. Examine substrate surfaces and associated work and conditions under which work will be installed. Do not proceed until unsatisfactory conditions have been corrected in a manner complying with the Contract Documents and acceptable to the Installer. Starting of work within a particular area will be construed as installer's acceptance of surface conditions.

3.02 INSTALLATION

A. General Requirements

1. Install in accordance with manufacturer's instructions.
2. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
3. Touch-up minor damaged surfaces caused during installation. Replace damaged components as directed by Architect.

B. Countertop Installation

1. Where required due to field conditions, scribe to abutting surfaces.
2. Jointing: Only factory prepared so there is no jobsite processing of top and edge surfaces.
3. Secure work surfaces to casework and equipment components with material and procedures recommended by the manufacturer.
4. Fastenings: Use concealed clamping devices for field joints located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with "Z" type fasteners or equivalent, using 2 or more fasteners at each front, end, and back.
5. Flatness: All installed counters shall have a flatness of no more than 1/16” per 6 linear feet of run. All counters shall be examined for flatness prior to installation and those that cannot meet this level of flatness shall be replaced by the contractor. Shims shall not exceed 1/8”.
6. Workmanship: Abut top and edge surfaces in one true plane with internal supports placed to prevent any deflection.
    a. Where necessary to penetrate tops with fasteners, countersink heads approximately 1/8" and plugholes flush with material equal in chemical resistance, color, hardness, and texture to top surface.
    b. After installation, carefully remove any surface scratches, clean and polish entire surface.
    c. Provide holes and cutouts as required for mechanical and electrical service fixtures.
    d. Provide scribe mountings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use chemical resistant, permanently elastic sealing compound where recommended by manufacturer.

3.03 CLEANING

A. Clean countertops as recommended by the manufacturer, rendering all work in a new and unused appearance. Touch up as required.

B. Clean adjacent construction and surfaces which may have been soiled in the course of installation of work in this section.

C. Clean countertops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

3.04 PROTECTION OF FINISHED WORK

A. Provide all necessary protective measures to prevent exposure of equipment and surfaces from exposure to other construction activity.

B. Advise general contractor of procedures and precautions for protection of material and installed equipment and casework from damage by work of other trades.

END OF SPECIFICATION SECTION 11 42 16

SECTION 21 05 00
COMMON WORK RESULTS FOR FIRE SUPPRESSION

P A R T 1 - G E N E R A L

SCOPE

This section includes information common to two or more technical fire protection specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work Reference
- Reference Standards
- Quality Assurance
- Continuity of Existing Services
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing and Fire Stopping
- Off Site Storage
- Codes
- Design Criteria
- Certificates and Inspections
- Submittals
- Operating and Maintenance Instructions
- Training of Owner Personnel
- Record Drawings

PART 2 - PRODUCTS
- Access Panels and Doors
- Identification
- Sealing and Fire Stopping

PART 3 - EXECUTION
- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Identification
- Sleeves and Openings
- Sealing and Fire Stopping

RELATED WORK

This section applies to all Division 21 sections of fire suppression.

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

Abbreviations of standards organizations referenced in this and other sections are as follows:

AGA American Gas Association
ANSI American National Standards Institute
ASME American Society of Mechanical Engineers
ASPE American society of Plumbing Engineers
ASTM American Society for Testing and Materials
AWWA American Water Works Association

AWS American Welding Society
CGA Compressed Gas Association
CS Commercial Standards, Products Standards Sections, Office of Engineering Standards Service, NBS
EPA Environmental Protection Agency
FM FM Global
FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
IAPMO International Association of Plumbing & Mechanical Officials
IEEE Institute of Electrical and Electronics Engineers
ISA Instrument Society of America
DSPS State of Wisconsin Dept. of Safety and Professional Services
MCA Mechanical Contractors Association
MICA Midwest Insulation Contractors Association
MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS National Bureau of Standards
NEC National Electric Code
NEMA National Electrical Manufacturers Association
NFPA National Fire Protection Association
STI Steel Tank Institute
UL Underwriters Laboratories Inc.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

OFF SITE STORAGE

Prior approval by DFD and the A/E will be needed. The contractor shall submit Storage Agreement Form AD-BDC-74 to DFD for consideration of off site materials storage. Generally, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage. No material will be accepted for off site storage unless shop drawings for the material have been approved.

CODES

Comply with requirements of Wisconsin Administrative Code, Dept. of Safety and Professional Services, NFPA Standards and local Fire Chief or Fire Marshal (AHJ, Authority Having Jurisdiction) regarding design, materials and installation.

DESIGN CRITERIA

Design fire protection systems in accordance with codes, standards and regulations noted above.

The automatic sprinkler system for office areas, conference/meeting rooms, toilet rooms, lobby corridors and similar spaces shall be designed to provide a minimum density of 0.10 gpm/sq. ft. over the hydraulically most remote 1,500 sq. ft. using ½", 165 degree F. rated quick response sprinklers, while allowing a 250 gpm hose stream allowance.

The automatic sprinkler system for mechanical rooms, storage rooms, laundry rooms and similar spaces shall be designed to provide a minimum density of 0.15 gpm/sq. ft. over the hydraulically most remote 1,500 sq. ft. using ½", 225 degree F. rated quick response sprinklers, while allowing a 250 gpm hose stream allowance.

Available water supply data for system design is as follows:

Performed By: Madison Water Utility

Hydrant Location	Outlet Elevation	Flow GPM	Static PSI	Residual PSI
Blair & Mifflin		3281	86	36

Water test data is preliminary for bidding purposes. Verify and obtain any additional test data required for design. Tests to be representative of high water use periods.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State or local installation inspections except those provided by the Architect/Engineer . Deliver originals of NFPA test certificates and DFD test reports to the Division's construction representative. Include copies of the certificates and reports in the Operating and Maintenance Instructions.

SUBMITTALS

Refer to Division 1.

Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following fire protection system data sheet. List piping material types, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves, specialties and equipment with manufacturer model number. The approved fire protection system data sheet(s) will be made available to the Owners project representative for their use on this project.

FIRE PROTECTION SYSTEM DATA SHEET

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Hangers & Supports			
Sprinkler Heads			
Valves			
Specialty Valves			
Pipe Specialties			
Fire Protection Specialties			

Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents. Include wiring diagrams of electrically powered equipment.

Submittals shall be sent to the local Fire Chief or Fire Marshal for review prior to the Architect/Engineer. Include copy of all review/approval letters in submission to Architect/Engineer.

Submit plans indicating water supply location and size, piping layout and size, sprinkler locations and type, hanger locations and type, equipment locations and type, valve locations and type, occupancy classes, hydraulic reference points, design areas and discharge densities.

Submit hydraulic calculations for water supply and sprinkler systems. Include summary sheet and detailed work sheets. Describe characteristics of water supply and location of effective point used in calculations. Include graph illustration of water supply, hose demand, sprinkler demand and in-rack sprinkler demand.

Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

- Operating and Maintenance Manuals
- Dane County Public Works 1 copy
- Dane County Facilities Management 1 copy
- Architect/Engineer 1 copy
- Local Fire Chief or Marshal 1 copy

OPERATING AND MAINTENANCE INSTRUCTIONS

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

- Copies of all approved submittals along with approval letters.
- Manufacturer's wiring diagrams for electrically powered equipment.
- Records of tests performed to certify compliance with system requirements.
- Certificates of inspection by regulatory agencies.
- Parts lists for equipment and specialties.
- Manufacturers installation, operation and maintenance recommendations for equipment and specialties.
- Valve schedules
- Warranties
- Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct Owner's personnel in the proper operation, maintenance and testing of systems and equipment provided as part of this project. Include not less than 2 hours of instruction, using the Operating and Maintenance manuals and record drawings during this instruction. Demonstrate testing, startup and shutdown procedures for all equipment. All training to be during normal working hours. Video record all instructions and provide Owner with copy.

RECORD DOCUMENTS

Refer to Division 1, General Requirements, Record Documents.

In addition to the data indicated in the General Requirements, maintain fire protection layout record drawings and hydraulic calculations on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings and calculations with the Operating and Maintenance manuals.

P A R T 2 - P R O D U C T S

ACCESS PANELS AND DOORS

LAY-IN CEILINGS:
Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Division 09 are sufficient; no additional access provisions are required unless specifically indicated.

CONCEALED SPLINE CEILINGS:
Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Division 09.

METAL PAN CEILINGS:
Removable sections of ceiling tile held in position by a pressure fit will be provided under Division 09.

PLASTER WALLS AND CEILINGS:
16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

IDENTIFICATION

STENCILS:
Not less than1/2" high letters for pipe sizes 1" through 2-1/2" and 1 inch high letters/numbers for pipe sizes 3" and above for marking pipe and equipment. Apply flow arrows to piping.

ADHESIVE LABELS:
Pressure-sensitive, adhesive backed, vinyl pipe markers with applicable labeling, ¾" min. size for lettering and surrounding tape on both ends. With flow arrows on piping. Conforming to ANSI, ANSI and NFPA standards. Seton Opti-Code, MSI, Brady or approved equal. Clean piping before application.

SNAP-AROUND MARKERS:
One-piece, pre-formed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling, ¾" min. size for lettering. Provide nylon ties on each end of pipe marker. Seton Setmark or approved equal.

SIGNS:
Metal construction, baked porcelain enamel finish signs, sizes conforming to NFPA no. 13 and 7-1.2, with holes and s-hooks/chains for hanging or securing. With applicable labeling. MSI, Seton, W.H. Brady or equal.

ENGRAVED NAME PLATES:
White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

VALVE TAGS:

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains with brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, MSI or W. H. Brady.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Manufacturers: 3M, Hilti, STI/SpeSeal, Tremco, or approved equal.

All fire stopping systems shall be provided by the same manufacturer.

Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Industry, Labor, and Human Relations/Dept. of Commerce.

Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop mortar, or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wood backing where specified in manufacturer's application detail.

NON-RATED PENETRATIONS:

Pipe Penetrations:

At pipe penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required, use urethane caulk in annular space between pipe insulation and wall material.

P A R T 3 - E X E C U T I O N

CUTTING AND PATCHING

Refer to Division 1, General Requirements, Cutting and Patching.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

EQUIPMENT ACCESS

Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Prime Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Fire Protection Contractor and installed by the General Prime Contractor.

Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

COORDINATION

Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify interior piping mains not less than once every 25 feet, not less than once in each room, adjacent to each access door or panel, and on both sides of the partition where exposed piping passes through walls or floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background, or approved pipe marking label systems, or provide snap-around type pipe markers as specified in Part 2 – Products.

Identify valves with signs per NFPA rulings.

Provide hydraulic design information sign of permanently marked weatherproof metal or engraved nameplate material. Secure to alarm valve with brass chain. Information to include location of the design areas, discharge densities, required flow and residual pressure at the base of riser, hose stream demand and sprinkler demand.

SLEEVES AND OPENINGS

Provide galvanized sheet metal sleeves for fire rated pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete walls where penetration is core drilled, pipe sleeve is not required. Grout holes directly around steel pipe.

Pipe sleeves are not required in interior non-rated drywall, plaster, or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

Pipe sleeves in new poured concrete construction shall be Schedule 40 steel pipe (size to allow insulated pipe to run thru sleeve), cast in place.

In all piping floor penetrations, fire rated and non-fire rated top of sleeve shall extend 1 inch above the adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the sleeve that will transfer the weight to existing floor structure.

SEALING AND FIRE STOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

NON-RATED PARTITIONS:

At all interior partitions and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

END OF SECTION

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SECTION 21 05 29
HANGERS AND SUPPORTS FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE

This section includes specifications for support of all fire suppression equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Beam Clamps
- Riser Clamps
- Concrete Inserts
- Anchors

PART 3 - EXECUTION
- Installation
- Hanger and Support Spacing
- Riser Clamps
- Concrete Inserts
- Anchors

RELATED WORK

Section 22 13 13 – Wet Pipe Sprinkler Systems

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

MSS SP-58
MSS SP-69

NFPA 13	Installation of Sprinkler Systems (Latest prevailing edition).
UL	Underwriters' Laboratories Listed.
FM	Factory Mutual Approved

QUALITY ASSURANCE

Substitution of Materials Refer to Section GC - General Conditions of the Contract, Equals and Substitutions.

DESCRIPTION

Provide all supporting devices as required for the installation of fire suppression equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

Do not hang any fire suppression system item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

Fasteners depending on soft lead for holding power or requiring explosive powder actuation will not be accepted.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

SHOP DRAWINGS

Schedule all hanger and support devices indicating attachment method and type of device for each pipe size and type of service. Provide details on the working drawings submitted for approval with all pertinent information listed.

DESIGN CRITERIA

Materials and application of pipe hangers and supports shall be in accordance with MSS SP-58 Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application and Installation unless noted otherwise.

Materials and application of pipe hangers and supports shall be in accordance with NFPA rulings and be UL/FM listed and approved.

Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

P A R T 2 - P R O D U C T S

MANUFACTURERS

B-Line, Anvil, Erico, Tolco, Afcon, Roof Products & Systems or approved equal.

STRUCTURAL SUPPORTS

Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

PIPE HANGERS AND SUPPORTS

HANGERS FOR PIPE SIZES 1/2" THROUGH 4":

Carbon steel, adjustable swivel ring with 3/8" min. UL/FM approved hanger rods. B-Line B3170NF, Anvil 69 or 70.

Carbon steel, adjustable clevis, standard, with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

HANGERS FOR PIPE SIZES 4" THROUGH 8":

Carbon steel adjustable swivel ring with ½" min. UL/FM approved hanger rods. B-Line B3170NF, Anvil 69 or 70.

Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

HANGERS FOR PIPE SIZES 10" and UP

Carbon steel, adjustable clevis, standard with UL/FM approved size hanger rods. B-Line B3100, Anvil 260.

MULTIPLE OR TRAPEZE HANGERS:
Manufactured steel channel system with manufacturers slotted interlocking pipe clamps with screw/nut securing and threaded hanger rods or steel channels with welded spacers and threaded hanger rods.

WALL SUPPORT:
Carbon steel welded bracket with hanger. B-Line 3060 Series, Anvil 190 Series.
Steel channels with pipe clamps.

VERTICAL SUPPORT:
Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

FLOOR SUPPORT:
Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

COPPER PIPE SUPPORTS:
All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, Grinnell PS 1400 series.

PIPE HANGER RODS
STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Pipe Size	Diam. Of Rod
Up to and Including 4"	3/8" or 9.5mm min.
5",6" and 8"	½" or 12.7mm min.
10" and 12"	5/8" or 15.9mm min.

BEAM CLAMPS
MSS SP-58 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

CONCRETE INSERTS
POURED IN PLACE:
MSS SP-58 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.

MSS SP-58 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Anvil 282.

DRILLED FASTENERS:

CONCRETE CONSTRUCTION
Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

WOOD CONSTRUCTION
Side or bottom mount lag thread by rod thread one piece hanger attachment installed per the Manufacturers standard and carrying capacity limit. Powers Fastener Vertigo, Erico Hangermate or equal.

ANCHORS
Use welding steel shapes, plates, and bars to secure piping to the structure.

P A R T 3 - E X E C U T I O N

INSTALLATION
Size, apply and install supports and anchors in compliance with manufacturers recommendations.

Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Perform welding in accordance with standards of the American Welding Society.

HANGER AND SUPPORT SPACING

Use hangers with minimum vertical adjustment.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of these specifications.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Copper	3/4" through 1"	8'-0"	10'-0"
Copper	1-1/4" through 1-1/2"	10'-0"	10'-0"
Copper	2" through 3"	12'-0"	10'-0"
Copper	3-1/2" through 8"	15'-0"	10'-0"
Steel	1" through 1-1/4"	12'-0"	15'-0"

Steel	1-1/2" through 8"	15'-0"	15'-0"

Unsupported length from the last hanger and an end sprinkler for steel piping systems shall be as follows:

1" piping	Not greater than 36"
1-1/4" piping	Not greater than 48"
1-1/2" piping or larger.	Not greater than 60"

RISER CLAMPS

Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor. Use method of securing the vertical risers to the building structure below in stairwell locations.

ANCHORS

Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

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SECTION 21 13 13
WET-PIPE SPRINKLER SYSTEM

P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for fire suppression pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Fire suppression Piping
- Unions and Flanges
- Mechanical Grooved Pipe Connections
- Sprinkler Heads
- Flexible Sprinkler Drop Fittings
- Flow Switches
- Pressure Switches
- Pressure Gauges
- Valves
- Fire Department Connection

PART 3 – EXECUTION
- General
- Preparation
- Erection
- Welded Pipe Joints
- Threaded Pipe Joints
- Mechanical Grooved Pipe Connections
- Unions and Flanges
- Piping System Leak Tests
- Underground Water Main Flushing
- Installation
- Construction Verification Items

RELATED WORK

Section 21 08 00 – Commissioning of Fire Suppression
Section 21 05 00 – Common Work Results for Fire Suppression
Section 21 05 29 – Hangers and Supports for Fire Suppression Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4
ANSI A21.11

ANSI A21.51	
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI B16.3	Malleable and Ductile Iron Threaded Fittings
ANSI B16.4	Cast Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.9	Factory Made Wrought Steel Buttweld Fittings
ANSI B16.11	Forged Steel Fittings, Socket Welded and Threaded
ANSI B16.18	Cast Bronze Solder Joint Pressure Fittings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A135	Electric Resistance Welded Steel Pipe
ASTM A181	Forgings, Carbon Steel for General Purpose Piping
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A536	Ductile Iron Castings
ASTM A795	Black and Hot Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use
ASTM B88	Seamless Copper Water Tube
AWS A5.8	Brazing Filler Metal
AWS D10.9	Qualification of Welding Procedures and Welders for Piping and Tubing, Level AR3
NFPA 13	Installation of Sprinkler Systems. (Latest prevailing edition)
NFPA 14	Installation of Standpipe and Hose Systems. (Latest prevailing edition)
UL	Underwriters' Laboratories Listing
FM	Factory Mutual Approval

SHOP DRAWINGS

Schedule from the contractor indicating the ANSI/ASTM specification number of the pipe being proposed along with its type and grade, if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all steel pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping systems for the highest pressures and temperatures in the respective system but not less than 175 psig.

Where weld fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where mechanical grooved fittings are used, use only ASTM standard radius fittings, short radius grooved fittings are not allowed.

Where ASTM A53 or A795 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where ASTM A135 grade A pipe is specified, grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10.9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at the Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project and all defective welds replaced.

P A R T 2 - P R O D U C T S

FIRE SUPPRESSION PIPING

STEEL PIPE:

Black steel pipe welded and seamless, Type F, Grade A, ASTM A53; black welded and seamless steel pipe for fire protection use, Type F, ASTM A795; electric resistance welded steel pipe, Grade A, ASTM A135.

Pipe wall Thickness: Schedule 40 for welded, rolled groove, cut groove and threaded. Schedule 30 for welded, rolled grove, 8" and larger cut groove and 8" and larger threaded piping. Schedule 10 up to and including 6" for rolled groove and welded.

Fittings: 2" and under – Cast iron threaded fittings, Class 125 or 250, ASTM A126/ANSI B16.4. Malleable iron threaded fittings, Class 150 or 300, ASTM A197/ANSI B16.3. Standard weight seamless steel weld fittings, ASTM A234 grade, ANSI B16.9. Mechanical grooved fittings with EPDM gaskets, ASTM A536 ductile iron, ATM A47 malleable iron or ASTM A53 fabricated steel.

Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

Finish: Hot dipped zinc coated (galvanized) finish on piping and fittings shall be used in drypipe and pre-action systems, piping exposed to weather and piping exposed to corrosive environments where indicated. Thread or cut groove hot dipped zinc coated pipe ends for fitting connections. Indoor dry standpipe systems supplied by a Fire Dept. connection only may be black steel piping and fittings.

UNIONS AND FLANGES

2" AND SMALLER STEEL:

ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Grooved couplings may be used in lieu of unions.

2-1/2" AND LARGER:

ASTM A181 or A105, Class 150, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. ANSI B16.1 or ANSI B16.5, Class 150 cast iron threaded flanges. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

MECHANICAL GROOVED PIPE CONNECTIONS

Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Anvil, or Grinnell may be used with steel pipe. Mechanical grooved components and assemblies to be rated for minimum 175 psi working pressure unless noted otherwise.

All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters shall be from the same manufacturer.

Couplings and fittings to be malleable iron, ASTM A47, or ductile iron A536 with painted finish. Fittings used on galvanized steel pipe to have galvanized finish, ASTM A153.

Gaskets to be EPDM, ASTM D2000. Gaskets for dry systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A-183, with zinc electroplated finish.

Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

SPRINKLER HEADS

Manufacturer: Sprinkler head model numbers establish type and style of head. Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted: Tyco, Reliable, Victaulic and Viking and Flexhead Industries.

Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" or 17/32” discharge orifice except where greater than normal density requires large orifice.

Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (155 to 165 degree) fusible link or glass bulb type except at skylights, sealed display windows, unventilated attics and roof spaces, over cooking equipment, adjacent to diffusers, unit heaters, uninsulated heating pipes or ducts, mechanical rooms, storage rooms, or where otherwise indicated.

Provide quantity of spare heads as noted below and 1 wrench for each type of head and each temperature range installed. Provide 6 spare heads per 300 or less installed heads, 12 per 1000 or less and 24 for more

than 1000. Provide steel cabinet for storage of heads and wrenches. Provide an equal number of concealed cover plates and/or sprinkler escutcheons for each spare sprinkler head.

FLEXIBLE SPRINKLER HEAD:
A flexible sprinkler head system may be used. The connection shall be a flexible fully braided stainless steel hose assemble with a minimum 1" internal ID and a multiport bracket. The system shall be approved for use in suspended ceiling systems, meeting ASTM C635, ASTM C636, and FM Global approved. System shall be equal to Flexhead Industries.

Pendant: Star Model SG (QR), chrome plated finish and escutcheon.

Horizontal Sidewall: Star Model SG (QR), chrome plated finish and escutcheon.

Quick Response Pendant: Viking Microfast M, chrome plated finish and escutcheon.

Quick Response Sidewall: Viking Microfast M, chrome plated finish and escutcheon.

Dry Pendant (Self-contained type): Viking Model C, brass finish with brass escutcheon.

Dry Pendant (Self-contained type): Viking Model M (Quick Response), adjustable, recessed, with chrome escutcheon.

Dry Horizontal Sidewall (Self-contained type): Viking Model M (Quick response), adjustable, recessed, with chrome escutcheon.

FLOW SWITCHES
Vane type waterflow switch with metal enclosure, adjustable pneumatic retard and electrical characteristics compatible with alarm system.

PRESSURE SWITCHES
Pressure actuated switch with field adjustable settings, metal enclosure and electrical characteristics compatible with alarm system.

PRESSURE GAUGES
Manufacturer: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

Cast aluminum, stainless steel, brass, polycarbonate or ABS case of not less than 3.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale. Include bronze 3-way globe valve with plugged outlet for Fire Inspector's test gauge.

VALVES
Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, or Watts.

BALL VALVES:
2" and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL approved @ 250 psi. Watts No. B-6000 UL.

GATE VALVES:
2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

2-1/2" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

BUTTERFLY VALVES:
2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.

2" and larger: Cast or ductile iron body butterfly valve, lug style or grooved, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, EPDM resilient seat, EPDM seals, nickel plated ductile iron disc. Valve assembly to be bubble tight to 175 psig with no downstream flange/pipe attached. Use cap screws for removal of downstream piping while using the valve for system shutoff.

SUPERVISORY/TAMPER SWITCHES:
For O S & Y valve or butterfly valve installations, UL/FM listed/approved, to monitor position of valve, tamper resistant cover screws, single or double SPDT switch contacts, corrosion resistant, for indoor or outdoor use, NEMA 4 & 6P enclosures.

CHECK VALVES:
3" and smaller: Bronze body, threaded end, Y-pattern, regrindable bronze seat, renewable bronze disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

2-1/2" and larger: Cast or ductile iron body, flanged or grooved ends, bronze trim, bolted cap, renewable bronze seat and disc, 175 psig, suitable for installation in a horizontal or vertical line with flow upward.

Provide 1/2" automatic drip drain on inlet of fire dept. connection check valve.

SPRING LOADED CHECK VALVES:
2" and smaller: Bronze body, threaded ends, bronze trim, stainless steel spring, stainless steel center guide pin, 175 psig, teflon seat unless only bronze available.

2-1/2" and larger: Cast or ductile iron body, wafer or globe type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required, 175 psig.

DRAIN VALVES:
3/4" minimum two piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap.

DOUBLE CHECK VALVES:
Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, and Wilkinson.

ASSE 1015 double check backflow preventer with 2 independent spring loaded check valves, 2 isolation ball or gate valves with normally open tamper switch with double wire leads, 4 valved test ports. Size for maximum pressure drop of 5 psig at 500 GPM. Constructed of bronze or epoxy coated cast iron or stainless steel body with bronze and plastic internal parts, stainless steel springs, silicone rubber valve discs, bronze seats, rated for 175 psig.

FIRE DEPARTMENT CONNECTION
Manufacturer: Badger-Powhatan, Croker, Elkhart Brass, J.W. Moon, Potter-Roemer, and W.D. ALLEN

EXPOSED:

Polished cast brass exposed fire department inlet, two-way inlet body, swing clappers, pin-lug swivels and plugs with chains, 2-1/2" National Standard female hose thread inlets, 4" outlet, cast brass lettered identification backplate.

PART 3 - EXECUTION

GENERAL

Install pipe fittings, and other fire suppression system components in accordance with reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION

Prior to installation, complete working drawings must be approved by the owner or designated reviwing agency, the Architect/Engineer, the State and the City of Madison Fire Department.

Provide all required offsets in fire protection piping that are necessary to accommodate mechanical, structural and electrical systems. Review all drawings and building conditions and make all necessary adjustments to piping layout as required. All sprinkler, drain and test piping, etc. installed through exterior walls should be galvanized. All piping must be substantially supported from building structure and only approved type hangers shall be used. Bulk mains and cross mains shall be supported from primary building structure members. Piping under ducts shall not be supported from ductwork but shall be supported from building structure with trapeze hangers where necessary or from steel angles supporting ductwork in accordance with NFPA 13. In all cases, consult drawings for locations of pipe spaces, ceiling types, and ceiling heights, ceiling grids, light fixtures, and grilles and diffusers before installing pipe.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Provide 3/32" min. thickness steel nailing plates behind or on either side of piping where the possibility of penetration from nails or drywall screws exists.

Maintain piping in clean condition internally during construction.

Provide clearance for access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Install piping so that system can be drained. Where possible, slope to main drain valve. Where piping not susceptible to freezing cannot be fully drained, install nipple and cap for drainage of less than 5 gallons or ball valve with hose thread outlet and cap for drainage over 5 gallons. Pipe main drain valve to grade or to air gap sewer receptor.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

Do not route piping within exterior walls.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable. "Weldolets" and "Threadolets" may be used up to one-half (1/2) the diameter of the main

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

UNIONS AND FLANGES

Install a union, flange or grooved coupling combination at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union or grooved coupling combination connections on the equipment side of the valve. Concealed unions, flanges or couplings are not acceptable.

PIPING SYSTEM LEAK TESTS

Conduct pressure test with test medium of water. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Test piping in sections or entire system as required by sequence of construction. Do not conceal pipe until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Entire test must be witnessed by the Division's representative.

Use clean water and remove air from the piping being tested where possible. Measure and record test pressure at the high point in the system.

Test system at 200 psi for 2 hours showing no leakage. Where system design is in excess of 150 psig, test at a pressure 50 psig above system design pressure.

All pressure tests are to be documented on NFPA Contractor's Material and Test Certificate forms.

UNDERGROUND WATER MAIN FLUSHING

Conduct flushing of the underground water/fire main service as required by NFPA 13. The 200 PSI pressure test of the main shall be conducted by the installer of the main. The flushing operation is to be documented on NFPA Underground Contractor's Material and Test Certificate forms.

INSTALLATION

Install fire protection system components in accordance with NFPA rulings, listings and manufacturers recommendations. Locate where accessible for servicing and replacement.

Sprinkler Heads: Locate sprinkler heads as indicated on fire protection plan and reflected ceiling plan maintaining minimum clearances from obstructions, ceilings and walls. Install sprinkler heads level in

locations not subject to spray pattern interference. Provide fire sprinkler head installations below ductwork, soffits, etc.

Switches: Locate flow and pressure switches where indicated and where required to obtain specified zoning to isolate floors and major areas of floors. Provide valved test connection for flow switch adjacent to flow switch. Pipe to floor drain. Test flow switch to verify proper operation.

Gauges: Provide a valved pressure gauge in main fire protection riser, at the top of each piping riser, at inlet and outlet of pump and elsewhere as indicated.

Valves: Properly align piping before installation of valves. Do not support weight of piping system on valve ends. Mount valves in locations which allow access for operation, servicing and replacement. Install all valves with the stem in the upright or horizontal position. Valves installed with the stems down will not be accepted. Provide a riser shutoff valve and a capped hose thread drain valve at the bottom of each riser. Provide capped hose thread drain valves to allow draining of each portion of piping.

END OF SECTION

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

P A R T 1 - G E N E R A L

SCOPE

This section includes information common to two or more technical plumbing specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Standards
- Quality Assurance
- Continuity of Existing Services
- Codes
- Certificates and Inspections
- Submittals
- Operating and Maintenance Data
- Training of Owner Personnel
- Record Drawings

PART 2 - PRODUCTS
- Identification
- Sealing and Fire Stopping
- Concrete Work

PART 3 - EXECUTION
- Demolition
- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Identification
- Lubrication
- Training

REFERENCE

Applicable provisions of Division 1 govern work under this section.

This section applies to all Division 22 00 00 sections of plumbing.

STANDARDS

Abbreviations of standards organizations referenced in this and other sections are as follows:

ABMA American Boiler Manufacturers Association
ANSI American National Standards Institute
ASME American Society of Mechanical Engineers
ASPE American society of Plumbing Engineers
ASSE American Society of Sanitary Engineering
ASTM American Society for Testing and Materials
AWS American Welding Society
CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
EPA Environmental Protection Agency
FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
IAPMO International Association of Plumbing & Mechanical Officials

MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
PDI	Plumbing and Drainage Institute
UL	Underwriters Laboratories Inc.

Standards referenced in this section:

ACI 614	Recommended Practice for Measuring, Mixing and Placing of Concrete
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
D.O.T.	Standard Specifications for Road and Bridge Construction, State of Wisconsin, Dept. of Transportation
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements

All products and materials used are to be new, undamaged, clean and in good condition. Existing products and materials are not to be reused unless specifically indicated.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the intended performance from the system into which these items are placed.

CONTINUITY OF EXISTING SERVICES

Do not interrupt or change existing services without prior written approval from the Owner's Project Representative. When interruption is required, coordinate scheduling of down-time with the Owner to minimize disruption to his activities.

CODES

Comply with requirements of Wisconsin Administrative Code.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1.

Obtain and pay for all required City of Madison or State of Wisconsin installation inspections except those provided by the Architect/Engineer in accordance with Wis. Admin. Code Section ILHR 50.12. Deliver originals of these certificates to the Owner's Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

SUBMITTALS

Refer to Division 1.

Not more than two weeks after award of contract but before any shop drawings are submitted, contractor to submit the following plumbing system data sheet. List piping material type for each piping service on the project, ASTM number, schedule or pressure class, joint type, manufacturer and model number where appropriate. List valves and specialties for each piping service, fixture and equipment with manufacturer

and model number. The approved plumbing system data sheet(s) will be made available to the Owner's Project Representative for their use on this project.

PLUMBING SYSTEM DATA SHEET

Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
Pipe			
Fittings			
Unions			
Valves:			
Ball			
Gas			
Balancing			
Check			
Pipe Specialties:			
Thermometers			
Press Gauges			
Strainers			
Plumbing Specialties:			
Floor Drains & Cleanouts			
Wall Hydrant & Hose Bibb			
Water Hammer Arrestors			
Backflow Preventers			
Hangers & Supports			
Insulation			
Plbg. Equipment			

Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material index list page showing item designation, manufacturer and additional items supplied with the installation. Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the construction documents. Include wiring diagrams of electrically powered equipment.

Submit sufficient quantities of equipment data sheets and shop drawings to allow the following distribution:

- Insertion into Operating and Maintenance Manuals 2 copies
- Dane County Public Works - record copy 1 copy
- Engineers - record copies 2 copies

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 - Basic Requirements.

Two copies of Operations and Maintenance Manuals shall be provided for the following distribution:

- Dane County Public Works 1 copy
- Dane County Facilities Management 1 copy

In addition to the general content specified under - Basic Requirements supply the following additional documentation:

1. Records of tests performed a to certify compliance with system requirements
2. Manufacturer's wiring diagrams for electrically powered equipment
3. Certificates of inspection by regulatory agencies
4. Valve schedules
5. Lubrication instructions, including list/frequency of lubrication
6. Parts lists for fixtures, equipment, valves and specialties.

7. Manufacturers installation, operation and maintenance recommendations for fixtures, equipment, valves and specialties.
8. Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include not less than 2 hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup, operation and shutdown procedures for all equipment. All training to be during normal working hours. Videotape all instructions and provide owner with copy.

RECORD DRAWINGS

Refer to Division 1. - Basic Requirements, As Built and Record Drawings and Specifications.

P A R T 2 - P R O D U C T S

IDENTIFICATION

STENCILS:

Not less than 1 inch high letters/numbers for marking pipe and equipment.

ENGRAVED NAME PLATES:

White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by W. H. Brady.

SNAP-AROUND PIPE MARKERS:

One-piece, preformed, vinyl construction, snap-around or strap-around pipe markers with applicable labeling and flow direction arrows, ¾" min. size for lettering. Provide nylon ties on each end of pipe markers. Equal to Seton Setmark.

VALVE TAGS:

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains, brass "S" hooks or one piece nylon ties around the valve stem, available from EMED Co., Seton Name Plate Company, or W. H. Brady.

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Manufacturers: 3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

All firestopping systems shall be provided by the same manufacturer.

Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

Submittals: Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

NON-RATED PENETRATIONS:

In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the cored opening or a water-stop type wall sleeve. The operating bolts of the mechanical type seal shall be accessible from the interior of the building.

At pipe penetrations of non-rated interior partitions, floors and exterior walls, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material

P A R T 3 - E X E C U T I O N

DEMOLITION

Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the Owner to minimize disruption to the existing building occupants.

All pipe, fixtures, equipment, wiring and associated conduit, insulation and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor except as specifically noted otherwise. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

CUTTING AND PATCHING

Provide required Cutting and Patching to complete the work. Refer to Division 1 – Basic Requirements.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

When access to the work area is through occupied areas coordinate building access times with the Owner’s Project Representative.

EQUIPMENT ACCESS

Install all piping, conduit and accessories to permit access to equipment for maintenance and service.

COORDINATION

Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify all new interior piping. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background.

Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device, located in another room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule indicating the valve number and the equipment or areas supplied by each valve and the symbols used for pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual. Schedule in mechanical room to be framed under clear plastic.

LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

TRAINING

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 2 hours. Session may be videotaped.

END OF SECTION

SECTION 22 05 14
PLUMBING SPECIALTIES

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for floor drains, roof drains, cleanouts, backflow preventers, water hammer arrestors and other miscellaneous plumbing specialties.

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Floor Drains
- Cleanouts
- Water Hammer Arrestors
- Backflow Preventers
- Wall Hydrants
- Hose Bibbs
- Thermostatic Mixing Valves
- Safings

PART 3 - EXECUTION
- Installation

RELATED DOCUMENTS
Section 22 05 23 – General-Duty Valves for Plumbing Piping
Section 22 11 00 – Facility Water Distribution
Section 22 13 06 – Sanitary Waste and Vent
Section 22 30 00 – Plumbing Equipment

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS
ANSI A112.21.1 - Floor Drains.
ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.
ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.
ASSE 1010 - Water Hammer Arrestors.
ASSE 1011 - Hose Connection Vacuum Breakers.
ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.
ASSE 1013 - Reduced Pressure Principle Backflow Preventers.
ASSE 1017-86- Thermostatic Mixing Valves
ASSE 1019 – Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

QUALITY ASSURANCE
Substitution of Materials: Refer to Section Division 1 – Basic requirements.

Plumbing products requiring approval by the State of Wisconsin Dept. of Safety and Professional Services must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS
Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

P A R T 2 - P R O D U C T S

FLOOR DRAINS
Manufacturer: Sioux Chief, Josam, Smith, Wade, Watts, Zurn.

FD-1: On-grade, adjustable floor drain with Sch 40 hub connection and cast nickel 6-1/2" round ring/strainer, equal to Sioux Chief 832-3ANR. Include SureSea "Plus" trap seal/check valve on drain in laundry room.

FD-2: On-grade, adjustable floor drain with Sch. 40 hub connection and 8-1/2" cast iron round strainer, equal to Sioux Chief 860-64i.

FD-3: Adjustable above grade flor drain with Sch. 40 hub connection and flashing collar with 6-1/2" round cast nickel ring/strainer, equal to Sioux Chief 833-3P-NR.

CLEANOUTS
Manufacturer: Sioux Chief, Josam, Smith, Wade, Watts, Zurn.

FCO-1: Adjustable, on-grade cleanout with Sch. 40 hub connection and cast nickel round ring/strainer, equal to Sioux Chief 834-P-NR.

INTERIOR FINISHED WALL AREAS: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446- (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)

INTERIOR EXPOSED VERTICAL STACKS: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.

INTERIOR HORIZONTAL LINES: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

WATER HAMMER ARRESTORS
Manufacturer: PPP Industries, Sioux Chief, Wade, Watts.

ANSI A112.26.1, ASSE 1010; sized in accordance with PDI WH-201, precharged piston type constructed of hard drawn Type K copper, threaded brass adapter, brass piston with o-ring seals, FDA approved silicone lubricant, suitable for operation in temperature range 35 to 150 degrees F, maximum 250 psig working pressure, 1500 psig surge pressure. Watts series 15.

BACKFLOW PREVENTERS
Manufacturers: Beeco, Cla-Val, Conbraco, Febco, Watts, Wilkins.

HOSE CONNECTION VACUUM BREAKERS: ASSE 1011, brass or bronze construction, EPDM diaphragm and seat, rated for 125 psig and 180^{o}F. Watts 8 (interior application).

PIPE APPLIED ATMOSPHERIC TYPE VACUUM BREAKERS: ASSE 1001, same size as pipe, brass or bronze construction, silicone disc, rated for 125 psig and 160^{o}F. Watts 288A.

INTERMEDIATE ATMOSPHERIC VENTED BACKFLOW PREVENTERS: ASSE 1012, same size as pipe, with intermediate atmospheric vent between independent check valves, bronze body with union ends, stainless steel springs, rated for 175 psig and 210^{o}F. Watts 9DM.

WALL HYDRANTS
Manufacturer: Josam, Smith, Wade, Watts, Woodford, Zurn.

WH-1: Freezeproof automatic draining wall hydrant with exposed chrome plated bronze wall plate, 3/4" inlet, 3/4" hose thread ASSE 1019-93 backflow preventer outlet, copper or bronze casing, loose key operator. Woodford model 65 series

HOSE BIBBS

HB-1: Bronze or brass construction hose faucet/valve, cast iron handwheel, replaceable disc, hose thread spout, equal to Chicago Faucet 835-RCF with Watts 8A vacuum breaker.

THERMOSTATIC MIXING VALVE
Manufacturer: Leonard, Symmons, Lawler

TC-1: Type TM thermostatic water mixing valve, Dura-Trul solid bimetal thermostat, color -coded dials, locking temperature regulator handle, adjustable limit stops, integral hot and cold supply check stops with unions, color-coded dial indicator, baked white enamel surface mounted steel cabinet, bottom inlets, top outlet, and factory assembled and tested. Mixing valve shall be capable of flowing 15 gpm at a 20 psi pressure drop. Equal to Leonard Model TM-86-26-LF-BWE-EXP.

SAFINGS
Manufacturers: Noble, Oatey.

Chlorinated polyethylene sheeting, 40 mils thick, ASTM D4068, joined with CPE solvent; or 3 lb./sq. ft. sheet lead.

P A R T 3 - E X E C U T I O N

INSTALLATION
Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

Set floor drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

Install water hammer arrestors where indicated and at quick closing valve installations.

Install backflow preventers in accordance with Wis. Dept. of Safety and Professional Services requirements maintaining minimum clearance distances for servicing and testing. Provide indirect waste piping with air gap installation from relief opening to above hub drain or floor drain.

Install lab faucet vacuum breakers with Loctite 242 “blue” on threads.

Where backflow preventers requiring Dept. of Safety and Professional Services registration are installed, provide initial registration, testing and report filing required by Dept. of Safety and Professional Services. List the name and address of the building that the backflow preventer installations occur in.

Mount wall hydrants recessed in exterior wall construction with valve plug extended beyond interior side of building insulation. Slope to drain to exterior. Install so discharge is 18” min. above finished grade. Set wall box in grout or caulk and fill exterior wall penetration with insulation.

Mount hose bibbs securely fastened to wall where indicated. Provide water hammer arrestor in line to hose bibb.

Install safing at floor drains above grade. Extend 12" beyond drains in all directions. Install on concrete floor that is smooth and free of debris. Seal all joints and connect to drain body clamp. Safing is subject to standing water leak test.

END OF SECTION

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SECTION 22 05 15
PIPING SPECIALTIES

P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for plumbing piping specialties for all piping systems. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

PART 3 - EXECUTION
- Thermometers
- Thermometer Sockets
- Test Wells
- Test Plugs
- Pressure Gauges
- Strainers

RELATED WORK

Section 22 11 00 - Facility Water Distribution Section
Section 22 05 23 - General-Duty Valves for Plumbing Piping
Section 22 07 00 - Plumbing Insulation
Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B650 Electrodeposited Engineering Chromium Coatings on Ferrous Substrates

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

SHOP DRAWINGS

Required for all items in this section. Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 - Basic Requirements.

DESIGN CRITERIA
All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

P A R T 2 - P R O D U C T S

THERMOMETERS
Ashcroft, Marsh, Taylor, H. O. Trerice, Ametek/U. S. Gauge, Weiss, Wika, Weksler.

Stem Type: Cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Hot Water
Scale Range, ^{o}F	30 - 180
Increment, ^{o}F	2

THERMOMETER SOCKETS
Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

TEST WELLS
Similar to thermometer sockets except with a brass cap that threads into the inside of the test well to prevent dirt from accumulating. Secure cap to body with a short chain. Furnish with extension necks, where appropriate, to accommodate the pipeline insulation.

TEST PLUGS
Brass threaded pressure and temperature test plug with neoprene self-closing valve, valve retainer, brass threaded cap, rated for 150 psi and 0-200 degrees F.

PRESSURE GAUGES
Ametek/U. S. Gauge, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Wika, Weksler.

Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Hot Water	Cold Water	Compressed Air
Scale Range, psig	0-100	0-100	0-200
Increment, psig	1	1	2

Pressure Snubbers: Bronze construction, 300 psig working pressure, 1/4" size.

Gauge Valves: Use ball valves as specified in Section 22 05 23 - General-Duty Valves for Plumbing Piping.

STRAINERS
Armstrong, Illinois, Keckley, Metraflex, Mueller Steam, Sarco, Watts.

Y type; cast bronze body, ASTM B62; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; sweat, threaded or flanged body rated at not less than 150 psi WOG.

Y type; cast iron body, ASTM A126; 20 mesh stainless steel screens; bolted or threaded screen retainer tapped for a blowoff valve; threaded or flanged ends; rated at not less than 150 psi WOG.

P A R T 3 - E X E C U T I O N

THERMOMETERS
Stem Type: Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

THERMOMETER SOCKETS
Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

TEST WELLS
Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for inserting a thermometer at a later date.

TEST PLUGS
Install in piping systems as indicated on the drawings and/or details wherever provisions are needed for short-term measurement of pressure or temperature.

PRESSURE GAUGES
Install in locations where indicated on the drawings and/or details, with scale range appropriate to the system operating pressures.

Pressure Snubbers: Install in gauge piping for all gauges used on water services.

Gauge Valves: Install at each gauge location as close to the main as possible and at each location where a gauge tapping is indicated.

STRAINERS
Install all strainers where indicated allowing sufficient space for the screens to be removed. Install a ball valve in the tapped screen retainer.

END OF SECTION

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SECTION 22 05 23
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

SCOPE

This section includes valve specifications for all Plumbing systems except where indicated under Related Work. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Water System Valves
  - Ball Valves
  - Swing Check Valves
  - Balance Valves
  - Drain Valves

PART 3 - EXECUTION
- General
- Shut-off Valves
- Balancing Valves
- Drain Valves

RELATED WORK

Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

SUBMITTALS

Schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 - Basic Requirements.

DESIGN CRITERIA

ASSE 1003 - Water Pressure Reducing Valves for Domestic Water Supply Systems.

Where valve types (ball, butterfly, etc.) are specified for individual plumbing services (i.e. domestic water, gas, etc.), each valve type shall be of the same manufacturer unless prior written approval is obtained from the Owner.

Valves to be line size unless specifically noted otherwise.

PART 2 - PRODUCTS

WATER SYSTEM VALVES

All water system valves to be rated at not less than 125 water working pressure at 240 degrees F unless noted otherwise.

BALL VALVES:

2-1/2" and smaller: Two or three piece bronze body; full-port sweat ends, stainless steel ball and stem; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 600 psig WOG. Provide valve stem extensions for valves installed in all piping with insulation. Equal to Apollo 77C-140-04 and 77C-240-04. Products by Nibco, Milwaukee, and Watts are considered equal.

SWING CHECK VALVES:

3" and smaller: Bronze body, sweat ends, Y-pattern, regrindable bronze seat, renewable bronze disc, Class 125, suitable for installation in a horizontal or vertical line with flow upward. Crane 1342, Hammond IB941, Nibco S413B, Watts CVYS, Jomar, Apollo and Milwaukee equals.

BALANCE VALVES:

Bronze body globe or ball valve with calibrated brass orifice, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, sweat or threaded ends, with or without integral unions, pressure taps with integral check valves and seals, adjustable memory stop, suitable for 125 psig water working pressure at 240 degrees F. Flowset AccuSetter, Armstrong CBV, Bell & Gossett Circuit Setter Plus, Illinois 6000 series, Tapco Circuit Setter, tour and Anderson.

DRAIN VALVES:

3/4 inch ball valve with integral threaded hose adapter, sweat or threaded inlet connections, with threaded cap and chain on hose threads, Watts B-6000-CC/B-6001-CC series.

PART 3 - EXECUTION

GENERAL

Properly align piping before installation of valves. Install and test valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Mount valves in locations which allow access for operation, servicing and replacement.

Provide valve handle extensions for all valves installed in insulated piping.

Install all valves with the stem in the upright or horizontal position. If possible, install butterfly valves with the stem in the horizontal position. Valves installed with the stems down will not be accepted.

Prior to flushing of piping systems, place all valves in the full-open position.

SHUT-OFF VALVES

Install shut-off valves at each piece of equipment, at each branch take-off from mains for isolation or repair and elsewhere as indicated.

BALANCING VALVES

Install where indicated on the drawings and details for balancing of flow in pumped hot water recirculation piping systems.

Upon project completion, adjust each valve and set position stop. Balance system to minimum flow in return piping branches needed to maintain even supply water temperature throughout building.

DRAIN VALVES

Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, downstream of riser isolation valves, equipment locations specified or detailed, other locations required for drainage of systems and elsewhere as indicated.

END OF SECTION

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SECTION 22 05 29
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE

This section includes specifications for supports of all plumbing equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Beam Clamps
- Concrete Inserts
- Anchors

PART 3 - EXECUTION
- Installation
- Hanger and Support Spacing
- Riser Clamps
- Concrete Inserts
- Anchors

RELATED WORK

Section 22 07 00 - Plumbing Insulation.

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS

MSS SP-58
MSS SP-69

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

DESCRIPTION

Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for building piping.

Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord of any truss or joist.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points; see Related Work above.

SHOP DRAWINGS
Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe size and type of service.

All submittals are to comply with submission and content requirements specified Division 1 - Basic Requirements.

DESIGN CRITERIA
Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

P A R T 2 - P R O D U C T S

MANUFACTURERS
Anvil, B-Line, Pate, Piping Technology or approved equal.

STRUCTURAL SUPPORTS
Provide all supporting steel required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may not be specifically indicated on the drawings.

PIPE HANGERS AND SUPPORTS
HANGERS FOR PIPE SIZES 1/2" THROUGH 2":
Carbon steel, adjustable swivel ring. B-Line B3170NF, Anvil 69 or 70.
Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

HANGERS FOR PIPE SIZES 2" AND LARGER:
Carbon steel, adjustable clevis, standard. B-Line B3100, Anvil 260.

MULTIPLE OR TRAPEZE HANGERS:
Steel channels with welded spacers and hanger rods.

WALL SUPPORT:
Carbon steel welded bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure, with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000 series clamps, Anvil type PS 200 H with PS 1200 clamps. When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series, and Anvil PS 1400 series.

VERTICAL SUPPORT:
Carbon steel riser clamp. B-Line B3373, Anvil 261 for above floor use.

FLOOR SUPPORT:
Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

COPPER PIPE SUPPORTS:
All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or polyvinylchloride coated. Where steel channels are used, provide isolation collar between supports/clamps/fasteners and copper piping.

PIPE HANGER RODS
STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, complete with adjusting and lock nuts.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

BEAM CLAMPS
MSS SP-69 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup point set screw. B-Line B3036L/B3034, Anvil 86/92.

MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter. B-Line B3054, Anvil 228.

CONCRETE INSERTS
POURED IN PLACE:
MSS SP-69 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by concrete in compression to maximize the load carrying capacity. B-Line B2505, Anvil 281.

MSS SP-69 Type 18 universal type to be constructed of black malleable iron body with a removable malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Anvil 282.

DRILLED FASTENERS:
Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

ANCHORS
Use welding steel shapes, plates, and bars to secure piping to the structure.

P A R T 3 - E X E C U T I O N

INSTALLATION
Size, apply and install supports and anchors in compliance with manufacturers recommendations.

Install supports to provide for free expansion of the piping system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe insulation or directly on piping.

Perform welding in accordance with standards of the American Welding Society.

HANGER AND SUPPORT SPACING

Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Use hangers with 1-1/2 inch minimum vertical adjustment.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of these specifications.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Steel	1/2" through 1-1/4"	7'-0"	15'-0"
Steel	1-1/2" through 6"	10'-0"	15'-0"
Plastic	Drain & Vent	5’-0”	15’-0”

RISER CLAMPS

Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

CONCRETE INSERTS

Select size based on the manufacturer's stated load capacity and weight of material that will be supported. Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

ANCHORS

Install where indicated on the drawings and details. Where not specifically indicated, install anchors at ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

END OF SECTION

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

SCOPE

This section includes insulation specifications for plumbing piping and equipment. Included are the following topics:

RELATED WORK

Section 22 05 00 - Common Work Results for Plumbing
Section 22 11 00 - Facility Water Distribution
Section 22 30 00 - Plumbing Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM B209	Aluminum and Aluminum Alloy Sheet and Plate
ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C302	Density of Preformed Pipe Insulation
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C612	Mineral Fiber Block and Board Thermal Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM E84	Surface Burning Characteristics of Building Materials
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

DESCRIPTION

Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- Pipe Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Project Representative.

DEFINITIONS

Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

SHOP DRAWINGS

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 - Basic Requirements.

PART 2 - PRODUCTS

MATERIALS

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

> Insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

INSULATION AND JACKETS

Manufacturers: Armstrong, Certainteed Manson, Childers, Dow, Extol, Halstead, H.B. Fuller, Imcoa, Knauf, Owens-Corning, Pittsburgh Corning, Rubatex, Johns-Mansville, or approved equal.

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

RIGID FIBERGLASS INSULATION:

Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

SEMI-RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

White kraft reinforced foil vapor barrier all service jacket, factory applied to insulation with a maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

FIREPROOFING INSULATION:
Mineral fiber with nominal density of 8 lbs. per cu. ft., flame spread index of 15, fuel contribution index of 0, and smoke developed index of 0, thermal conductivity of not more than 0.23 at 75 degrees F.

Jacket material shall be the same as jacket for adjacent insulation.

METAL JACKETS:
.016 inch thick aluminum or .010 inch thick stainless steel with safety edge.

INSULATION INSERTS AND PIPE SHIELDS
Manufacturers: B-Line, Pipe Shields, Value Engineered Products

Construct inserts with calcium silicate, minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom of supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials, thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-engineered pre-manufactured product described above. On low temperature systems, extruded polystyrene may be substituted for calcium silicate provided insert and shield length and gauge are increased to compensate for lower insulation compressive strength.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x 6" block for piping through 2-1/2" and three 1" x 6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/pre-manufactured product described above.

Wood blocks will not be accepted.

ACCESSORIES
All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

Bedding compounds to be non-shrinking and permanently flexible.

Vapor barrier coatings to be non-flammable, fire resistant, polymeric resin.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

PART 3 - EXECUTION

INSTALLATION

Install insulation, jackets and accessories in accordance with manufacturers instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Cover and seal exposed fiberglass insulation when insulation is terminated, no raw fiberglass insulation is allowed. Provide neat and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates. Install with longitudinal joints facing wall or ceiling.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full-length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

Insulation shall be continuous through sleeves and openings. Vapor barriers shall be maintained continuous through all penetrations.

Provide a complete vapor barrier for insulation on the following systems:

- Cold water

PIPING, VALVE, AND FITTING INSULATION

GENERAL:

Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2” lap on jacket seams and 2” tape on butt joints, firmly cemented with lap adhesive. Additionally secure with staples along seams and butt joints. Coat staples with vapor barrier mastic on systems requiring vapor barrier.

Water supply piping insulation shall be continuous throughout the building and installed adjacent to and within building walls to a point directly behind the fixture that is being supplied.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor barrier is not required, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration. Where

riser clamps are required to be attached directly to piping requiring vapor barrier, extend insulation and vapor barrier jacketing/coating around riser clamp.

INSULATION INSERTS AND PIPE SHIELDS:
Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES:
Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Cover insulation with fabric reinforcing and mastic or where temperatures do not exceed 150 degrees, PVC fitting covers. Secure PVC fitting covers with tack fasteners and 1-1/2" band of mastic over ends, throat, seams or penetrations. On systems requiring vapor barrier, use vapor barrier mastic.

PIPE INSULATION SCHEDULE:
Provide insulation on new and existing remodeled piping as indicated in the following schedule:

Service	**Insulation Types**	**Insulation Thickness by Pipe Size**				
		1" and smaller	**1-1/4" to 2"**	**2-1/2" to 4"**	**5" to 6"**	**8" and larger**
Hot Water Supply & Tempered Water	Rigid Fiberglass	1.5"	1.5"	1.5"	1.5"	1.5"
Hot Water Circulating	Rigid Fiberglass	1"	1"	1.5"		
Cold Water	Rigid Fiberglass	0.5"	0.5"	1"	1"	1"

END OF SECTION

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION

P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria

PART 2 - PRODUCTS
- Domestic Water
- Dielectric Unions and Flanges
- Unions and Flanges
- Mechanical Grooved Pipe Connections
- Domestic Hot Water Temperature Maintenance System

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Copper Pipe Joints
- Threaded Pipe Joints
- Mechanical Grooved Pipe Connections
- Domestic Hot Water Temperature Maintenance System
- Water Hammer Arrestors
- Sterilization of Water Distribution System
- Dielectric Unions and Flanges
- Unions and Flanges
- Piping System Leak Tests

RELATED WORK

22 05 15 - Piping Specialties
22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4
ANSI A21.11
ANSI A21.51
ANSI B16.3 Malleable Iron Threaded Fittings
ANSI B16.4 Cast Iron Threaded Fittings
ANSI B16.5 Pipe Flanges and Flanged Fittings
ANSI B16.22 Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ANSI B16.29 Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV
ASTM A53 Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless

ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM B32	Solder Metal
ASTM B88	Seamless Copper Water Tube
ASTM B280	Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
AWS A5.8	Brazing Filler Metal
AWWA C104	Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water
AWWA C105	Polyethylene Encasement for Ductile Iron Piping for Water
AWWA C110	Ductile Iron and Gray Iron Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C111	Rubber Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings
AWWA C151	Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
AWWA C153	Ductile Iron Compact Fittings, 3 In. Through 48 In., for Water and Other Liquids
AWWA C600	Installation of Ductile Iron Water Mains and Their Appurtenances
AWWA C651	Disinfecting Water Mains

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

Order all copper, cast iron and steel with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, AWWA or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

P A R T 2 - P R O D U C T S

DOMESTIC WATER

ABOVE GROUND:

Type L copper water tube, H (drawn) temper, ASTM B88; wrought copper pressure fittings, ANSI B16.22; lead free (<.2%) solder, ASTM B32; flux, ASTM B813; copper phosporous brazing alloy, AWS A5.8 BCuP. Copper mechanical grooved fittings and couplings on roll grooved pipe may be used in lieu of soldered fittings. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for branch takeoffs up to one-half (1/2) the diameter of the main.

Galvanized steel, Schedule 40, Grade A, ASTM A53; with cast iron threaded fittings, Class 125, ANSI B16.4; forged steel threaded fittings, ANSI 16.11; mechanical cut groove couplings and fittings; galvanize coat all fittings, ASTM A123.

Fittings 4” and larger may be cast iron, flanged, galvanized, 125 psi, ANSI standard B16.1 with neoprene gasket.

DIELECTRIC UNIONS AND FLANGES

Watts Regulator Company, Lochinvar, Wilkins or EPCO Sales, Inc., dielectric unions 2" and smaller; dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe thread end connections, non-asbestos gaskets, having a pressure rating of not less than 175 psig at 180 degrees.

UNIONS AND FLANGES

Unions, flanges and gasket materials to have a pressure rating of not less than 150 psig at 180 degrees. Gasket material for flanges and flanged fittings shall be teflon type. Treated paper gaskets are not acceptable.

2" AND SMALLER STEEL:

ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping.

2" AND SMALLER COPPER:

ANSI B16.18 cast bronze union coupling or ANSI B15.24 Class 150 cast bronze flanges.

2-1/2" AND LARGER STEEL:

ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding neck, or slip-on pattern on black steel and threaded only on galvanized steel. Use raised face flanges ANSI B16.5 for mating with other raised face flanges or equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges

with full face teflon gaskets for mating with other flat face flanges on equipment. Gaskets shall be teflon type.

2-1/2" AND LARGER COPPER:
ANSI B15.24 Class 150 cast bronze flanges with full face teflon gaskets.

MECHANICAL GROOVED PIPE CONNECTIONS
Mechanical grooved pipe couplings and fittings, ASTM F1476, as manufactured by Victaulic, Gruvlok or Gustin-Bacon may be used with cut groove galvanized steel pipe, cut groove ductile iron pipe or roll groove copper pipe where noted. Mechanical grooved components and assemblies to be rated for minimum 250 psi working pressure.

All mechanical grooved pipe material including gaskets, couplings, fittings and flange adapters to be from the same manufacturer.

Couplings to be malleable iron, ASTM A47, or ductile iron ASTM A536 with painted finish. Reducing couplings are not acceptable.

Fittings used on galvanized steel pipe to be malleable iron, ASTM A47, or ductile iron A536, with galvanized finish, ASTM A153. Fittings used on ductile iron pipe to be cement mortar lined ductile iron with coal tar coating, ASTM A536; conforming to requirements of AWWA C110/C153 and AWWA C606. Fittings used on copper pipe to be copper.

Gaskets to be EPDM, ASTM D2000. Gaskets for hot water systems and dry pipe systems to be flush seal design. Heat treated carbon steel oval neck track bolts and nuts, ASTM A183, with zinc electroplated finish ASTM B633.

Flange adapters to be ductile iron, ASTM A536; except at lug type butterfly valves where standard threaded flanges shall be used.

Credit for the inherent flexibility of mechanical grooved pipe connections when used for expansion joints or flexible connectors may be allowed upon specific application by the Contractor. Three flexible couplings at first three connection points both upstream and downstream of pumps may be used in lieu of flexible connectors. Request for expansion joints shall be made in writing and shall include service, location, line size, proposed application and supporting calculations for the intended service.

DOMESTIC HOT WATER TEMPERATURE MAINTENANCE SYSTEM
The self regulating heater shall consist of two (2) 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core, specially designed for hot-water temperature maintenance application that varies its heat output along all its length, allowing the heater to maintain the water in the selected range. The heater shall be covered by a radiation cross-lined polyolefin dielectric jacket and protected by a tinned copper braid.

The heater shall operate on a line voltage of 208 volts, 240 volts without the use of transformers or thermostats. The circuit shall be protected with a GFI.

Power connection, end seal, splice and tee components shall be applied in the field. Include “Rayclic”-PC power connector and “Rayclic”-T tee connector. Circuit breakers, conduits, power wiring, and junction boxes shall be as specified in Section 16.

The heater shall be HWAT-Plus” HWAT-Y2 (105 degrees F), as manufactured by Raychem Corporation.

CONTROLLER

Provide temperature controller equal to Tyco thermal controls (Raychem) catalog HWAT-ECO. Temperature setpoints adjustable between 105 degrees F and 140 degrees F. Include provisions to connect to a building management system (BMS). Unit shall have nine (9) pre-defined programs that can be customized by the user.

P A R T 3 - E X E C U T I O N

GENERAL

Install pipe and fittings in accordance with reference standards, manufacturers recommendations and recognized industry practices.

PREPARATION

Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

Piping shall be pitched to drain entire system; install drain vales at low points. Provide unions at piping connections to all equipment, control valves etc. Provide offsets and transition fittings are required.

No water piping shall be installed in exterior walls above grade unless specifically approved by A/E and unless adequately protected from freezing. Two inch insulation shall be installed on back and sides of chase, front shall be open to rom heat, covered only by finished wall material.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Use dielectric unions for connecting copper and steel piping.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Maintain piping in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, elevator equipment rooms, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures and systems installed by others where same requires the piping services indicated in this section.

Use dielectric unions for connecting copper and steel piping.

Provide necessary backflow devices as required by code. All water piping required for HVAC equipment shall terminate within ten (10) feet of equipment.

Extend hot water piping from water heaters and connect to all fixtures and equipment as required.

Hot water, hot water return and cold water lines shall be kept at least six (6) inches apart whenever possible.

HOT WATER CIRCULATING SYSTEM

Install return system including check valves, balancing valves, and circulating pump.

Pitch and grade all lines as required to ensure satisfactory circulation. Avoid dips or depressions in pipe runs.

Install time clock, and adjust times per owners direction.

Balance return flow to provide continuous circulation throughout entire system. Test and demonstrate this to the A/E.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

THREADED PIPE JOINTS

Use a thread lubricant or teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools specially designed for the application. Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

DOMESTIC HOT WATER TEMPERATURE MAINTENANCE SYSTEM

Install self-regulating heater and components on domestic water supply piping as indicated on the plans and specifications after the piping has been pressure tested, but before thermal insulation is applied. Secure the heater to piping with Raychem GT-66 fiberglass tape.

Apply “electric-traced” signs to the outside of the thermal insulation.

After installation and before and after installing the thermal insulation, test heater using a 1000 VDC megger. Insulation resistance should be between 20 and 1000 megaohms regardless of length.

WATER HAMMER ARRESTORS

Water supply piping serving fixtures, appliance, and equipment with quick closing devices shall be provided with water hammer suppressors.

Shock absorbing devices shall be mechanical suppressors as required and approved by the Plumbing code. Mechanical suppressors shall be installed in accordance with hydraulic design of system and PDI Std. WH201.

STERLIZATION OF WATER DISTRIBUTION SYSTEM

Prior to use, isolate and fill system with potable water. Allow to stand 24 hours. Flush each outlet proceeding from the service entrance to the furthest outlet for minimum of 1 minute and until water appears

clear. Fill system with a solution of water and chlorine containing at least 50 parts per million of chlorine and allow to stand for 24 hours. Alternately a solution containing at least 200 parts per million of chlorine may be used and allowed to stand for 3 hours. Flush system with potable water until chlorine concentration is no higher than source water level.

Wait 24 hours after final flushing. Take samples of water for lab testing. The number and location of samples shall be representative of the system size and configuration and are subject to approval by Engineer. Test shall show the absence of coliform bacteria. If test fails, repeat disinfection and testing procedures until no coliform bacteria are detected. Submit test report indicating date and time of test along with test results.

DIELECTRIC UNIONS AND FLANGES

Install dielectric unions or flanges at each point where a copper-to-steel pipe connection is required in domestic water systems.

UNIONS AND FLANGES

Install a union or flange at each connection to each piece of equipment and at other items which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal pipe until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust restrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the Owners Project Representative. All pressure tests are to be documented on forms to be provided to the contractor.

	Test	Initial Test		Final Test	
System	Medium	Pressure	Duration	Pressure	Duration
Above Ground Domestic Water	Water	N/A		100 psig	8 hr

END OF SECTION

PIPING SYSTEM TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

□ Plumbing □ Fire Sprinkler

Test Medium: □ Air □ Water □ Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ Initial Pressure: _____ PSIG

Stop Test Time: _____ Final Pressure: _____ PSIG

Tested By: _____ Witnessed By: _____

Title: _____ Title: _____

Signed: _____ Signed: _____

Date: _____ Date: _____

Comments: _____

_____

_____

_____

SECTION 22 13 00
SANITARY WASTE AND VENT PIPING

PART 1 – GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project.

RELATED WORK

22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
22 05 15 – Piping Specialties

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI A21.4
ANSI A21.11
ANSI A21.51

ANSI B16.3	Malleable Iron Threaded Fittings
ANSI B16.4	Cast Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.22	Wrought Copper and Wrought Alloy Solder Joint Pressure Fittings
ANSI B16.29	Wrought Copper and Wrought Alloy Solder Joint Drainage Fittings – DWV
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A888	Hubless Cast Iron Soil Piping and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
ASTM B32	Solder Metal
ASTM B306	Copper Drainage Tube (DWV)
ASTM B813	Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
ASTM C564	Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
ASTM C1540	Standard Specifications for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings
ASTM D1785	Poly Vinyl Chloride (PVC) Plastic Pipe (SDR Series)
ASTM D2466	Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2564	Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2665	Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
ASTM D2729	Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D2855	Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3034	Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3139	Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212	Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals
ASTM D3222	Unmodified Poly Vinylidene Fluoride (PVDF) Molding Extrusion and Coating Materials
ASTM D3311	Drain, Waste and Vent (DWV) Plastic Fitting Patterns
AWS A5.8	Brazing Filler Material
CISPI 301	Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications

CISPI 310	Couplings For Use in Connection With Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications.

SHOP DRAWINGS

Schedule from the contractor indicating the ASTM or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM or CISPI specification contained in this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 – Basic Requirements.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

DELIVERY, STORAGE AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM, or CISPI specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, grade A type E or S, or grade B type E or S may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88 type L H (drawn) temper copper tubing is specified, ASTM B88, type K H (drawn) temper copper tubing may be substituted at Contractor's option.

PART 2 – PRODUCTS

SANITARY WASTE AND VENT

INTERIOR ABOVE GROUND
Hubless cast iron soil pipe and fittings, ASTM A888; with no hub couplings, CISPI 310, ASTM A74. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute or receive prior approval of the Engineer.

Type M copper water tube, H (drawn) temper, ASTM B88; with cast copper drainage fittings (DMV), ANSI B16.23; wrought copper drainage fittings (DMV), ANSI B16.29; lead free(<.2%) solder, ASTM B32; flux, ASTM B813; copper phosphorus brazing alloy, AWS A5.8 BCuP. Mechanically formed brazed tee connections may be used in lieu of specified tee fittings for vent branch takeoffs up to one-half (1/2) the diameter of the main.

PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

Galvanized steel pipe, Schedule 40, Type F, Grade A, ASTM A53; with cast iron threaded drainage fittings, ASTM B16.12.

INTERIOR BELOW
Cast iron soil piping and fittings, hub and spigot, service weight, ASTM A74, with neoprene rubber compression gaskets, ASTM C564, CISPI 301 and CISPI HSN 85. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Pipe Institute.

PVC Plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fittings patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

PART 3 – EXECUTION

GENERAL
Install pipe and fittings in accordance with reference standards, manufacturer's recommendations, and recognized industry practices.

PREPARTION
Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from the interior and exterior of each section of pipe and fitting prior to assembly.

ERECTION
Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit, and equipment of other trades and existing piping to allow sufficient clearances. In all cases, consult drawings for exact location of pipe spaces, ceilings heights, door and window openings, or other details before installing piping.

Where copper or steel piping is embedded in masonry or concrete, provide protective sleeve covering of elastomeric pipe insulation.

Maintain in clean condition internally during construction.

Provide clearance for installation of insulation, access to valves and piping specialties.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through transformer vaults or above transformers, elevator equipment rooms, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

Install all valves and piping specialties, including items furnished by others, as specified and/or detailed. Provide access to valves and specialties for maintenance. Make connections to all equipment, fixtures, and systems installed by others where same requires piping services indicated in this section.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with metal brush, emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux and assemble joint to socket stop. Apply flame to fitting until solder melts when placed at joint. Remove flame and feed solder into joint until full penetration of cup and ring of solder appears. Wipe excess solder and flux from joint.

THREADED PIPE JOINTS

Use a thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

SOLVENT WELDED PIPE JOINTS

Install in accordance with ASTM D2855 "Making Solvent Cemented Joints With PVC Pipe and Fittings". Saw cut piping square and smooth. Tube cutters may be used if they are fitted with wheels designed for use with PVC/CPVC pipe that do not leave a raised bead on pipe exterior. Support and restrain pipe during cutting to prevent nicks and scratches. Bevel ends 10-15 degrees and deburr interior. Remove any, dust, debris, moisture, grease and other superfluous materials from the pipe interior and exterior. Check dry fit of pipe and fittings. Reject materials which are out of round or do not fit within close tolerance. Use heavy body solvent cement for large diameter fittings.

Maintain pipe, fittings, primer and cement between 40 and 100 degrees during application and curing. Apply primer and solvent using separate daubers (3" and smaller piping only) or clean natural bristle brushes about 1/2 the size of the pipe diameter. Apply primer to the fitting socket and pipe surface with a scrubbing motion. Check for penetration and reapply as needed to dissolve the surface to a depth of 4-5 thousandths. Apply solvent cement to the fitting socket and pipe in an amount greater than needed to fill any gap. While both surfaces are wet, insert pipe into socket fitting with a quarter turn to the bottom of the socket. Solvent cement application and insertion must be completed in less than 1 minute. Minimum of 2 installers is required on piping 4" and larger. Hold joint for 30 seconds or until set. Reference manufacturer's recommendations for ignition set time before handling and for full curing time before pressure testing. Cold weather solvent/cement may be utilized only under unusual circumstances and when specifically approved by the Owner's Project Representative.

MECHANICAL HUBLESS PIPE CONNECTIONS

Place the gasket on the end of one pope or pope fitting and clamp the assembly on the other end of the pipe of fitting. Firmly seat the pipe or pipe fitting ends against the integrally molded shoulder inside the neoprene gasket. Slide the clamp assembly into position over the gasket. Tighten fasteners to manufacturer's recommended torque.

SANITARY WASTE AND VENT

Verify invert elevations and building elevations prior to installation. Install interior piping pitched to drain at minimum slope of 1/4" per foot where possible and in no case less than 1/8" per foot for piping 3" and larger.

Flush piping inlets (floor drains, mop basins, fixtures, etc.) with high flow of water at completion of project to demonstrate full flow capacity. Remove blockages and make necessary repairs where flow is found to be impaired.

PIPING SYSTEM LEAK TESTS

Isolate or remove components from system which are not rated for test pressure. Perform final testing for medical and lab gas with all system components in place. Test piping in sections or entire system as required by sequence of construction. Do not insulate or conceal piping until it has been successfully tested.

If required for the additional pressure load under test, provide temporary restraints at fittings or expansion joints. Backfill underground water mains prior to testing with the exception of thrust retrained valves which may be exposed to isolate potential leaks.

For hydrostatic tests, use clean water and remove all air from the piping being tests by means of air vents or loosening of flange/unions. Measure and record test-pressure at the high point in the system.

For air or nitrogen tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. System will not be approved until it can be demonstrated that there is no measureable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.
Entire test shall be witnessed by the owners representative. All pressure tests are to be documented on forms to be provided to the contractor

System	**Test Medium**	**Initial Test Pressure**	**Duration**	**Final Test Pressure**
Sanitary Waste and Vent	Water	N/A	2 hr.	10’ Water

END OF SECTION

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SECTION 22 20 00
NATURAL GAS FUEL SYSTEM

P A R T 1 - G E N E R A L

DESCRIPTION

Provide a complete interior natural gas fuel piping system to the water heaters, kitchen range, and clothes dryers including all fittings, valves, regulators, hardware, and controls.

RELATED WORK AND REQUIMENTS
22 05 00 – Common Work Results for Plumbing
22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
22 05 14 – Plumbing Specialties
22 05 15 – Piping Specialties

REFERENCES

Standards:
ANSI/ASME B36.10 welded and seamless wrought-steel pipe
ANSI Z21.15 gas ball valves
ANSI B16.33-90 metallic gas valves
ANSI Z21.24 standard for connectors for gas appliances.
NFPA 54 Natural Fuel Gas Code
International Fuel Gas Code

WELDER QUALIFCATIONS

Welding procedures, welders, and welding operators for all building service piping to be in accordance with certified welding procedures of the National Certified Pipe Welding Bureau and Section 927.5 of ASME B31.9 Building Services Piping or AWS 10/9 Qualification of Welding Procedures and Welders for Piping and Tubing. Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section 927.6 of ASME B31.9 Building Services Piping.

The Architect or Engineer reserves the right to test the work of any welder employed on the project, at Owner's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from further doing any welding on the project and all defective welds replaced at no cost to the Owner.

SUBMITTALS

Include submittals for all piping, valve, and miscellaneous devices and products listed in this section.

PART TWO – PRODUCTS

PIPING

Above Ground 2" and smaller:
Black steel pipe, schedule 40, Type F, Grade A, ASTM A53; with black malleable iron threaded fittings, Class 150, ASTM A197/ANSI B16.3; seamless carbon steel weld fittings, standard, weight, ASTM A234 grade WPB/ANSI B16.9.

ASTM A240 Type 304, 321 Corrugated Stainless steel tubing (TMH 1042) with a minimum wall thickness of 0.010. Jacketing to be TENITE polyethylene meeting the requirements of ASTM E84 for flame spread and smoke density. All mechanical tube fittings are to SAE CA 360 brass incorporating double wall flare

for sealing and Jacket Lock TM jacket capturing for steel tubing protection. Piping system shall be equal to GASTTE complying with ANSI/IAS LC-1.

VALVES

4" and smaller:
Ball or eccentric plug valve, bronze or cast iron body, 2" and nder threaded ends, 2-1/2" and over flanged ends, chrome plated bronze ball, bronze or nickel plated cast iron plug, TFE or Hycar seast and seals, lever handle, 175 psi W.O.G. U.L listed for use as natural gas shut-off. Apollo 80-100, DeZurik 425.

GAS PRESSURE REGULATORS

2" and smaller:
Cast iron body, aluminum and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20 degrees F to 150 degrees F.

GAS SAFETY RELIEF

Kunkle, Fisher, or crane are acceptable manufacturers. ASME standard for gas safety relief with stainless steel seat and sisc.

GAS PRESSURE GAUGE

Trerice, N.S. or Taylor are acceptable manufacturers. Trerice No. 660 with 4-1/2" face, aluminum case, bronze bushing movement, white background, and black figures. Graduated from 0 to 1 psig in inch of water increments, mount gauge maximum of 6' above floor.

PART THREE – EXECUTION

Gas piping installation shall conform to the requirements of NFPA-54 and the International Fuel Gas Code.

Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth sediment trap at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end that will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

Valves shall not be located within plenum ceilings.

Do not install gas pipe below a building or its foundation.

Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

TESTING

Air test entire piping system, by sections if necessary, with a pressure of 100 psi without loss of pressure for 24 hours.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE

This section includes specifications for water heaters, water softeners, pumps and other equipment used for plumbing applications. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Documents
- Reference
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Water Heaters
- Expansion Tanks
- Water Softener

PART 3 - EXECUTION
- Installation
- Training

RELATED DOCUMENTS

Section 22 05 14 – Plumbing Specialties
Section 22 05 15 – Piping Specialties
Section 22 05 23 - General-Duty Valves for Plumbing Piping
Section 22 07 00 - Plumbing Insulation

REFERENCE

Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 1 - Basic Requirements.

Plumbing products requiring approval by the State of Wisconsin Dept. of Commerce must be approved or have pending approval at the time of shop drawing submission.

SHOP DRAWINGS

Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under Division 1 - Basic Requirements.

P A R T 2 - P R O D U C T S

GAS FIRED WATER HEATERS

Equal to: Bradford Model EF-100T-300E-3NA.

Products by A.O. Smith, Bock and Rheem are considered equal.

High efficiency gas fired direct vented water heaters having a gas input of 300,000 BTU/hr and a recovery rate of 335 GPH at a 100° F temperature rise when tested and certified at 99% thermal efficiency. Water heater shall have a storage capacity of 100 gallons. Water heater shall have CSA seal off certification and supplied with a factory installed CSA ASME rated temperature and pressure relief valve, and meet SCAQMD rule 1146.2. Water heater shall be certified for Schedule IV venting with power vent and powered direct vent options. Water heater shall be covered by three year limited tank warranty against tank leaks. Include condensate neutralizer, Rheem part no. SP12151 for each heater.

The water heater shall be ASME constructed in accordance with the requirements of the ASME boiler and pressure vessel code section IV part HLW.

IN-LINE CLOSE COUPLED CENTRIFUGAL PUMPS

Building Circulator: B&G model NBF-9U/LW, three speed, 41 watts, single phase, 115 volts, 3GPM @ 8' HD.

Manufacturer: Bell and Gossett, Gould, Grundfos, Taco.

Type: Horizontal single stage close coupled oil lubricated in-line pumps, 125 psig maximum working pressure at operating temperature of 225^{o}F. continuous. The manufacturer shall certify all pump ratings. All pumps to operate without excessive noise or vibration.

Casing: Bronze or stainless steel; sweat suction and discharge connection.

Impeller: Brass, bronze or thermoplastic, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

Bearings: Double-sintered carbon.

Shaft: Ceramic.

Seal: Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

Motor: Provide pump with open dripproof motor with built-in thermal overload protection sized for non-overloading over the entire pump curve. Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Furnish and install timeclock equal to A.O. Smith Model TC-1 and Aquastat Model AQ-34.

EXPANSION TANKS

Manufacturer: Amtrol, Bell and Gossett, Wessels.

Equal to Amtrol model no. ST-12-C.

Vertical steel precharged hydro-pneumatic expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service.

WATER SOFTENER

Equal to: Hellenbrand Model H151-180. Products by Capital or Culligan are considered equal.

Tanks: Fiberglass reinforced mineral tank constructed of molded high density polyethylene inner shell reinforced by exterior fiberglass winding and epoxy resin. NSF approved and rated for 150 psig. Mount slotted or lateral hub PVC distributor in tank with underbedding gravel.

Mineral: High capacity ion exchange mineral, FDA approved, Sybron/Ionac, Rohm & Haas, Resintech or Puralite. Uniform beads rated for removal of 30,000 grains of hardness as calcium carbonate when regenerated with 15 lbs. of salt. Design for minimum of 50% resin bed freeboard.

Valve: Top mount brass valve with motor drive, hydraulically balanced piston, seal and spacers, adjustable brine flow control, backwash flow control, adjustable capacity and regeneration settings. Provide bypass ball valve arrangement.

Controls: Factory wired and tested controls with transformer and labeled terminal block for single operation consisting of the following:

- Electronic meter demand with calendar day override
- Scrolling user screen showing capacity remaining, time of day, and flow rate.
- Fully programmable

Mineral tank shall include 6 cubic feet mineral resin with a capacity of 168,000 grains using 60 pounds of salt, and a flow rate of 43 GPM at 15 psi pressure drop.

Brine Tank: High density polyethylene brine tank with high salt platform, PVC brine measuring and float valve, PVC injector. Contractor to provide initial salt fill.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

Set commercial water heaters, water softener on concrete housekeeping pads. Adjust and level equipment.

Cycle Softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc.

Connect equipment to water and drain piping using unions or flanges and isolation valves.

Size temperature and relief valves per CSA ratings. Pipe temperature and pressure relief valves to floor drain or floor as indicated.

Startup and test equipment adjusting operating and safety controls for proper operation.

Lubricate pumps before startup. Adjust pumps for rated flow.

Adjust expansion tank precharge to scheduled minimum operating pressure prior to connecting to system.

Hot Water Return Pumps

Pumps operate on signal from aquastat in hot water return line (5 feet from heater) to start on water temperature drop below 100 degrees F. and stop when temperature reaches 120 degrees F. adjustable. Furnish and mount aquastat and 24 hour timeclock. Timeclock to override aquastat control. Timeclock will allow pump to operate under control of aquastat during daytime and shut-off pump at night. Day-nite schedule set per Owner’s direction. Aquastat and timeclock wiring under Division 16, Electrical.

TRAINING

Provide training to designated owner personnel. Refer to Section 22 05 00

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 – GENERAL

SCOPE
This section includes specifications for plumbing fixtures, faucets and trim.

RELATED WORK
Section 22 11 00 – Facility Water Distribution
Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
Section 22 05 14 – Plumbing Specialties
Section 22 05 15 – Piping Specialties

REFERENCE
Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE
Substitution of Materials: Refer to Division 1 – Basic Requirements.

Plumbing products requiring approval by the State of Wisconsin Dept. of Commerce must be approved or have pending approval at the time of shop drawing submittal.

SUBMITTALS
Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction, ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance limitations ad appropriate identification.

DESIGN CRITERIA
ANSI A112.6.1M-88 – Supports for Off-the Floor Plumbing Fixtures for Public Use.
ANSI A112.19.2M-82 – Vitreous China Plumbing Fixtures.
ANSI A112.19.5-79(R1990) – Trim for Water Closet Bowls, Tanks and Urinals
ANSI A112.18.1-94-Finished Rough Brass Plumbing Fixture Fittings

PART 2 – PRODUCTS

PLUMBING FIXTURES
Manufacturers: Fixture descriptions establish fixture type, quality, materials, features and size. Products of the following manufacturers determined as equal by the Architect/Engineer will be accepted.

- Water Closets – American Standard, Kohler, Zurn
- Flush Valves - Sloan, Zurn, Coyne & Delany
- Water Closet Seats – Bemis, Beneke, Centoco, Olsonite Sperzel.
- Lavatories – American Standard, Kohler, Zurn, Sloan
- Sinks – Elkay, Just, Bradley, Sloan
- Electric Water Coolers – Elkay, Haws, Oasis, Sunroc
- Faucets – Chicago Faucet, Kohler, Speakman, Symmons, Sloan, Zurn.
- Stops and Supplies – Chicago Faucet Co., T&S Brass, McGuire.
  (Heavy Duty Type Only)
- Traps – Kohler, McGuire, Dearborn, Engineered Brass Co. (17 Gauge Min.)
- Carrier and Supports – Josam, Smith, Wade, Watts Drainage, Zurn.
- Shower– Chicago, Symmons, Leonard

Water Closet WC-1

Wall hung, back outlet, white vitreous siphon jet water closet with elongated bowl, 1-1/2" top spud, 2-5/2" passageway, 1.6 gallon flush, white open front seat, less cover, hard wired sensor operated flush valve.

Fixture: Kohler "Kingston" K-4330

Flush Valve: Sloan "royal" Model 111-ES-S hard wired. Include one transformer for 5 WC-1 @ 1st floor and 3 WC-1 @ 2nd floor.

Seat: Bemis 1055SSC self-sustaining concealed check hinge.

Carrier: Commercial grade for a minimum of 650 pound support.

Lavatory L-1:

Wall hung, white vitreous china drilled for concealed arm carrier with 4" on center faucet openings with deck mounted hard wired sensor operated faucet.

Fixture: Kohler "Kingston" K-2005

Carrier: Floor mounted concealed arm

Facuet: Sloan EAF-100-P/EAF-100-LT hard wired sensor faucet w/ETF 607-A trim late, and EAF-12 0.56GPM aerator. Provide one faucet with plug in transformer and the remainder of faucets with daisy chain electrical splitter cable model EAF-23-A. Include model EAF-25-A and EAF-17-A extension cables as required.

Drain: Kohler L-13885 open grid perforated strainer, and 1-1/4" offset tailpiece.

Trap: 1-1/4" x 1-1/2" 176A cast brass.

Supplies & Stops: McGuire BV07 with loose key handles.

Lavatory L-2

Same as L-1, except provide thermostatic mixing valve equal to Watts model LFUSGB. Include Durabla Model SCV check valves on supplies to mixing valve.

Sink S-1:

Counter mounted 18 Ga. Type 302 stainless steel single compartment sink with 3 faucet openings 4" on center, deck mounted single handle faucet with pullout spray spout.

Fixture: Elkay LK-2219

Faucet: Kohler "Coralais" K15160-CP

Drain: Elkay LK-18 perforated grid strainer with 1-1/2" O.D tailpiece.

Trap: 1-1/2" x 1-1/2" 17 GA. Cast brass.

Supplies & Stops: McGuire H2165LK with loose key handles.

Sink S-2:

Counter mounted natural quartz surface with a blend of bio-based resin. Include strainer and drain assembly.

Fixture: Bradley Model LVS-4, single station

Faucet: Kohler “Coralais” K15160-CP pull-out spray head spout.

Trap: 1-1/2” x 1-1/2” 17 GA. Cast brass.

Supplies & Stops: McGuire H2165LK w/loose key handles.

Sink S-3:

Undermount 18 GA. Type 302 stainless steel double compartment sink with 3 faucet openings 4” on center in stainless steel counter. Single handle faucet with pull out spray spout, and trim piece.

Fixture: Elkay ELUG-311810

Faucet: Kohler “Coralais” K15160-CP

Drain: Elkay LK-35

Trap: 1-1/2” x 1-1/2” 17 GA. Cast brass

Supplies & Stops: McGuire H2165LK w/loose key handles.

Shower SH-1:

Built up shower walls and base by general contractor.

Tempered water concealed metering push button shower valve with integral stop and “Fre-Flo” institutional showerhead with adjustable spray, 2.5 gpm.

Fixture: Symmons Model 3-320 or 3-320-R with vandal resistant recessed hex socket type screws.

Drain: Sioux Chief Model 840-20PNR

Shower SH-2

Same as SH-1, except provide two (2) shower heads and a diverter valve Symmons model 4-451.

Electric Water Cooler EWC-1:

Dual level, wall mounted barrier free electric water cooler with exposed stainless steel basin, water filter, self closing front front/side push button, wall hanger and 1-1/4” tailpiece rated for 8.0 GPH at 80 degree inlet water, 80 degree ambient and 50 degree leaving water, 380 watts, 4.5 FLA, 120/60/1. Color to be selected by Architect/Owner from manufacturers standard color selection.

Fixture: Elkay EZSTL8C

Trap: 1-1/4” x 1-1/4” 17 GA. Cast brass trap

Supplies & Stop: Accessible ½” ball valve with ½” riser (concealed).

PART 3 – EXECUTION

INSTALLATION

Verify the existing water closet rough-in dimensions before ordering new units.

Install all plumbing fixtures in accordance with manufacturer’s instructions. Set level and plumb. Secure in place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to floor and wall. Secure rough-in fixture piping to prevent movement exposed piping.

Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily accessible location for servicing.

Install barrier free fixtures in compliance with IBC 1108 and 3408, COMM 69 and Federal ADA Accessibility guidelines. Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to avoid contact by wheelchair users.

Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.

Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome plated brass, same items in concealed locations may be of rough brass finish.

Seal openings between walls, floors and fixtures with mildew-resistant silicone sealant same color as fixture.

Test fixtures to demonstrate proper operation. Replace malfunctioning units or components. Adjust valves for intended water flow rate to fixtures without splashing, noise or overflow. Lavatory metering faucets will be run for 2 minutes upon continuous detection. Adjust shower metering valves to run for 90 seconds.

Protect fixtures during construction. At completion clean plumbing fixtures and trim using manufacturer's recommended cleaning methods and materials.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

P A R T 1 - G E N E R A L

SCOPE
This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

RELATED WORK
Section 07 84 00 - Fire Stopping
Section 23 05 13 - Common Motor Requirements for HVAC.
Section 23 33 00 - Air Duct Accessories.

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
Abbreviations of standards organizations referenced in other sections are as follows:

AABC	Associated Air Balance Council
ABMA	American Boiler Manufacturers Association
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE
Refer to Division 1, General Conditions, Equals and Substitutions.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

PROTECTION OF FINISHED SURFACES
Refer to Division 1, General Requirements, Protection of Finished Surfaces.

Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

SLEEVES AND OPENINGS
Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND FIRE STOPPING
Sealing and fire stopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. Provide all fire stopping of fire rated penetrations and sealing of smoke rated penetrations in compliance with section 07 84 00 Fire Stopping.

SUBMITTALS
Refer to Division 1, General Conditions, Submittals.

Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the electrical drawings. Include a statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the motor starter schedules are in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

Include wiring diagrams of electrically powered equipment.

Submit sufficient quantities of shop drawings to allow the following distribution:

- Operating and Maintenance Manuals 2 copies
- Testing, Adjusting and Balancing Contractor 1 copy
- Owner 1 copy
- A/E 1 copy

- Electroninc copies may be submitted in lieu of paper copies. Entire subbmital may not be returned, only a a Submittal Review Form with status of the submittal and any comments and potentially selected sheets of the submittal with comments noted.

OFF SITE STORAGE
Prior approval by Owner and the A/E will be needed. The contractor shall submit a request for offsite storage for consideration of offsite materials storage.

Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for offsite storage. For material that can be stored off site, no material will be accepted for offsite storage unless shop drawings for that material have been approved.

CERTIFICATES AND INSPECTIONS
Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer in accordance with code. Deliver originals of these certificates to the Division Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Records of tests performed a to certify compliance with system requirements
2. Certificates of inspection by regulatory agencies
3. Valve schedules
4. Lubrication instructions, including list/frequency of lubrication
5. Copies of all approved shop drawings.
6. Manufacturer's wiring diagrams for electrically powered equipment

7. Temperature control record drawings and control sequences
8. Parts lists for manufactured equipment
9. Warranties
10. Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct owner personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Include not less thanfour hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

RECORD DRAWINGS

Refer to Division 1, General Requirements, Record Drawings.

In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

P A R T 2 - P R O D U C T S

ACCESS PANELS AND DOORS

LAY-IN CEILINGS:

Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

GYPSUM WALL BOARD WALLS AND CEILINGS:

16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needing service; minimum size is 12" by 12".

IDENTIFICATION

STENCILS:

Not less than 1 inch high letters/numbers for marking pipe and equipment.

SNAP-ON PIPE MARKERS:

Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services, or equal.

ENGRAVED NAME PLATES:

White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

SEALING

NON-RATED PENETRATIONS:

Pipe Penetrations:

At pipe penetrations of non-rated interior walls, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood walls where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

Duct Penetrations:

Annular space between duct (with or without insulation) and the non-rated walls or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

PART 3 - EXECUTION

DEMOLITION

Perform all demolition as indicated on the drawings to accomplish new work.
All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the owner Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

CUTTING AND PATCHING

Refer to Division 1, General Requirements, Cutting and Patching.

BUILDING ACCESS

Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

EQUIPMENT ACCESS

Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and service.

COORDINATION

Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number with one coat of black enamel against a light background or white enamel against a dark background.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location.

LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

SLEEVES AND OPENINGS

Pipe penetrations in existing concrete floors: Core drill openings. Where penetrating pipe or conduit weight is supported by floor, provide manufactured product or structural bearing collar designed to carry load.

DUCT SLEEVES:
Duct sleeves are not required in non-rated partitions or floors.

END OF SECTION

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE
This sections includes requirements for single and three phase motors that are used with equipment specified in other sections.

RELATED WORK
Section 23 09 14 - Electric Instrumentation and Control Devices for HVAC
Section 23 05 14 - Variable Frequency Drives
Section 23 21 23 - Pumps
Section 23 34 00 - Fans
Section 23 36 00 - Air Terminal Units
Section 23 52 00 - Boilers
Section 23 74 00 - Packaged Roof Top Heating- Cooling Units
Division 26 00 00 - Electrical

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
ANSI/IEEE 112	Test Procedure for Polyphase Induction Motors and Generators
ANSI/NEMA MG-1	Motors and Generators
ANSI/NFPA 70	National Electrical Code

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

ELECTRICAL COORDINATION
All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications.

Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor.

Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished by this Contractor and indicated to be wired by the Electrical Contractor.

PRODUCT CRITERIA
Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

P A R T 2 - P R O D U C T S

THREE PHASE, SINGLE SPEED MOTORS
Use NEMA rated, voltage as scheduled, three phase, 60 hertz motors for all motors 1/2 HP and larger unless specifically indicated.
Use NEMA general purpose, continuous duty, Design B , normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless other types of motors are scheduled or specified in specific equipment sections motors are specified in the equipment sections.

Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for re-lubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested in accordance with NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

MOTOR	-----Open Drip-Proof Motors------		
	-------Nominal Motor Speed-------		
HP	1200 rpm	1800 rpm	3600 rpm
1	82.5	85.5	77.0
1-1/2	86.5	86.5	84.0
2	87.5	86.5	85.5
3	88.5	89.5	85.5
5	89.5	89.5	86.5
7-1/2	90.2	91.0	88.5
10	91.7	91.7	89.5

SINGLE PHASE, SINGLE SPEED MOTORS

Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

MOTORS USED ON VARIABLE FREQUENCY DRIVES

In addition to the requirements specified above, the motor must be suitable for use with the drive specified in Section 23 05 14, including but not limited to motor cooling. Motor shall comply with NEMA MG1 Part 31 to provide windings capable to withstand up to 1600 peak Volts with a rise time of 0.1 µs. Provide bearing protection grounding rings to bleed current from the motor shaft to the motor casing. Manufacturers: Aegis SGR, Inpro/Seal CDR, or equal.

P A R T 3 - E X E C U T I O N

INSTALLATION

Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot to get a secure installation.

When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

Verify the proper rotation of each three-phase motor as it is being wired or before the motor is energized for any reason.

Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

SECTION 23 05 14
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

Applicable provisions of Division 1 shall govern all work under this Section

SCOPE
This section includes variable frequency drives, bypass starters, and line reactors.

RELATED WORK
Section 23 21 23 - Hydronic Pumps
Section 23 74 00 – Packaged Roof Top Heating - Cooling Units

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
ANSI/IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Converters

SUBMITTALS
Submit shop drawings and product data under provisions of Division 1, General Conditions of the Contract.

Include physical, electrical, and performance characteristics of each variable frequency drive and associated components, including dimensions; weight; input and output performance; voltage, phase, current and overcurrent characteristics; installation instructions; protective features; wiring and block diagrams indicating specified options; electrical noise attenuation equipment where required to meet the criteria specified; line side voltage notch wave form and line side current harmonics; certified efficiency versus load and speed curves; and required operating environment.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

EQUIPMENT STARTUP AND AGENCY TRAINING
Provide the services of a factory trained and certified technician to approve the installation; start-up, test, and adjust for proper operation of the unit(s). Upon completion of the equipment startup, submit a complete manufacturer's field report, including startup and test log, signed by the factory trained technician. Coordinate with the Temperature Control Contractor and the Balancing Contractor. The startup shall be coordinated with Division 26.

WARRANTY
The warranty shall be for a period of twenty-four (24) months from the date of project Substantial Completion. Further, the warranty shall include all parts, labor, travel time, administrative costs, overhead, travel expenses, technical support and any and all other costs to provide the warranty service.

PART 2 PRODUCTS

MANUFACTURERS
ABB, Toshiba, Danfoss, Trane/Danfoss, Emerson, Yaskawa, Mitsubishi, Allen Bradley

DESIGN AND CONSTRUCTION
The unit shall be variable torque, modular design for control of the motors as specified in Division 23 and rated at the motor full load nameplate amps.

The unit shall be U.L. listed, solid state, microprocessor based with a pulse width modulated (PWM) output wave form (none others are acceptable).

The VFD shall employ a full wave bridge rectifier and capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.

The VFD package shall contain the equivalent of 5% impedance to reduce harmonic distortion. The 5% equivalent impedance shall be provided in the form of a DC bus choke, an input AC line reactor in each phase, or a combination of the two methods.

Control circuitry shall be plug-in, plug-out modular basis with a corrosion resistant coating on printed circuit boards.

Units to be suitable for an operating environment from 0°C to 40°C temperature and humidity up to 90% non-condensing.

Electrically and physically isolate control circuitry and conductors from power circuitry and power conductors. Control conductors and power conductors shall not be run in the same pathway.

The unit enclosure shall be NEMA 1 as required for the application minimum and all components shall be fully factory assembled and tested prior to leaving the manufacturing facility.

Include the following operating and monitoring devices mounted on the front cover:

- A disconnect switch or circuit breaker to de-energize both the drive and bypass circuit with door interlocked handle and lock-open padlocking provisions.
- Operating mode selector switch marked "hand-off-auto".
- Manual speed adjustment via keypad, mounted on the door.

PERFORMANCE REQUIREMENTS

Units shall be suitable for input power of electrical system as scheduled on the drawings ±10%, 3 phase, 60 Hertz nominal.

Use a current limiting control device to limit output current to 110% continuous for one minute; also refer to Protection Features in this section. Full load output current available from drive shall not be less than motor nameplate amperage. The full load amp rating of the VFD shall not be less than the values indicated in the NEC Table 430-150.

Output power shall be suitable for driving standard NEMA B design, three phase alternating current induction motors at full rated speed with capability of 6:1 turndown.

Additional performance capabilities to include the following:

- Ride through a momentary power outage of 15 cycles,
- Start into a rotating load without damage to drive components or motor,
- Capable of automatic restart into a rotating load after a preset, adjustable time delay following a power outage
- Input power factor: Min 0.95 throughout the speed range
- Minimum efficiency: 95% at 100% speed, 85% at 50% speed

CONTROL FEATURES

Use control circuits compatible with input signal from temperature control system in the automatic mode and from manual speed control in the manual mode. Vary motor speed in response to the input control signal. Include components necessary to accept the signal from the temperature control system in the form that it is sent. Refer to Division 23, Sections 23 09 14 through 23 09 93.

Include the following additional control features:

- Hand-Off-Automatic (HOA) selector switch to select local or remote start/stop and speed control
- Analog input, selectable 0-10v or 4-20 mA, for automatic control from the temperature control system
- Local speed control at the VFD
- Adjustable acceleration and deceleration rate so that the time period from start to full speed and from full speed to stop can be field adjusted
- Adjustable minimum and maximum speed settings for both automatic and manual modes of operation
- Field adjustment of minimum and maximum output frequency
- Two (2) sets of programmable form "C" contacts for remote indication of variable frequency drive condition. Note: default programming to be set for "Drive Run & Fault".
- Illuminated display keypad.
- External Fault indicator
- One (1) input for a N.O. dry contact type input for a 2-wire remote start/stop
- One (1) input for a N.C. dry contact type input for external faults: (freezestats, fire alarm, smokes, etc). This input shall be factory wired to prevent both the VFD and bypass starter operation when external fault is present.
- One (1) N.O. dry contact output for proving motor status. This output shall be programmed to detect belt or coupling break that would remove the load from the motor. The dry contact will open on loss of load or VFD being off.
- PID control loop capable of VFD control from an external device connected to a VFD analog input.

The VFD controller shall convert VFD information into the BACnet MSTP protocol that will be compatible with the building direct digital energy management system (EMS) supplied on the project. This output shall be through a serial interface port capable of two-way communication with the building EMS provided on this project. Final connection shall not require any additional intermediate gateway devices to provide throughput of data. The following data shall be provided at a minimum:

- Fault condition
- Speed
- Amperage
- Frequency
- Voltage
- Bypass status (if supplied)

PROTECTION FEATURES

Use electronic protection circuitry in the power circuits to provide an orderly shutdown of the drive without blowing fuses or tripping circuit breakers and prevent component loss under the following abnormal conditions:

Activation of any safety device;
Instantaneous overcurrent and/or over voltage of output;
Power line overvoltage and undervoltage protection;
Phase loss;
Single and three phase short circuiting;
Ground faults;
Control circuit malfunction;
Overtemperature; and
Output current over limit.

Provide the following additional protective features:

- Input transient overvoltage protection up to 3000 volts per ANSI 37.90A;
- DC bus fusing or other electronic controls which limit the rate of rise of the DC bus current and de-energizes the drive at a predetermined current level;
- Fusing for the control circuit transformer;
- Grounded control chassis; and
- Devices and/or control circuitry to ensure that the variable frequency drive and bypass starter are not both energized and driving motor simultaneously.

DIAGNOSTICS

Provide an English character display (no error codes) with indicators for the following:

- Phase loss
- Ground fault
- Overcurrent
- Overvoltage
- Under voltage
- Over temperature
- Overload
- DC bus status

QUALITY ASSURANCE TESTS

Use a factory heat stress test to verify proper operation of all functions and components under full load.

AC INPUT LINE REACTORS

When needed to comply with the requirement for 5% equivalent impedance, furnish and factory install AC input line reactors.

Line reactors shall be installed in each phase of the AC input side of the VFD and mounted within a common enclosure with the VFD.

Line reactor shall be a three phase inductor, iron core, 600V, Class H insulation, 115 degree C rise, copper windings with screw type terminal blocks.

OUTPUT LINE FILTER

Provide a three phase dV/dT output filter for any 460VAC drive with output line length of over 120 feet or as specified.

PART 3 EXECUTION

VARIABLE FREQUENCY DRIVES

Install where indicated on drawings and in accordance with approved submittals and manufacturer's published recommendations. Installation to be by the Division 26 00 00 - Electrical contractor.

Input power wiring shall be installed in a separate conduit, output power wiring shall be installed in a separate conduit and control wiring shall be installed in a separate conduit. Do not mix input power, output power, or control wiring in a common conduit. Separate conduits for input and output power wiring shall be provided for each motor. Input and output power wiring for more than one motor shall not share a common conduit. Power wiring shall be furnished and installed by the Div. 26 contractor. If provided, do not mount output line filter above the drive.

Temperature Control Contractor will furnish and install the required temperature control wiring in metal conduit and in accordance with Division 26 00 00 - Electrical of this specification.

AGENCY TRAINING

All training provided for owner shall comply with the format, general content requirements and submission guidelines specified under Section 23 05 00.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of [XX] hours.

END OF SECTION

SECTION 23 05 15
PIPING SPECIALTIES

P A R T 1 - G E N E R A L

SCOPE
This section contains specifications for HVAC piping specialties for all piping systems
RELATED WORK
Section 23 11 00 - Facility Fuel Piping
Section 23 21 13 - Hydronic Piping
Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 07 00 - HVAC Insulation

REFERENCE
Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Required for all items in this section; Include materials of construction, dimensional data, ratings/capacities/ranges, pressure drop data where appropriate, and identification as referenced in this section and/or on the drawings.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
All piping specialties are to be rated for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

P A R T 2 - P R O D U C T S

THERMOMETERS
Manufacturers: Ashcroft, Marsh, Taylor, H. O. Trerice, U. S. Gauge, Weiss, Weksler.

Stem Type, cast aluminum case, nine inch scale, clear acrylic window. adjustable angle brass stem with stem of sufficient length so the end of the stem is near the middle of a pipe without reducing the thickness of any insulation, red or blue indicating fluid, black lettering against a white background, with scale ranges as follows:

Service	Scale Range, °F	Min. Increment, °F
Hot Water	30 - 240	2

THERMOMETER SOCKETS
Brass with threaded connections suitable for thermometer stems and temperature control sensing elements in pipeline. Furnish with extension necks for insulated piping systems.

HOSE CONNECTION CAPS
Hose connection caps shall be pressure rated for 150 psig at 180 deg F.

PRESSURE GAUGES

Manufacturers: Ametek/U. S. Gauge Division, Ashcroft, Marsh, Taylor, H. O. Trerice, Weiss, Weksler.

Cast aluminum case of not less than 4.5 inches in diameter, double strength glass window, black lettering on a white background, phosphor bronze bourdon tube with bronze bushings, recalibration from the front of the dial, 99% accuracy over the middle half of the scale, 98.5% accuracy over the remainder of the scale, with scale range as follows:

Service	Scale Range, psig	Min. Increment, psig
Hot Water		

STRAINERS

Manufacturers: Armstrong, Hoffman, Illinois, Keckley, Metraflex, Mueller Steam, or Sarco.

WATER SYSTEMS:

Y type; cast iron body; stainless steel screens; bolted or threaded screen retainer tapped for a blow off valve; threaded body in sizes through 2 inch and rated at not less than 175 psi WOG; flanged body in sizes over 2 inch and rated at not less than 125 psi WOG at 240°F. Screen to be 20 mesh for line sizes 2 inch and less, 0.125 inch perforations for line sizes 2-1/2 inch through 4 inch, and 0.25 inch perforations for line sizes 5 inch and larger.

EXPANSION TANKS

Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, John Wood, Taco, Wessels.

BLADDER TYPE:

Steel construction, tested and stamped in accordance with Section 8D of the ANSI/ASME Code and furnished with the National Board Form U-1, rated for not less than 125 psig working pressure, precharged with air to the initial fill pressure indicated on the drawings, butyl replaceable bladder suitable for fluid temperatures to 220°F, and furnished with a tank drain connection, system connection, mounting saddles for horizontal installation or base for vertical installation, prime coated, size/capacity as indicated on the drawings. Tank and bladder construction must allow field replacement of the bladder on its failure.

AIR SEPARATORS

Manufacturers: Amtrol/Thrush, Armstrong Pumps, Bell and Gossett, John Wood, Taco.

1-1/2 inch and smaller: Cast iron construction, suitable for in-line installation, top and bottom connections for use with expansion tanks specified above, rated at not less than 125 psig at 220°F.

2 inch and larger: Welded steel construction, ASME constructed and stamped for a working pressure not less than 125 psig at 220°F, threaded or flanged connections for 2 inch size, flanged or grooved connections if grooved piping is allowed for all sizes over 2 inch, suitable for use with expansion tanks specified above, drain connection at the bottom of unit, vent/tank connection at the top of unit, suitable for the system flow rates as indicated on the drawings. Include a galvanized or stainless steel strainer with provisions in the unit shell for strainer removal. Provide a blowdown connection located so that the inside surface of the strainer can be cleaned by draining the system fluid through the blowdown connection.

AIR AND DIRT SEPARATORS

Manufacturers: Caleffi, Bell & Gossett, Spirotherm, Inc., Wessels

Separator body to epoxy resin painted steel body, with brass a*ir vent body & shut-off and drain valve body: brass.*

Internal element and float to be stainless steel

Performance

Temperature range: - with insulation 32–220°F (0 – 105°C)

Particle separation capacity: to 5 µm

Connections

Flanged, ANSI B16.5 150 CLASS RF

Agency Approval

Series NA549 is designed and built in accordance with Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code and tagged and registered with the National Board of Boiler and Pressure Vessel Inspector, and CRN registered.

Technical specifications of insulation

Inner part

Material: rigid closed cell expanded polyurethane foam

Thickness: 2 3/8” (60 mm)

Density: 3 lb/ft3 (45 kg/m3)

Conductivity (ISO 2581): 0.16 BTU·in/hr·ft2·°F (0.023 W/(m·K)

Temperature range: 32–220°F (0–105°C)

Outer part

Material: Embossed aluminium

Thickness: 7-mil (0.70 mm)

Fire resistance (DIN 4102): Class 1

Head covers

Heat formed material: PS

AIR VENTS

MANUAL KEY TYPE VENTS:

Bell and Gossett Model 4V; Eaton/Dole Model 9, 9B, or 14A.

Bronze body with nonferrous internal parts, screwdriver operated, designed to relieve air from the system when vent is opened, rated at not less than 125 psig at 220°F.

MANUAL BALL VALVE VENTS:

Provide 1/4" ball valves for manual venting of air handling unit coils and where indicated elsewhere on drawings and details. Reference specifications section 23 05 23.

AUTOMATIC VENTS:

Thrush Model 720, Bell and Gossett Model 107, Watson McDaniel Model AV813W

Cast iron body with nonferrous internal parts, designed to vent air automatically with float principle without allowing air to enter the system, rated at not less than 125 psig at 220°F.

P A R T 3 - E X E C U T I O N

THERMOMETERS

STEM TYPE:

Install in piping systems as indicated on the drawings and/or details using a separable socket in each location.

THERMOMETER SOCKETS

Install at each point where a thermometer or temperature control sensing element is located in a pipeline.

PRESSURE GAUGES

Install in locations where indicated on the drawings and/or details, including any gauge piping, with scale range appropriate to the system operating pressures.

PRESSURE SNUBBERS:

Install in gauge piping for all gauges used on water services.

EXPANSION TANKS

Install tanks where indicated on the drawings, coordinating concrete base installation with the General Contractor or fabricating steel supports to suit the application. Install all specified tank accessories.

BLADDER TANKS:
Verify proper air charge; recharge as necessary. Install an isolation valve in the piping connecting the tank to the system. In the piping between the tank and the isolation valve, install a pressure gauge and a drain valve with a hose adapter. Install a drain valve with hose adapter in the drain connection of the tank. Make sure that all drains are accessible and a hose can be attached.

AIR AND DIRT SEPARATORS
Mount in hot water lines as indicated on the drawings/details. Install ball valve with hose adapter in bottom blowdown connection and skimming connection.

Open the drain/blowdown valve after system cleaning and again after 30 days of operation.

AIR VENTS

MANUAL KEY TYPE VENTS:
Install at all high points where air may collect and not be carried by the system fluid. Use a soft Type L copper "pigtail" so the vent can be positioned for venting and collecting any water that might escape.

MANUAL BALL VALVE VENTS:
Install on air handling coils and where indicated elsewhere as shown on drawings and details.

AUTOMATIC VENTS:
Install on the top of air separators on systems using bladder type expansion tanks. Install at other locations as indicated on the drawings or details. All locations to have a ball valve installed upstream of the vent for maintenance purposes.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING

P A R T 1 - G E N E R A L

SCOPE
This section includes valve specifications for all HVAC systems except where indicated under Related Work.

RELATED WORK
Section 23 05 15 - Piping Specialties

REFERENCE
Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS
Refer to division 1, General Conditions, Submittals.
Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer. .

P A R T 2 - P R O D U C T S

MANUFACTURERS
Anvil, Apollo, Armstrong, Bell & Gossett, Cash-Acme, Dresser Consolidated, Conval, Crane, Anderson Greenwood and Crosby, Danfoss-Flomatic, DeZurik, Durco, Fisher, Grinnell, Griswold, Hammond, Hancock, Hoffman, Jamesbury, Keystone, Kunkle, Leslie, Lunkenheimer/Cincinnati, Metraflex, Milwaukee, Mueller, Newco, Nexus, Nibco, Powell, RP&C, Sarco, Spence, Stockham, Taco, Tasco, Thrush-Amtrol, Vogt, Watts, or approved equal.

WATER SYSTEM VALVES
All water system valves to be rated at not less than 125 psig water working pressure at 240°F unless noted otherwise.

BALL VALVES:
2-1/2" and smaller: Two piece bronze body; threaded or soldered ends, as appropriate to the pipe material; stainless steel or chrome plated brass/bronze ball; conventional port; glass filled teflon seat; threaded packing gland follower; blowout-proof stem; 600 psig WOG.

Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.

Apollo 70-100/200 series, Hammond 8301/8311, Milwaukee BA100/150, Nibco T/S 585-70, Stockham S206/216.

2-1/2" and over: Ball valves will not be accepted in sizes over 2 inch.

BUTTERFLY VALVES
2-1/2" and smaller: Use ball valves; butterfly valves will not be accepted in sizes 2 inch and smaller.

2-1/2" and larger: Cast iron body; stainless steel shaft; Teflon, nylatron, or acetal bearings; EPDM resilient seat. Disk to be bronze, aluminum-bronze, nickel plated ductile iron, cast iron with welded nickel edge, or 316 - stainless steel. Pressure rated to 150 psig. Valve assembly to be bi-directionally bubble tight to 150 psig with no downstream flange/pipe attached. Nylon coated ductile iron discs are not acceptable. Polymid or polyamide coated valves are not acceptable.

Valve stems shall allow operators to clear insulation without interference. Provide stem extensions when valve operators interfere with pipe insulation.

Use threaded lug type valves for installation with class 125/150 flanges.

Centerline series 200, DeZurik BOS-CL, Keystone Fig. 222, Nibco LD2000 (2-1/2"-12")/LD1000 (14" and above), Bray Series 31H, Victaulic 300 series (2-1/2"-12")/709 series (14"-24").

SWING CHECK VALVES:
2" and smaller: Class 125, bronze body, threaded or soldered ends, regrindable seat, bronze disc, threaded cap, suitable for installation in a horizontal or vertical line with flow upward.

Crane 137/1342, Hammond IB912/IB940, Lunkenheimer 2144/2145, Milwaukee 509/1509, Nibco T-413-B/S-413-B, Powell 578/1825, Stockham B-309/B-319.

2-1/2" and larger: Class 125, cast iron body, flanged ends, bronze trim, bolted cap, renewable bronze seat and disc, non-asbestos gasket, suitable for installation in a horizontal or vertical line with flow upward.

Crane 373, Hammond IR1124, Lunkenheimer 1790, Milwaukee F2974, Nibco F918, Powell 559, Stockham G-931.

SPRING LOADED CHECK VALVES:
2" and smaller: Class 125, bronze body, threaded, solder or wafer ends, bronze trim, stainless steel spring, teflon seat unless only bronze available.

APCO 300 series, ConBraCo 61 series, Mueller 303BP, Nibco T-480-Y/S-480-Y, Val-Matic 1400 series.

2-1/2" and larger: Class 125, cast iron or semi-steel body, wafer or globe flanged type, bronze trim, bronze or EPDM seat, stainless steel spring, stainless steel stem if stem is required. Valves with ductile iron in contact with the working fluid will not be accepted.

APCO 600 series, Metraflex 900 series, Milwaukee 1800 series, Mueller Steam 101M-AP/105M-AP, Nibco F910 series, Val-Matic 1800 series, Victaulic series 716.

BALANCE VALVES:
2" and smaller: Bronze or copper alloy body with calibrated ball, globe or venturi/valve arrangement, integral pointer and calibrated scale to register degree of valve opening, memory stop, drain tapping, threaded or soldered ends, with or without integral unions, P/T or Shraeder pressure taps with integral check valves and seals, adjustable memory stop, suitable for 200 psig water working pressure at 250°F.

Armstrong CBV, Bell & Gossett Circuit Setter Plus, Griswold Quickset, Nexus Orturi, Nibco 1710 Series, Taco Accu-Flo, Tour & Anderson STAS/STAD, Victaulic series 786/787.

DRAIN VALVES:
Use 3/4 inch ball valve with threaded hose adapter except strainer blowdown valves to be the same size as the blowdown connection. Provide hose connection caps pressure rated for 150 psig at 180 deg F.

WATER PRESSURE REDUCING VALVES:
Brass or bronze body, diaphragm operated, with an integral anti-syphon check valve, inlet strainer, adjustable reduced pressure range, and rated for 125 psig at 225 degrees F. Valve to be pre-set for the scheduled pressure.

Bell & Gossett, Cash-Acme, or Watts.

WATER RELIEF VALVES:
Iron or bronze body, direct pressure actuated, teflon seat, stainless steel stem and spring, suitable for 125 psig water working pressure at 240° F and ASME stamped, with Btu capacity and set point as scheduled.

Bell & Gossett, Cash-Acme, Consolidated, Kunkle, Watts.

NATURAL GAS SYSTEMS

SHUT OFF VALVES:
2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.

2-1/2" through 4": Cast iron body, flanged ends, bronze bearings, electroless nickel plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

PART 3 - EXECUTION

GENERAL
Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Install all temperature control valves.

Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position or where large valves are provided with chain wheel operators.

SHUT-OFF VALVES:
Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for isolation or repair.

BALANCING VALVES
Provide balancing valves for all major equipment and at each major branch takeoff and at the discharge of each pump as indicated on drawings and details.

CALIBRATED BALANCE VALVES
Install where indicated on the drawings and details for balancing of hydronic systems. Retain the shipping container for use as removable insulation.

DRAIN VALVES
Provide drain valves for complete drainage of all systems. Locations of drain valves include low points of piping systems, equipment locations specified or detailed including reheat coils, other locations required for drainage of systems.

SAFETY RELIEF VALVES

Install relief valves in locations indicated on drawings, downstream of all pressure reducing valves, and on all boilers.

Install valves in the vertical position, with drain piped to the nearest drain.

SPRING LOADED CHECK VALVES
Install a spring loaded check valve in each pump discharge line where two pumps operate in parallel and no combination shutoff, check and balancing valve is being used.

SWING CHECK VALVES

Provide swing check valves where specified, detailed, and at steam condensate lines where they rise at outlet of traps. In such cases, provide isolation valves to allow repair or replacement of check valve.

PRESSURE REDUCING VALVES

Provide ball valve and strainer at inlet. Provide gate valve at outlet.

Install pressure gauges to indicate inlet and outlet pressure at each pressure reducing valve in accordance with Section 23 05 15 - Piping Specialties.

Use eccentric reducers at inlet and outlet of reducing valves where connections are not the same size as adjacent piping.

GAS PRESSURE REGULATORS

When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for supports of all HVAC equipment and materials as well as piping system anchors.

RELATED WORK
Section 23 07 00 - HVAC Insulation

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

REFERENCE STANDARDS
MSS SP-58 Materials, Design, Manufacture, Selection, Application, and Installation

QUALITY ASSURANCE
Refer to Division 1, General Conditions, Equals and Substitutions.

DESCRIPTION
Provide all supporting devices as required for the installation of mechanical equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points; see Related Work above.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

DESIGN CRITERIA
Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 unless noted otherwise.

Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

PART 2 - PRODUCTS

PIPE HANGER AND SUPPORT MANUFACTURERS
Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

STRUCTURAL SUPPORTS
Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

PIPE HANGERS AND SUPPORTS
HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":
Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

HANGERS FOR STEEL PIPE SIZES 2-1/2" AND OVER:
Carbon steel, adjustable, clevis, black finish. Anvil figure 260.

MULTIPLE OR TRAPEZE HANGERS:
Steel channels with welded spacers and hanger rods if calculations are submitted.

WALL SUPPORT:
Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with

VERTICAL RISER SUPPORT:
Carbon steel riser clamp, copper plated when used with copper pipe. Anvil figure 261 for steel pipe, figure CT121 for copper pipe.

COPPER PIPE SUPPORT:
Carbon steel ring, adjustable, copper plated or polyvinylchloride coated.

INSULATION PROTECTION SHIELDS:
Galvanized carbon steel of not less than 18 gauge for use on insulated pipe 2-1/2 inch and larger. Minimum shield length is 12 inches. Equal to Anvil figure 167.

STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, black finish.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8

Provide rods complete with adjusting and lock nuts.

BEAM CLAMPS
MSS SP-58 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

CONCRETE INSERTS

Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same manufacturer as anchor. Hilti, Rawl, Redhead.

ANCHORS

Use welding steel shapes, plates, and bars to secure piping to the structure.

ROOF MOUNTED SUPPORTS

SUPPORTS 18" OR LESS IN HEIGHT:

Prefabricated Metal Sleeper Curb:

Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing with metal receiver cap Attach a galvanized steel channel track for securing pipe or duct roller and roller support. Do not use built-in metal base flashings or cants.

Wood Build Sleeper Curb:

Constructed of wood blocking anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing with metal receiver cap. Attach a steel channel track for securing pipe or duct roller support. Do not use built-in metal base flashings or cants.

Use galvanized structural steel members supported by pipe supports and use pipe or duct rollers fastened to the structural member. Pipe supports to be secured to the roof structure and sealed per pipe penetrations through roof specifications as specified in this section.

EQUIPMENT CURBS

Prefabricated Metal Curb:

Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load with no penetrations through the curb flashing, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density rigid fiberglass insulation, integral deck mounting flange, nominal two inch wood nailer, galvanized steel counter flashing. Do not use built-in metal base flashings or cants. Use 18 inch high equipment curbs where the curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

PIPE PENETRATIONS THROUGH ROOF

Multiple Pipe Penetrations:

Refer to acceptable Equipment Curb types listed above for curb specifications. An 8" high (minimum) curb height is required. The coping cap shall be constructed from laminated acrylic clad thermoplastic (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or mechanical locking seal for securing boots around the ABS coping cap flanges.

Single Pipe Penetrations:

A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes but is not limited to steam condensate vent piping, steam safety relief piping, and flues.

A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane roofs only.

PART 3 - EXECUTION

INSTALLATION

Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Piping shall be supported independently from ductwork and all other trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes for the supporting steel.

Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

HANGER AND SUPPORT SPACING

Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

VERTICAL RISER CLAMPS

Support vertical piping with clamps secured to the piping and resting on the building structure or secured to the building structure below at each floor.

ROOF MOUNTED SUPPORTS

Use for all pipe and ductwork on roof. Secure bottom of support flat on roof deck. Apply two coats of zinc rich paint to cut edges of all galvanized steel elements. Flashing and counter flashing by the Division 07 Contractor.

EQUIPMENT CURBS

Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment manufacturer's instructions. Flashing and counter flashing by the Division 07 Contractor.

Fill the entire void space with compressible fiberglass insulation.

PIPE PENETRATION THROUGH ROOF

Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the Division 07 Contractor.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

P A R T 1 - G E N E R A L

SCOPE
This section includes air and water testing, adjusting and balancing for the entire project.

RELATED WORK
Section 23 05 00 Common Work Results for HVAC
Section 23 07 00 HVAC Insulation
Section 23 09 14 Electric Instrumentation and Control Devices for HVAC
Section 23 09 23 Direct Digital Control System for HVAC
Section 23 09 93 Sequence of Operation for HVAC Cotrols

REFERENCE
Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

REFERENCE STANDARDS

AABC	National Standards for Total System Balance, Sixth Edition, 2002.
ASHRAE	ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing.
NEBB	Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005.
TABB	Tab Procedural Guide, First Edition, 2003.

DESCRIPTION
The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC, NEBB, or TABB.

Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

QUALITY ASSURANCE

Qualifications
An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other than that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

A certified member of AABC or certified by NEBB or TABB in the specific area of work performed. Maintain certification for the entire duration of the project. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact DFD immediately.

Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and grilles and diffusers.

PRE-INSTALLATION MEETING AND SCHEDULING

The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Mechanical Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule.

SUBMITTALS

See also Related Work in this section.

Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC or TABB Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:

* General Information
* Summary
* Air Systems
* Hydronic Systems

Contents: Provide the following minimum information, forms and data:

General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

P A R T 2 - P R O D U C T S

INSTRUMENTATION

Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or TABB Standards and instrument manufacturer's specifications.

All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB, AABC, or TABB Standards

P A R T 3 - E X E C U T I O N

PRELIMINARY PROCEDURES

Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

PERFORMING TESTING, ADJUSTING AND BALANCING

Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure

Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

Final air system measurements to be within the following range of specified cfm:

Fans	0% to +10%
Supply grilles, registers, diffusers	0% to +10%
Return/exhaust grilles, registers	0% to -10%

Final water system measurements must be within the following range of specified gpm:

Heating flow rates	0% to -10%
Cooling flow rates	-5% to +5%

Contact the temperature control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

Coordinate and assist CxP with all verification activities defined within section (01 91 01, 02) including providing all required sampling date necessary for the commissioning process.

Verify and record, in the T&B Report, "K" factors for all VAV air terminal devices and air flow stations.

Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

Coordinate Fume Hood Monitor calibration with the Fume Hood Manufacturer.

VAV SUPPLY AND EXHAUST DUCT SYSTEM STATIC PRESSURE SET POINT

For VAV supply systems with VAV air terminal devices, determine the minimum required duct static pressure at the DDC static pressure sensor location(s) needed to insure that all VAV air terminals are operating at their design airflows with the most demanding VAV terminal wide open. Provide these static pressure numbers to the DDC temperature controls contractor and record them in the T&B report for each system.

HYDRONIC SYSTEM DIFFERENTIAL PRESSURE CONTROL SET POINT

For hydronic systems with variable speed pumping, determine the minimum required system differential pressure set point needed to insure that all terminal devices are operating at their design water flows with the most demanding terminals device control valve wide open. Provide the differential control setting set point to the DDC temperature control contractor and record them in the T&B report for each system.

For HVAC pumps 10 horsepower or less, valve throttling alone may be used for hydronic system balancing.

Future fouling of an open piping system may be considered when determining impellor trim requirements.

Verify butterfly valves utilized for hydronic system balancing are provided with position-lock operators (memory stops) in accordance with Section 23 05 23. The adjustment and marking of lever-lock operators that use throttling notches will not be accepted. Lock all memory stops so the valves can be reopened to their balanced positions if they are used for isolation purposes.

DEFICIENCIES

Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the Owner's Project Representative of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the State of Wisconsin. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

P A R T 1 - G E N E R A L

SCOPE
This section includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment.

RELATED WORK
Section 23 05 00 - Common Work Results for HVAC
Section 23 11 00 - Facility Fuel Piping
Section 23 21 13 - Hydronic Piping
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 31 00 - HVAC Ducts and Casings

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C302	Density of Preformed Pipe Insulation
ASTM C272	Water Absorption of Core Materials for Sandwich Constructions
ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C921	Properties of Jacketing Materials for Thermal Insulation
ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
ASTM D5590	Test Method for Determining the Resistance of Coatings to Fungal Defacement
ASTM E84	Surface Burning Characteristics of Building Materials
ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
MICA	National Commercial & Industrial Insulation Standards
NFPA 225	Surface Burning Characteristics of Building Materials
UL 723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions

Insulation systems shall be applied by experienced contractors. Within the past five (5) years, the contractor shall be able to document the successful completion of a minimum of three (3) projects of at least 50% of the size and similar scope of the work specified in this section.

DESCRIPTION
Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

* Pipe Insulation
* Duct Insulation
* Equipment Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications.

DEFINITIONS
Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, shall be considered as exposed.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

ENVIRONMENTAL REQUIREMENTS
Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

Protect installed insulation work with plastic sheeting to prevent water damage.

P A R T 2 - P R O D U C T S

MATERIALS
Manufacturers: CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa, Johns Manville, Knauf, Owens-Corning, , Pittsburgh Corning, , VentureTape or approved equal.

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

INSULATION TYPES
Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

FLEXIBLE FIBERGLASS INSULATION:
Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.30 at 75 degrees F, rated for service to 250 degrees F.

RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, 0.25 at 125 degrees F, 0.27 at 150 degrees F, 0.29 at 200 degrees F, 0.32 at 250 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

SEMI-RIGID FIBERGLASS INSULATION:
Minimum nominal density of 3 lbs. per cu. ft., thermal conductivity of not more than 0.28 at 75 degrees F, minimum compressive strength of 125 PSF at 10% deformation, rated for service to 450 degrees F. Insulation fibers perpendicular to jacket and scored for wrapping cylindrical surfaces.

ADHESIVES, MASTIC, SEALANTS, AND REINFORCING MATERIALS
Products shall be compatible with surfaces and materials on which they are applied, and shall be suitable for use at operating temperatures of systems to which they are applied.

FIBERGLASS INSULATION ADHESIVE:
Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.

VAPOR RETARDING MASTIC:
Below ambient equipment/piping insulation, mastic water vapor permeance shall be less than 0.03 perms at 45 mils dry film thickness per ASTM E 96: Foster 30-65 Vapor Fas, Childers CP-34,
Vimasco 749.

LAGGING ADHESIVE / COATINGS:
Indoors applications used in conjunction with canvas/glass cloth: Foster 30-36, Childers CP-50 AMV1, Vimasco 713.

REINFORCING MESH:
Foster 42-24 Mast A Fab, Childers Chil Glas #10 or Pittsburgh Corning PC 79.

INSULATION JOINT SEALANT: (cellular glass, polyisocyanurate, phenolic)
Used on all below ambient piping to prevent moisture ingress. Foster 95-50 Flextra, Childers CP-76 Chil-Byl, Pittsburgh Corning CW Sealant.

JACKETS
PVC FITTING COVERS AND JACKETS (PFJ):
White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .02" indoors/.03"outdoors for piping 12" and smaller, .03" indoors/.04" outdoors for piping 15" and larger.

ALL SERVICE JACKETS (ASJ):
Heavy duty, fire retardant material with white kraft reinforced foil vapor retarding jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and minimum beach puncture resistance of 50 units.

FOIL SCRIM ALL SERVICE JACKETS (FSJ):
Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

FABRIC REINFORCED MASTIC JACKETS (FMJ):
Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer's recommended procedure for 2 coat application.

INSULATION INSERTS AND PIPE SHIELDS
Manufacturers: B-Line, Pipe Shields, Value Engineered Products.

Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2" and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-engineered/premanufactured product described above.

Wood blocks will not be accepted.

ACCESSORIES
All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be 0.015 inch for aluminum and 0.010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing used with lagging adhesive shall have a minimum untreated weight of 6 oz./sq. yd.

Joint sealants and metal jacketing sealants to be non-shrinking and permanently flexible.

Vapor retarding coatings to have maximum applied water vapor permeance of 0.03 perms or less at 45 ,ils dry as tested by ASTM E96.

Fungicidal water base duct liner coating (Foster 40-20 or equal) to be compatible with vapor retarding coating. This product must be EPA registered to be used inside HVAC ducts. Coating must comply with ASTM D 5590 with 0 growth rating.

P A R T 3 - E X E C U T I O N

EXAMINATION

Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

INSTALLATION

All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor retarding jacket shall be maintained continuous through all penetrations.

Provide a continuous unbroken moisture vapor retarding jacket on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

Provide a complete vapor retarding jacket for insulation on the following systems:

* Insulated Duct
* Equipment, ductwork or piping with a surface temperature below 65 degrees F

PROTECTIVE JACKET INSTALLATION

PVC FITTING COVERS AND JACKETS (PFJ):

Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb expansion and contraction. For sections where vapor retarding jacket is not required and jacket requires routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems requiring a vapor retarding jacket, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

ALL SERVICE JACKETS (ASJ) and FOIL SCRIM ALL SERVICE JACKETS (FSJ):

Install according to manufacturer's recommendations using factory supplied lap seals and butt strip seals.

PIPING, VALVE, AND FITTING INSULATION

GENERAL:
Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally secure with staples along seams and butt joints.

On systems requiring a vapor retarding jacket, seal off all raw ends of insulation and butt joints with vapor retarding mastic at intervals of not more than 20 feet on piping. Coat staples, longitudinal and transverse seams with vapor retarding mastic and on systems requiring vapor retarding jacket, coat insulated elbows, fittings, and valves with vapor retarding mastic.

Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior of insulation. Where a vapor retarding jacket is not required or where roller hangers are not being used, hangers and supports may be attached directly to piping with insulation completely covering hanger or support and jacket sealed at support rod penetration.

Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous through the hangers and supports. High density inserts shall be provided as required to prevent the weight of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation shall not be notched or cut to accommodate the supporting channels.

Fully insulate all reheat coil piping, fittings and valves (with the exception of unions) up to coil connection to prevent condensation when coil is inactive during cooling season. Provide a vapor proof seal between the pipe insulation and the insulated coil casing.

INSULATION INSERTS AND PIPE SHIELDS:
Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Quantity and placement of inserts shall be according to the manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

FITTINGS AND VALVES:
Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not exceed 150 degrees, furnish and install PVC fitting covers.

PIPE INSULATION SCHEDULE:
Provide insulation on new and existing remodeled piping as indicated in the following schedule:

SERVICE	INSULATION	JACKET	INSULATION THICKNESS BY PIPE SIZE				
			< 1"	1" to < 1-1/2"	1-1/2" to < 4"	4" to < 8"	8" and Larger
Heating Hot Water	Rigid Fiberglass	ASJ	1.5"	1.5"	2"	2"	2"

The following piping and fittings are not to be insulated:
* Hot water piping inside radiation, convector, or cabinet heater enclosures
* Piping unions for systems not requiring a vapor retarding Jacket

DUCT INSULATION
GENERAL:
Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.

Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.

Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape

of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed with vapor retarding mastic.

Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.

External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner. Provide 4" overlap of external insulation over ends of acoustically lined sections.

Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

DUCT INSULATION SCHEDULE:

Provide duct insulation on new and existing remodeled ductwork in the following schedule:

SERVICE	INSULATION TYPE	JACKET	THICKNESS
Outside air ducts	Rigid Fiberglass	FSJ	2"
Mixed air ducts	Rigid Fiberglass	FSJ	2"
Exposed supply ducts*	Rigid Fiberglass	FSJ	2"
Concealed supply ducts	Flexible Fiberglass	FSJ	1-1/2"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2"
Louver blank-off panels	Rigid Fiberglass	FSJ	2"

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

EQUIPMENT INSULATION

GENERAL:

Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal insulation at these locations.

SEMI-RIGID FIBERGLASS:

Apply insulation to equipment shells using weld pins, bonding adhesive, banded and wired in place. Fill all joints, seams and depressions with insulating cement to a smooth, even surface. Cover with reinforcing fabric and 2 coats of mastic (FMJ). Use vapor retarding mastic on systems requiring a vapor retarding barrier.

EQUIPMENT INSULATION SCHEDULE:

Provide equipment insulation as follows:

EQUIPMENT	INSULATION TYPE	JACKET	THICKNESS
Reheat coil casing in exposed supply ducts	Rigid Fiberglass	FSJ	2"
Reheat coil casing in concealed supply ducts	Flexible Fiberglass	FSJ	1-1/2"
Hot Water Air separators	Semi-Rigid Fiberglass	ASJ/FMJ	1.5"

END OF SECTION

SECTION 23 09 14
ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

P A R T 1 - G E N E R A L

SCOPE
This sections includes electric control system specifications for all HVAC

WORK OF SECTI ONS 23 09 14, 23 09 27, 230925 AND 23 09 93 SHALL BE PERFORMED BY A SINGLE APPROVED MATERIAL VENDOR AND INSTALLING INSTALING CONSTRATOR.

POINT LIST (Section 23 09 15)

RELATED WORK
Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC - Coordination
Section 23 09 15 - Direct Digital Control Input/Output Point Summary Tables
Section 23 09 24 - Direct Digital Control System for HVAC
Section 23 09 25 - Integrated Automation System for HVAC
Section 23 09 93 - Sequence of Operation for HVAC Controls
Division 23 - HVAC - Equipment provided to be controlled or monitored
Division 26 - Electrical - Installation requirements

REFERENCE
Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE
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.

REFERENCE STANDARDS
AMCA 500-D Laboratory Method of Testing Dampers for Rating

SYSTEM DESCRIPTION
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; and electric control for other terminal units.

Approved Vendors:
Environmental systems Inc. (ESI), 3410 Gateway Rd, Brookfield, WI 53045. 262-544-8860, 800-522-037
Mechanical Technologies, Inc. (MTI), 701 Morley Rd, Green Bay, WI 54303. 920.491.5860, 800.572.2063

SUBMITTALS
Include the following information:

Manufacturer’s data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.

Schematic flow diagrams of systems showing fans, pumps, coils, dampers, valves, and other control devices. Each control device provided under this Section shall be uniquely labeled. Duplicate labeling may be used within similar mechanical systems. Label each device with setting or adjustable range of control. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.

Details of construction, layout, and location of each temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings location of mechanical equipment

controlled (room number), horsepower and flow of motorized equipment (when this data is available on plans), locations of all remote sensors and control devices (either by room number or column lines).

Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow, and number and size of operators required.

Schedule of control valves indicating system in which the device is to be used, rated capacity, flow coefficient, flow required by device served, actual pressure drop at design flow, size of operator required, close-off pressure, and locations where valves are to be installed.

Provide a complete set of control Record Drawings incorporating DDC and electric controls as specified. Where communication and/or power wiring is specified to be provided under this Section, point to point routing of communication trunks and power wiring between DDC controllers, DDC communication devices, control panels, and Ethernet switches shall be documented in the control Record Drawings.

DEMOLITION

Remove any previously abandoned control devices in a similar manner.

DESIGN CRITERIA

Size all control apparatus to properly supply and/or operate and control the apparatus served.

Provide control devices subject to corrosive environments with corrosion protection or construct them so they are suitable for use in such an environment.

Provide devices exposed to outside ambient conditions with weather protection or construct them so they are suitable for outdoor installation.

Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

11. A complete set of record control drawings.

MATERIAL DELIVERY AND STORAGE

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.

P A R T 2 - P R O D U C T S

CONTROL DAMPERS

Provide control dampers shown on the plans and as required to perform the specified functions. Dampers shall be rated for velocities that will be encountered at maximum system design and rated for pressure equal or greater than the ductwork pressure class as specified in Section 23 31 00 of the ductwork where the damper is installed.

Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities encountered in the system.

All dampers in aluminum ductwork shall be constructed of stainless steel or aluminum.

Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

All dampers, unless otherwise specified, to be rated at a minimum of 180º F working temperature. Leakage testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless otherwise specified, shall have leakage ratings as follows:

Damper Class	DifferentialPressure	Leakage
Class IA	1” w.g.	$\leq$3 CFM/ft^2

Class I	4" w.g.	$\leq$8 CFM/ft^2

Leakage rate dampers for differential pressures that they will encounter at maximum system design pressures.

Steel framed dampers: Nailor models 2010 & 2020; Greenheck models VCD-33 & VCD-42; Johnson Controls model V-1330; Ruskin Models CD60 & CD40; other approved equal.

Aluminum frame and blade dampers: Nailor models 2010EAF & 202EAF; Greenheck model VCD-43; Ruskin model CD50; Arrow model AFD-20; other approved equal.

Dampers used for throttling or modulating applications other than air stream mixing to be opposed blade type. Two position dampers may be parallel or opposed blade type.

Dampers to have frames of not less than 16 gauge galvanized steel or 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use plated steel linkage hardware.

Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating actuators out of the air stream is impossible, obtain mounting location approval from the designer unless the contract documents indicate in air stream mounting is acceptable. In no cases shall damper actuators for fume exhaust systems be located in the air stream or require entering the air stream to service an actuator.

Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to provide tight shutoff against system temperatures and pressure encountered. For electric modulating actuation, use fully proportional actuators with zero and span adjustments. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. See 23 09 15 for specific type of input signal required. All electric actuators will be provided with overload protection to prevent motor from damage when stall condition is encountered.

Provide independently mounted damper end switches (Kele TS-475, Ruskin SP-101/105, or equal) with form "C" contacts where control sequences require damper position indication or interlock. Damper end switches shall be independent of the damper actuators and be mounted directly to the damper shaft or auxiliary shaft that is mounted to a drive blade of the damper. End switches shall not contain mercury.

All power required for electric actuation shall be provided by this contractor.

Provide operators with linkages and brackets for mounting on device served.

CONTROL VALVES

Provide all control valves as shown on the plans/details and as required to perform functions specified. Spring ranges must be selected to prevent overlap of operation and simultaneous heating and cooling.

Size operators to allow smooth and positive operation of devices served and to provide sufficient torque capacity for tight shutoff against system temperatures and pressure encountered. For pneumatic actuated systems, use rolling diaphragm, spring loaded, and piston type operators. For electric modulating actuation, use fully proportional actuators with 0-10VDC inputs and zero and span adjustments unless specified otherwise in the chart below. If TriState with feedback is specified, valve position shall be fed back to the controller and controller shall position valve based on this feedback. For two-position electric actuation use 24 VAC for DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. Electric actuators, for applications other than terminal units, shall be provided with a manual override capability. All electric actuators shall be provided with a visible position indicator.

All power required for electric actuation shall be provided by .

Provide operators that are full proportioning or two-position, as required for specified sequence of operation. Provide spring-return for applications involving fire, freeze protection, moisture protection or specified normally open/closed operation. Valves shall move to their fail positions on loss of electrical power or air pressure to the actuator. For high pressure (> 20 PSI) full proportioning pneumatic actuators, provide with zero bleed pilot positioners that are integral with the actuator. For high pressure two-positioning actuators, provide with electro-pneumatic solenoid air valve and adjustable bleed orifice integral with the actuator.

Two-position shut-off valves used for isolation of mechanical devices shall be sized for a maximum pressure drop of 2 PSI at design flow and shall be a minimum of line size.

Provide operators with linkages and brackets for mounting on device served.

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

VALVE SERVING	**TYPE** Globe Butterfly (BF) Ball Press Independent Ball (PI Ball)	**SIGNAL** 0-10 VDC TriState (24VAC) 2-Position Elect Pneumatic (Pneu)	**SPRING RETURN** REQUIRED Yes No	**FAIL POSITION** Open (thru Coil) Closed (bypass Coil) Last Position
Reheat Coil	Globe or Ball	0-10 VDC or TriState w/feedback	No	Last Position
Radiation w/Reheat	Globe or Ball	0-10 VDC or TriState	No	Last Position
Standalone Radiation	Globe or Ball	0-10 VDC	No	Last Position
CUH	Globe or Ball	TriState or 2-Pos Elect	Yes	Open

See plan details, notes, and schedules for where two-way and three-way valves should be used.
1. Existing valves shall be reused unless it is determined that the existing valves need to be replaced. Replace only when directed by the Owners Project Manager.

WATER SYSTEMS:
Use equal percentage valves for two-way control valves; size for a pressure drop not less than 4 psi or more than 6 psi. Consult with AE for acceptable pressure drop if available valve selections do not fall within the desired pressure range. Note: For low flows, the required minimum Cv size will result in lower pressure drop than 4 psi.

Characterized Ball Valves: The following manufacturers are acceptable: Honeywell, Belimo, Johnson Controls, KMC Controls, Yamatake, Bray. For use on terminal units only where specified above. 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.

Acceptable manufacturers: Belimo

Pressure Independent Characterized Ball Valves: The following manufacturers and models are acceptable: Belimo model PICCV and Griswold Controls PIC-V. For use on terminal units only where specified above. Forged brass or bronze body, 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. Flow shall be varied by actuator position and at any given position, flow through the valve shall not vary more that +/- 5% due to system pressure fluctuations across the valve in the selected operating range. Valves shall be pressure independent between a system differential pressure of 8 and 50 PSID. Minimum size for ball valves shall be 0.4 Cv.

Acceptable manufacturers: Belimo

THERMOSTAT GUARDS
Thermostat guards shall be provided at all first floor locationswhen thedevice is capable of being adjusted by the occupant.

Provide clear plastic locking covers keyed the same. For locations that are subject to physical abuse, provide metal guard.

ELECTRIC/ELECTRONIC THERMOSTATS
ELECTRIC THERMOSTATS:
For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and cooling as required. Provide the required number of heating and/or cooling stages required for the application. For line voltage ventilation applications utilizing fans and where otherwise specified in the sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating shall be equal or greater to electrical load of device being controlled.

LOW LIMIT THERMOSTATS (freezestats):
Electric two-position type with temperature sensing element and manual reset for all applications Unit to be capable of opening control circuit if any one-foot length of sensing element is subject to a temperature below the setpoint. Length of sensing element to be not less than one lineal foot per square foot of coil surface areas. Unless otherwise indicated, set low limit controls at 36°F.

DUCT SMOKE DETECTOR AND FIRE ALARM INTERFACE MODULES
Duct smoke detectors and fire alarm control modules shall be provided by others. Provide wiring, conduit, and necessary interface with fire alarm system to perform specified sequence of operation.

TEMPERATURE CONTROL PANELS
Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide asbuilt wiring/piping diagram within enclosure. Provide raceways for wiring and poly within panel for neat appearance. Provide termination blocks for all wiring terminations. Label outside of panel with panel number corresponding to plan tags and asbuilt control drawings as well as building system(s) served.

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.

For panels that have 120VAC power feeds provide a resettable circuit breaker. Provide label within the panel indicating circuit number of 120VAC serving panel

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 shutdown and which is auto.

Terminal unit sensors shall be provided with blank covers and no adjustments.

DIFFERENTIAL PRESSURE SWITCHES
Differential pressure switches shall sense both inlet and outlet of fans and pumps. Device shall be rated for 150% of maximum system pressures that may be encountered. Provide with pressure differential that will be required to meet specified operation and/or to prevent nuisance “toggling” of the device in the system served.

AIR PRESSURE SAFETY SWITCHES
Air pressure safety switches shall be a differential pressure switch that will sense differential, negative, or positive pressure as required by the sequence of operation specification. Device shall be rated for a minimum of 150% of maximum system pressures that may be encountered. Provide with pressure range that will be required to meet specified operation in the system served. Provide with a normally closed contact that will open above setpoint and will not close until the manual reset button is depressed. Setpoint shall be manually adjustable.

CURRENT STATUS SWITCHES
Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives. When used on variable speed motor applications, use a current sensor that will not change state due to varying speeds.

POWER SUPPLIES
Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies. Electrical contractor will be providing one 12o volt, single phase circuit on each floor for use by the control contractor.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install system with trained mechanics and electricians employed by the control equipment manufacturer or an authorized representative of the manufacturer. Where installing contractor is an authorized representative of the control manufacturer, such authorization shall have been in effect for a period of no less than three years.

Install all control equipment, accessories and wiring, in a neat and workmanlike manner. All control devices must be installed in accessible locations. This contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified in Section 23 09 93.

Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit except above accessible ceilings as noted below. See Wire and Air Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All raceways, enclosures, fittings and associated supports shall be provided and installed according to the requirements set forth in Division 16, NFPA 90 (NEC) and Chapter SPS 316 of the Wisconsin Administrative Code. All conduits shall be routed parallel and/or perpendicular to walls and adjacent piping. Raceways shall be located to maintain headroom and working clearance around equipment and devices that require inspection and service.

In general, support all raceways from the building structure. No component of a raceway system shall be secured to corrugated metal roof deck. Do not impose on the installations of other trades. Securing conduit, rods, straps, hangers, etc. to suspended ceiling components, electrical raceways, plumbing piping, fire protection sprinkler piping, HVAC piping or ductwork, or their associated support systems, will not be accepted.

Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

Where HVAC equipment control panels, or devices, do not provide for the direct connection of conduits, exposed wiring may be extended to complete the final connections, providing it does not exceed 18 inches in length.

Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations shall be in conduit. Wire for wall sensors shall be run in conduit. Wiring for radiation valves shall be run in conduit where routed through walls.

Where wiring is installed free-air, installation shall comply with the following:

- Wiring shall run at right angles and be kept clear of other trades work.
- Wiring shall be supported utilizing "J" or "Bridal-type" steel mounting rings anchored to ceiling concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of open design (not a closed loop) to allow additional wire to be strung without being threaded through the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting ring with a strap.
- At HVAC terminal units only, where the wiring serves a specific device; e.g. controller, actuator, transmitter, etc. associated with the unit, the j-hooks or Bridal rings required to support the wiring, may be secured to the rods or straps that support the ductwork or piping that serves the unit. Wall penetrations shall be sleeved.
- Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If wiring "sag" at mid-span exceeds 6-inches; another support shall be used.
- Wall penetrations shall be sleeved and fire stopped as specified.
- Wiring shall not be supported from existing cabling, existing tubing, plumbing or steam piping, ductwork, any component of a suspended ceiling, or electrical or communications conduit.

WIRE CONDUIT AND TUBING INSTALLATION SCHEDULE

The following conduit schedule shall apply to wire in conduit where conduit is specified wiring. Conduit and tubing referenced below shall meet specifications in Section 26 05 33 and as defined below.

Conduit other than that specified below for specific applications shall not be used.

Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

CONTROL DAMPERS

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.

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.

Coordinate installation with the sheet metal installer to obtain smooth duct transitions where damper size is different than duct size. Blank off plates will not be accepted.

Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used, provide multiple operators.

CONTROL VALVES

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.

ROOM THERMOSTATS AND TEMPERATURE SENSORS

Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Locate room thermostats and sensors with occupant adjustment 48 inches above floor. 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.

Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature seal the conduit and any other opening that will effect the measurement.

Provide guards on thermostats and as specified in Part 2, or in locations where thermostat is subject to physical damage.

LOW LIMIT THERMOSTATS (Freezestats)

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.

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.

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.

TEMPERATURE CONTROL PANELS

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.

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.

DIFFERENTIAL PRESSURE SWITCHES

Provide for each fan or pump specified, or shown on point list. Provide shutoff valves at piping takeoff points. Readjust pressure and/or differential setpoints for proper operation after final balancing is completed.

CURRENT STATUS SWITCHES

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. A separate current switch provided under this Section shall be wired in parallel with the VFD motor status relay when a bypass starter is provided on the VFD to prove motor status in the bypass mode.

OWNER TRAINING

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of 2 hours.

END OF SECTION

SECTION 23 09 24
DIRECT DIGITAL CONTROL SYSTEM for HVAC

PART 1 - GENERAL

SCOPE

Furnish all labor, materials, equipment, and service necessary for a complete and operating Direct Digital Control System (DDCS), utilizing Direct Digital Controls as shown on the drawings and as described herein. Drawings are diagrammatic only. All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

WORK OF SECTI ONS 23 09 14, 23 09 27, 230925 AND 23 09 93 SHALL BE PERFORMED BY A SINGLE APPROVED MATERIAL VENDOR AND INSTALLING INSTALING CONSTRATOR.

SYSTEM DESCRIPTION

The entire Direct Digital Control System (DDCS) shall be comprised of a network of interoperable, stand-alone digital controllers communicating via the communication protocol to Network Area Controllers (NAC), provided under Section 23 09 25. The DDCS shall include all Ethernet network wiring to create a control LAN that shall connect all NAC's, operator workstations, servers, printers, routers, switches and other network devices as indicated on the riser diagram and provided under Section 23 09 25.

Acceptable Manufacturers:
Distech, Alerton, Tridium

Approved Vendors:
Environmental systems Inc. (ESI), 3410 Gateway Rd, Brookfield, WI 53045. 262-544-8860, 800-522-037
Mechanical Technologies, Inc. (MTI), 701 Morley Rd, Green Bay, WI 54303. 920.491.5860, 800.572.2063

SPECIFICATION NOMENCLATURE

Acronyms used in this specification are as follows:

FMCS	Facility Management and Control System
DDCS	Direct Digital Control System
NAC	Network Area Controller
IDC	Interoperable Digital Controller
ASC	Application Specific Controller
PCU	Programmable Control Unit
GUI	Graphical User Interface
WBI	Web Browser Interface
POT	Portable Operator's Terminal
PMI	Power Measurement Interface
DDC	Direct Digital Controls
LAN	Local Area Network
WAN	Wide Area Network
OOT	Object Oriented Technology
PICS	Product Interoperability Compliance Statement

DIVISION OF WORK

Note that the work required by section 23 09 24 and Section 23 09 25 shall be performed by the same contractor. This paragraph only defines work included in each section.

The DDCS Contractor Section 23 09 24 shall be responsible for all controllers (IDC), control devices, control panels, controller programming, controller programming software, controller input/output wiring, power wiring, interlock and safety wiring, controller network wiring, and Ethernet LAN wiring, if applicable.

The Section 23 09 25 shall be responsible for the Network Area Controller(s) (NAC), workstations, printers, servers, software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, setup of schedules, logs and alarms, LonWorks network management, global supervisory control applications, system integration and coordination of the NAC to the local or wide area network.

RELATED WORK SPECIFIED ELSEWHERE

Section 23 09 25, System Integration:

- Providing Network Area Controllers
- LonWorks network management
- Integration of LonWorks devices
- Graphical user interface software
- Global supervisory control sequences
- Integration of owner's existing control system (if applicable)

Division 26, Electrical:

- Providing motor starters and disconnect switches (unless otherwise noted).
- Power wiring and conduit (unless otherwise noted).
- Provision, installation and wiring of smoke detectors (unless otherwise noted).

AGENCY AND CODE APPROVALS

All products of the FMCS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable. UL-916; Energy Management Systems, ULC; UL - Canadian Standards Association, FCC, Part 15, Subpart J, Class A Computing Devices.

SOFTWARE LICENSE AGREEMENT

The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

DELIVERY, STORAGE AND HANDLING

Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

JOB CONDITIONS

Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

QUALITY ASSURANCE The manufacturer of the digital controllers shall provide documentation supporting compliance with ISO-9001 (Model for Quality Assurance in Design/Development, Production, Installation and Servicing). Product literature provided by the digital controller manufacturer shall contain the ISO-9001 Certification Mark from the applicable registrar.

SUBMITTAL

Eight copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will

properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

Submittal shall also include a complete point list of all connected points to the DDC system. The DDCS Contractor shall provide catalog data sheets, wiring diagrams and point lists to the Section 23 09 25 System Integrator for proper coordination of work.

The DDCS contractor Section 23 09 24 shall he Section 23 09 25 Systems Integrator shall prior to programming equipment to insure all necessary points are provided at the time of programming for proper operation.

Upon completion of the work, provide a complete set of 'as-built' drawings and application software on magnetic floppy disk media or compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on magnetic floppy disk media or compact disk.

PART 2 – MATERIALS

GENERAL

The Direct Digital Control System (DDCS) shall be comprised of a network of interoperable, stand-alone digital controllers and other devices as specified herein.

Not all devices specified in this section may be required to complete the specified control sequences.

OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

The intent of this specification is to provide a peer-to-peer networked, distributed control system based on the LonTalk and/or BACnet communication protocols.

INTEROPERABLE DIGITAL CONTROLLERS (IDC)

IDC controllers shall be microprocessor based Interoperable LonMark□/LonWorks and/or BACnet controllers. Where possible, all Interoperable Digital Controllers shall bear the applicable LonMark□ interoperability logo on each product delivered.

Provide IDC's and ancillary devices as herein specified, as indicated on the drawings, and as necessary to perform the sequences of operation. The following equipment shall be controlled:

- Air Terminal Devices (i.e., VAV, Dual Duct, Fan Coil Units, etc.)
- Roof Top Units (fans, valve and damper actuators, sensors. etc.)
- Pumps
- Boilers (via interface provided by manufacturer)
- Connectors
- Exhaust Fans for ventilation and pressurization control
- Additional equipment outlined herein or on the Mechanical and Electrical Drawings.

Where applicable, control shall be accomplished using LonMark□ based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, such as some freely programmable controllers, the manufacturer must provide an XIF file for the device to the Section 23 09 25 System Integrator. Publicly available specifications for the Applications Programming Interface (API) must be provided to the Section 23 09 25 System Integrator for each controller defining the programming or setup of each device. The DDCS Contractor shall provide all programming and documentation necessary to set up and configure the supplied devices per the specified sequences of operation.

The DDCS Contractor shall route the LonWorks and/or BACnet MSTP network trunk to the Network Area Controller (NAC) as indicated on the riser diagram in the bid documents. Coordinate locations of the NAC with the Section 23 09 25 System Integrator to ensure that maximum network wiring distances, as specified

by the LonWorks and BACnet wiring guidelines, are not exceeded. A maximum of 70 devices may occupy any one LonWorks and/or BACnet MSTP trunk. LonWorks trunks must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonTalk communication transceivers.

The Network Area Controller (NAC), supplied under Section 23 09 25. Section 23 09 25 will provide all scheduling, alarming, trending, and network management for the LonMark/LonWorks and/or BACnet-based devices.

The IDCs shall communicate with the NAC at a baud rate of not less than 32K baud. The IDC shall provide LED indication of communication and controller performance to the technician, without cover removal.

All IDCs shall be fully application programmable and shall at all times maintain their LONMARK certification, if so certified. Controllers offering application selection only (non-programmable), require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory, which is not dependent upon the presence of a battery, to be retained.

The DDCS Contractor supplying the IDC's shall provide, at a minimum, the following documentation for each device:

- Network Variable Inputs (nvi's); name and type
- Network Variable Outputs (nvo's); name and type
- Network configuration parameters (nci, nco); name and type
- BACnet Object Type, Object Instance and description

It is the responsibility of the DDCS Contractor to ensure that the proper Network Variable Inputs and Outputs (nvi and nvo) and/or BACnet objects are provided in each IDC and are exposed for connection to them by the Section 23 09 25 System Integrator, as required by the point charts. Refer to the software point charts for the required functionality (read-only, write-only, read-write) for each data point. Use of manufacturer-specific Network Variables and/or BACnet objects shall not be permitted, unless software is provided to allow the use of them by anythird-party network management tool.

All IDC's shall be capable of being managed (upload, download, discovery, reload, bindings, etc.), by any Lon network management tool. IDC's that can be managed only with LNS-based tools or plug-ins built exclusively for LNS, shall not be permitted.

The DDCS Contractor shall provide two copies of the IDC programming tool and configuration tool, with documentation, to the owner.

- This tool shall allow the owner to fully program, configure, diagnose and otherwise manage the controller, without limitations.
- The tool shall be of the latest revision currently in production release by the manufacturer.
- The tool shall be licensed to the owner and shall not require annual license renewal fees.
- The tool shall not be dependent on the LNS network management system in order to properly function and shall be capable of running as a stand-alone application on a Windows XP operating system. Use of LNS-based plug-ins for programming and configuration are not acceptable.

CONTROL SYSTEM HARDWARE

INTEROPERABLE DIGITAL CONTROLLERS

APPLICATION SPECIFIC CONTROLLER (ASC)

Each terminal unit shall have a LONWorks® and/or BACnet-based DDC Application Specific Controller (ASC) designed to provide the specified sequences. The controller shall be LONMark® certified, shall store all specific control sequences and program settings in non-volatile memory.

Each ASC shall perform all intended temperature control functions in a 'standalone' mode should the unit incur a loss of communications.

The complete ASC including accessory devices such as relay, transducers, power supplies, etc., shall be factory-mounted, wired and housed in a NEMA 1 enclosure or as required by the location and local code requirements.

Each ASC shall allow Peer-to-Peer communications over the LON utilizing free-topology transceivers over a single pair 22 AWG twisted, stranded cable, Category 5 or Level IV.

All ASC's shall be provided as self sufficient units to maximize reliability and shall include internal 'soft' clock, operating systems, communication timing and interrupt controls, and shall be suitable for the specified applications.

In the event of a power outage or controller reset, each ASC shall enter a preprogrammed state on power re-application. Upon application of power to the ASC, all control conditions will start from an 'off' / 'closed' position or the default state. This state will be maintained for an automatically adjusted amount of time. Once this time delay has passed, the ASC control sequence shall resume according to current values

Network and controller-to-controller communications must conform to LONTalk® standards.

All ASC's shall be provided with a communications port to allow connection of any industry standard laptop PC and custom configuration tools. Program access via this communications port allows direct field modification of the configuration parameters.

Digital Inputs:
- All digital inputs shall be over voltage protected.
- Digital input types supported by the CU:
  - Normally open contacts (24V and 120V).
  - Normally closed contacts (24V and 120V).
  - Current/no current.
  - Voltage/no voltage.
  - Pulse/Totalizer contacts.

Digital Outputs:
- All digital outputs shall be 24 volt AC, current sinking, 0.5 amp opto-isolated triacs.
- Digital outputs shall be capable of handling maintained as well as pulsed outputs for momentary or magnetic latching circuits. It shall be possible to configure outputs for 3-mode control (fast-slow-off) and 2-mode control.

Analog Inputs:
- All analog inputs shall be over voltage protected.
- The analog to digital resolutions shall be a minimum of 10 bit.
- Analog inputs shall accept the following temperature types: 10K Ohm thermistor, 20K Ohm thermistor, or 1K Ohm RTD.
- Inputs shall be configurable to accept a wide range of inputs including: 4-20mA, 1-5Vdc, 2-10Vdc, etc.

Analog Outputs:
- The ASC shall accommodate true analog outputs. Voltage (0-10V) and current (4-20 mA) outputs shall be accommodated.
- All analog outputs shall be proportional current or voltage type.
- The digital to analog resolution shall be a minimum of 10 bit.
- Outputs shall be configurable so that 0-100% output commands can represent any portion of the output voltage/current range.
- Outputs shall be reversible so that an increasing output command yields a decreasing electrical signal.

In addition to local physical or internal I/O, each ASC shall support distributed, or 'bound' I/O. This bound I/O canbe used to allow the ASC to provide I/O data to another controller on the LON or to allow another controller to provide data to the controlling ASC.

The following modes of control shall be incorporated into each ASC:

- Occupied shall be a mode designed for normal occupied control of an area during regular business hours. This mode shall have unique heating and cooling setpoints associated with it.
- Unoccupied shall be a mode designed for after hours control of an area. This mode shall have unique heating and cooling setpoints associated with it.
- Override shall be a mode designed to invoke normal occupied control during after hours of an area. This mode shall use the occupied heating and cooling setpoints.
- Economy shall be a mode designed for normal occupied times when energy demand usage is high and control setpoints need to be adjusted for lower energy use. This mode shall have unique heating and cooling setpoints associated with it.
- Morning Warm-Up on units with a outdoor air economizer shall be a mode designed for the pre-heat/pre-cool time before normal occupancy occurs. This mode shall allow heating or cooling as required by the occupied setpoints but it will prevent outdoor air from entering the space. The outdoor air will move to its minimum position once the morning warm-up mode is over and the occupied mode is activated.
- Morning Warm-Up on VAV units shall be a mode designed for the pre-heat/pre-cool time before normal occupancy occurs. This mode shall allow heating or cooling as required by the occupied setpoints but it will prevent the VAV box from maintaining a minimum air flow until the morning warm-up mode is over and the occupied mode is activated.

VAV box ASC's shall have an integral damper actuator and shall be the manufacturer's standard VAV box controller.

It shall be the responsibility of the control contractor to verify that VAV box controllers will physically fit into the VAV box controls enclosure, and that the controllers can register the expected minimum and maximum flow rates utilizing the flow probe provided by the VAV box manufacturer.

PROGRAMMABLE CONTROL UNITS (PCU'S)

A LONWorks® based DDC Programmable Control Unit (PCU) shall be provided where required to perform the sequence of operation. The PCU shall be fully configurable by configuration tool. The controller shall be store all specific control sequences and program settings in non-volatile memory.

All PCU processors shall be Echelon based 3150 Neurons operating at 5 MHz or higher with 8K of RAM and 64K of Flash memory with a minimum 10 year memory retention between program downloads.

Each PCU shall perform all intended temperature control functions in a 'standalone' mode should the unit incur a loss of communications.

The complete PCU including accessory devices such as relay, transducers, power supplies, etc., shall be factory-mounted, wired and housed in a NEMA 1 enclosure or as required by the location and local code requirements.

Each PCU shall allow Peer-to-Peer communications over the LON utilizing free-topology transceivers over a single pair 22 AWG twisted, stranded cable.

All PCU's shall be provided as self sufficient units to maximize reliability and shall include internal 'soft' clock, operating systems, communication timing and interrupt controls, and shall be suitable for the specified applications.

In the event of a power outage or controller reset, each PCU shall enter a preprogrammed state on power re-application. Upon application of power to the PCU, all control conditions will start from an 'off' / 'closed' position or the default state. This state will be maintained for an automatically adjusted amount of time. Once this time delay has passed, the PCU control sequence shall resume according to current values

Network and controller-to-controller communications must conform to LONTalk® standards.

All PCU's shall be provided with a communications port to allow connection of any industry standard laptop PC and custom configuration tools. Program access via this communications port allows direct field modification of the configuration parameters.

Digital Inputs:
• All digital inputs shall be over voltage protected.
• Digital input types supported by the CU:
  - Normally open contacts (24V and 120V).
  - Normally closed contacts (24V and 120V).
  - Current/no current.
  - Voltage/no voltage.
  - Pulse/Totalizer contacts.

Digital Outputs:
• All digital outputs shall be 24 volt AC, current sinking, 0.5 amp opto-isolated triacs.
• Digital outputs shall be capable of handling maintained as well as pulsed outputs for momentary or magnetic latching circuits. It shall be possible to configure outputs for 3-mode control (fast-slow-off) and 2-mode control. Analog Inputs:
• All analog inputs shall be over voltage protected.
• The analog to digital resolutions shall be a minimum of 10 bit.
• Analog inputs shall accept the following temperature types: 10K Ohm thermistor, 20K Ohm thermistor, or 1K Ohm RTD.
• Inputs shall be configurable to accept a wide range of inputs including: 4-20mA, 1-5Vdc, 2-10Vdc, etc.

Analog Outputs:
• The ASC shall accommodate true analog outputs. Voltage (0-10V) and current (4-20 mA) outputs shall be accommodated.
• All analog outputs shall be proportional current or voltage type.
• The digital to analog resolution shall be a minimum of 10 bit.
• Outputs shall be configurable so that 0-100% output commands can represent any portion of the output voltage/current range.
• Outputs shall be reversible so that an increasing output command yields a decreasing electrical signal.

In addition to local physical or internal I/O, each ASC shall support distributed, or 'bound' I/O. This bound I/O can be used to allow the ASC to provide I/O data to another controller on the LON or to allow another controller to provide data to the controlling ASC.

The following modes of control shall be incorporated into each PCU:

Occupied shall be a mode designed for normal occupied control of an area during regular business hours. This mode shall have unique heating and cooling setpoints associated with it.

Unoccupied shall be a mode designed for after hours control of an area. This mode shall have unique heating and cooling setpoints associated with it.

Override shall be a mode designed to invoke normal occupied control during after hours of an area. This mode shall use the occupied heating and cooling setpoints.

Morning Warm-Up on units with an outdoor air economizer shall be a mode designed for the pre-heat/pre-cool time before normal occupancy occurs. This mode shall allow heating or cooling as required by the occupied setpoints but it will prevent outdoor air from entering the space. The outdoor air will move to its minimum position once the morning warm-up mode is over and the occupied mode is activated.

Morning Warm-Up on VAV units shall be a mode designed for the pre-heat/pre-cool time before normal occupancy occurs. This mode shall allow heating or cooling as required by the occupied setpoints but it will prevent the VAV box from maintaining a minimum air-flow until the morning warm-up mode is over and the occupied mode is activated.

TEMPERATURE SENSORS AND TRANSMITTERS

General Sensor & Transmitter Requirements

- Provide sensors and transmitters required as outlined in the input/output summary and sequence of operation, and as required to achieve the specified accuracy as specified herein.
- Temperature transmitters shall be equipped with individual zero and span adjustments. The zero and span adjustments shall be non-interactive to permit calibration without iterative operations. Provide a loop test signal to aid in sensor calibration.
- Temperature transmitters shall be sized and constructed to be compatible with the medium to be monitored. Transmitters shall be equipped with a linearization circuit to compensate for non-linearities of the sensor and bridge and provide a true linear output signal.
- Temperature sensors shall be of the resistance type and shall be 10K or 20K Ohm Thermistor type.
  - Thermistors are acceptable provided the mathematical relationship of a thermistor with respect to resistance and temperature with the thermistor fitting constraints is contained with the controllers operating software and the listed accuracy's can be obtained. Submit proof of the software mathematical equation and thermistor manufacturer fitting constants used in the thermistor mathematical/expressions. Thermistors shall be of the Thermistor (NTC) Type with a minimum of 50 ohm/°C. resistance change versus temperature to insure good resolution and accuracy. Thermistors shall be certified to be stable ±0.13°C. over 5 years and ±0.2°C. accurate and free from drift for 5 years.
- The following accuracy's are required and include errors associated with the sensor, lead wire and A to D conversion.

Point Type	Accuracy
Outside Air	+/-3%
Hot Water	+/-1%
Room Temperature	+/-1%
Steam	+/-5%
Duct Temperature	+/-3%

Thermowells:

- When thermowells are required, the sensor and well shall be supplied as a complete assembly including well head and greenfield fitting, except where wells are to be installed under separate contract.
- Thermowells shall be pressure rated and constructed in accordance with the system working pressure
- Thermowells and sensors shall be mounted in a threadolet or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
- Thermowells shall be constructed of the following materials:
  - Hot Water; brass.

Outside Air Sensors:

- Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
- Sensors exposed to wind velocity pressures shall be shielded by a perforated plate surrounding the sensor element. • Temperature transmitters shall be of NEMA 3R construction and rated for ambient temperatures.
- Solar load sensors shall be provided in locations shown. The use of a thermistor combined with a solar compensator is acceptable. Provide calibration charts as part of the O&M Manual.

Duct Type Sensors:

- Duct mount sensors shall mount in a hand box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement. A neoprene grommet (sealtite fitting and mounting plate) shall be used on the sensor assembly to prevent air leaks.
- Duct sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate. Duct sensors probe shall be constructed of 304 stainless steel.
- For outdoor air duct applications, use a weatherproof mounting box with weatherproof cover and gasket.

Averaging Duct Type Sensors:

- Where called out on the drawings and points lists, provide averaging type duct sensors. Thermistor sensors are acceptable. The sensor shall be multi-point sensitive through the length of the temperature conducting tubing. The thermistors shall be configured in a series / parallel method which creates an end result of total average resistance equal to the same span as a standard thermistor.
- Provide capillary supports at the sides of the duct to support the sensing element.

Acceptable Manufacturers: BAPI, Tac/Invensys, Staefa, ACI

DIFFERENTIAL PRESSURE TRANSMITTERS AND ACCESSORIES

General Air and Water Pressure Transmitter Requirements:

- Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage and to hold calibrated accuracy when subject to a momentary 40% over-range input.
- Pressure transmitters shall provide the option to transmit a 0 to 5V dc, 0 to 10V dc, or 4 to 20 mA output signal.
- Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device and shall be supplied with shutoff and bleed valves in the high and low sensing pick-up lines (3 valve manifolds).
- Provide a minimum of a NEMA 1 housing for the transmitter. Locate transmitters in accessible local control panels wherever possible.
- Low air pressure, differential pressure transmitters used for room pressurization control (i.e. laboratories, OR's clean rooms, etc.) shall be equipped with a LED display indicating the transmitter output signal.
- Duct sensing pressure applications where the velocity exceeds 1500 fpm shall utilize a static pressure traverse probes.

Low Air Pressure Applications (0 to 125 Pa)

- The pressure transmitter shall be capable of transmitting a linear electronic signal proportional to the differential of the room and reference static pressure input signals with the following minimum performance specifications.
  - Span: Not greater than two times the design space DP.
  - Accuracy: Plus or minus 0.5% of F.S.
  - Dead Band: Less than 0.3% of output.
  - Repeatability: Within 0.2% of output.
  - Linearity: Plus or minus 0.2% of span.
  - Response: Less than one second for full span input.
  - Temperature Stability: Less than 0.05% output shift per degree C change.
- The transmitter shall utilize variable capacitance sensor technology and be immune to shock and vibration.
- Acceptable Manufacturers: BAPI, Setra, Veris, Mamac

Medium to High Air Pressure Applications (125 Pa to 2500 Pa)

- The pressure transmitter shall be similar to the Low Air Pressure Transmitter except the performance specifications are not as severe. Provide differential pressure transmitters which meet the following performance requirements.
  - Zero & span: (% F.S./Deg. C): .05% including linearity, hysteresis and repeatability
  - Accuracy: 1% F.S. (best straight line)
  - Static Pressure Effect: 0.5% F.S. (to 700 KPa)
  - Thermal Effects: <±.05% F.S./Deg. C. over 5°C. to 40°C. (calibrated at 22°C.)
- Acceptable manufacturers: BAPI, Setra, Veris, Mamac

LOW DIFFERENTIAL, WATER PRESSURE APPLICATIONS (0 KPa to 5 KPa)

The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20mA output in response to variation of flow meter differential pressure or water pressure sensing points.

The differential pressure transmitter shall have non-interactive zero and span adjustments adjustable from the outside cover and meet the following performance specifications.

- 0 – 10 KPa input differential pressure range
- 4 - 20 mA output
- Maintain accuracy up to 20 to 1 ratio turndown
- Reference Accuracy: ± 0.2% of full span

Provide a two year warranty for each transmitter. Replace all transmitters found to be defective at no cost to the Owner during the warranty period. Acceptable Manufacturers: Tobar, Foxboro, Omega, Bailey, Modus, Setra

MEDIUM TO HIGH DIFFERENTIAL WATER PRESSURE APPLICATIONS (5 KPa to 700 KPa)

The differential pressure transmitter shall meet the low pressure transmitter specifications except the following:

- Differential pressure range: 5 KPa to 700 KPa.
- Reference Accuracy: ±l% of full span (includes non-linearity, hysteresis, and repeatability)
- Warranty: 1 year.

Acceptable Manufacturers: BAPI, Veris, Mamac, Setra

Bypass Valve Assembly: Mount stand-alone pressure transmitters in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with hi and low connections piped and valved. Air bleed units, bypass valves and compression fittings shall be provided

ELECTRONIC VALVE AND DAMPER ACTUATORS

General Requirements:

- Electronic actuators shall be electric, direct-coupled type capable of being mounted over the shaft of the damper. They shall be UL listed and the manufacturer shall provide a 2 year unconditional warranty from the date of commissioning. Power consumption shall not exceed 8 watts or 15 VA of transformer sizing capacity per high torque actuator nor 2 watts or 4 VA for VAV actuators. Sound level shall not exceed 45 dB for high torque nor 35 dB for VAV actuators.
- Electronic overload protection shall protect actuator motor from damage. If damper jams actuator shall not burn-out. Internal end switch type actuators are not acceptable. Actuators may be mechanically and electrically paralleled on the same shaft to multiply the available torque. A reversing switch shall be provided to change action from direct to reverse in relation to control signal as operation requires.
- Warranty must be two years by manufacturer on actuator as a whole and all components.

Acceptable manufacturers: Belimo

Control Damper Actuators:

- OA (outside air), RA (return air), and EA (exhaust air) actuators shall be spring return type for safety functions. Individual battery backup or capacitor return is not acceptable.
- The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within ± 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating damper position. Accuracy shall be within ± 2.5%.

Miscellaneous Damper Actuators:

- OA combustion and ventilation air intake REA (relief air), and EA damper actuators shall be 2 position spring return closed if any water piping, coils or other equipment in the space which the damper serves needs to be protected from freezing. Otherwise drive open, drive closed type 2 position may be used. The minimum torque for any actuator shall be 5 N-m.
- Provide auxiliary switches on damper shaft or blade switch to prove damper has opened on all air handling equipment handling 100% outside air and greater than 6 KPa TSP.

Air Terminals:
Air terminal actuators shall be minimum 5 N-m torque and use fully modulating floating (drive open, drive closed) 3 wire control or use control circuit as detailed in control dampers depending on the controllers requirements.

Approved Vendors: Belimo

VALVE ACTUATORS

Control Valves Actuators (3 inch and smaller):

- Actuators shall have a gear release button on all non-spring return models to allow manual setting. The actuator shall have either an insulating air gap between it and the linkage or a non-conducting thermoplastic linkage. Care shall be taken to maintain the actuator's operating temperatures and humidity within its specifications. Pipes shall be fully insulated and heat shields shall be installed if necessary. Condensation may not form on actuators and shall be prevented by a combination of insulation, air gap, or other thermal break.
- The control circuit shall be fully modulating using 2 - 10 volt or 4 - 20 mA signals. Accuracy and repeatability shall be within 1/21 of control signal. A 2 - 10 v or 4 - 20 mA signal shall be produced by the actuator which is directly proportional to the shaft clamp position which can be used to control actuators which are paralleled off a master motor or to provide a feedback signal to the automation system indicating valve position.
- Valve body and actuators shall be shipped fully assembled and tested at the valve factory prior to shipment.

Control Valve Actuators (4 inch and larger):

- The valve actuator shall consist of a permanent split capacitor, reversible type electric motor which drives a compound epicycle gear. The electric actuator shall have visual mechanical position indication, readable from a distance of 8 meters, showing output shaft and valve position. Unit shall be mounting directly to the valves without brackets and adapters, or readily adapted to suit all other types quarter-turn valves.
- The actuator shall have an integral terminal strip, which, through conduit entries, will ensure simple wiring to power supplies. Cable entries shall have UL recommended gland stops within the NPT hole to prevent glands from being screwed in too far and damaging cable.
- The actuator shall be constructed to withstand high shock and vibrations without operations failure. The actuator cover shall have captive bolts to eliminate loss of bolts when removing the cover from the base. One copy of the wiring diagram shall be provided with the actuator.
- The actuator shall have a self-locking gear train which is permanently lubricated at the factory. The gearing shall be run on ball and needle bearings. Actuators with 70 N-m or more output torque shall have two adjustable factory calibrated mechanical torque limit switches of the single-pole, double-throw type. The motor shall be fitted with thermal overload protection. Motor rotor shaft shall run in ball bearings at each end of motor.
- The actuator housing shall be hard anodized aluminum for full environmental protection.
- The environmental temperature range of the actuator shall be -30°C to +60°C.
- For intermittent on/off service, the actuator shall be rated at a 20% duty cycle (i.e., 12 minutes extended duty in every hour, or alternatively; one complete cycle every 2 minutes). For more frequent cycling and modulating service, an actuator shall be rated for continuous duty. The actuator rated for continuous duty shall be capable of operating 100% of the time at an ambient temperature of 40°C.
- The actuator shall have an integral self-locking gear train. Motor brakes shall not be required to maintain desired valve position. Levers or latches shall not be required to engage or disengage the manual override. Mechanical travel stops, adjustable to 15° in each direction of 90° rotation shall be standard, as well as two adjustable travel limit switches with electrically isolated contacts. Additional adjustable switches shall be available as option.
- Single Phase Motor: The motor shall have Class B insulation capable of withstanding locked-rotor for 25 seconds without overheating. Wiring shall also be Class B insulation. An auto-reset thermal cut-out protector shall be embedded in the motor windings to limit heat rise to 80°C in a 40°C ambient. All motors

shall be capable of being replaced by simply disconnecting the wires and then removing mounting bolts. Disassembly of gears shall not be required to remove the motor.

- Materials of Construction: The electric actuator shall have a pressure die-cast, hard anodized aluminum base and cover. The compound gear shall be made of die-cast, hard anodized aluminum or steel. An alloy steel worm gear shall be provided for manual override and torque limiting. Bearings for gears shall be of the ball and needle type; bronze bearings shall be used on the shafting parts.
- Accessories: Potentiometer for providing continuous feedback of actuator position at the controller (for valves specified position feedback).

Acceptable manufacturers: Belimo

CONTROL VALVES

Control valves shall be 2-way or 3-way pattern as shown constructed for tight shutoff and shall operate satisfactorily against system pressures and differentials. Two-position valves shall be 'line' size. Proportional control valves shall be sized for a maximum pressure drop of 5.0 psi at rated flow (except as may be noted on the drawings). Valves with sizes up to and including 2 inches shall be "screwed" configuration and 2-1/2 inch and larger valves shall be "flanged" configuration. Electrically controlled valves shall include spring return type actuators sized for tight shut-off against system pressures and furnished with integral switches for indication of valve position (open-closed).

Acceptable manufacturers: Belimo

SWITCHES

Differential Pressure Switches:

- All pressure sensing elements shall be corrosion resistant. Pressure sensing elements shall be bourdon tubes, bellows, or diaphragm type. Units shall have tamper-proof adjustable range and differential pressure settings.
- Pressure sensor switch contacts shall be snap action micro-switch type. Sensor assembly shall operate automatically and reset automatically when conditions return to normal. Complete sensor assembly shall be protected against vibration at all critical movement pivots, slides and so forth.
- Differential pressure switches shall be vented to withstand a 50% increase in working pressure without loss of calibration.
- Acceptable Manufacturers: Mercoid, Dwyer, McDonnell Miller

Electric Low Limit Thermostat (Freeze Stat):

- Duct type, fixed 3 degrees Celsius differential, range 0 to 15 degrees Celsius. Sensing element shall be a 7 meter long capillary tube responding to the lowest temperature sensed along any 30 cm of bulb length. Switch shall be SPDT 120/240 volts AC, rated for 10 amps at 120 volts full load. Unit shall be manually reset. Provide one low limit thermostat for each 2 square meter or fraction thereof of coil surface area.
- Provide DPST switches, 1 NO, 1 NC contact.
- Provide manual type low limit thermostat set at 2 degrees Celsius on each air handling unit.
- Provide thermostat override on air handling units for smoke control in area being served.

Water Flow Switches:

- UL listed, suitable for all service application conditions. Body minimum working pressure rating shall equal or exceed service pressure. Switch electrical rating shall be 230 volts AC 3.7 ampere, 115 volts AC 7.4 ampere, and 125 VAC 115-230 VAC AC Pilot duty. Unit shall have two SPDT switches. Actuating flow rated shall be field adjustable for the specified and indicated service. Switch location shall preclude exposure to turbulent or pulsating flow conditions. Flow switch shall not cause pressure drop exceeding 2 psi at maximum system flow rate.
- Acceptable Manufacturer: McDonnel-Miller.

Strap-On Aquastat: UL listed, provided with a suitable removable spring clip for attaching aquastat to pipe and a snap-action SPDT switch. Switch setpoint shall be as indicated. Electrical rating shall be 5 amperes, 120 VAC.

Current Sensitive Switches: Solid state, split core current switch that operates when the current level (sensed by the internal current transformer) exceeds the adjustable trip point. Current switch to include an integral LED for indication of trip condition and a current level below trip set point.

FLOW, PRESSURE AND ELECTRICAL MEASURING APPARATUS

Traverse Probe Air Flow Measuring Stations:

- Traverse probes shall be a dual manifolded, cylindrical, type constructed of 3003 extruded aluminum with an anodized finish to eliminate surface pitting and unnecessary air friction. The multiple total pressure manifold shall have sensors located along the stagnation plane of the approaching air flow and without the physical presence of forward projecting sensors into the airstream. The static pressure manifold shall incorporate dual offset static tips on opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as $\pm 20^{o}$ in the approaching airstream.
- The air flow traverse probe shall not induce a measurable pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the airstream. Each airflow measuring probe shall contain multiple total and static pressure sensors placed at equal distances along the probe length. The number of sensors on each probe and the quantity of probes utilized at each installation shall comply with the ASHRAE Standards for duct traversing.
- Traverse probes shall be accurate to ±25% of the measured airflow range down to 60 Pa static pressure.
- Each flow measuring station shall be complete with its own dedicated microprocessor with a 4-line, 80 character, Alpha Numeric display and full function key pad. The panel shall be fully programmable and display calculated liters per minute directly on a LED monitor on the panel face.
- Provide 24 volt 1 phase power to each flow measuring station.
- Acceptable Manufacturers: Air Monitor, Ultratech, Air Sentinel, Ebtron

Shielded Static Pressure Sensor:

- Provide for each zone where required a shielded static pressure sensor suitable for ceiling surface mounting, complete with multiple sensing ports, pressure impulse suppression chamber with minimum volume of 800 cubic centimeters, airflow shielding, and 3/8" compression takeoff fittings, all contained in a welded stainless steel casing, with polish finish on the exposed surfaces.
- These probes shall be capable of sensing the static pressure in the proximity of the sensor to within 1% of the actual pressure value while being subjected to a maximum airflow of 300 meters per minute from a radial source.
- The shielded static sensing devices shall be used for both reference and space pressure sensing.
- Pressure sensors used for outside air pressure reference purposes shall be equipped with a conduit seal for pneumatic tubing and bushings for a weather tight installation.

Static Pressure Traverse Probe:

- Provide multipoint traverse probes in the duct at each point where static pressure sensing is required.
- Each duct static traverse probe shall contain multiple static pressure sensors located along the exterior surface of the cylindrical probe. Pressure sensing points shall not protrude beyond the surface of the probe.

- The duct static traverse probe shall be of 304 stainless steel construction and (except for 3/4" dia. probes with lengths of 60 cm or less) be complete with threaded end support rod, sealing washer and nut, and mounting plate with gasket and static pressure signal fitting. The static traverse probe shall be capable of producing a steady, non-pulsating signal of standard static pressure without need for correction factors, with an instrument accuracy of 21.
- Acceptable Manufacturers: Mamac, STAT-Probe/l, Veris, Setra, BAPI

Venturi Flowmeter

- Pressure drop on venturi type flowmeters shall not exceed 60 Pa. Each venturi low and high pressure taps shall be equipped with nipples, valves and quick disconnects.
- Equip each venturi with a metal identification tag indicating the size, location, Liters Per Minute (LPM) and meter reading for the LPM specified.

- Provide (1) dial differential pressure meter of the proper range to determine piping system flow rate. The meter shall be the property of the Owner.
- Venturi meters shall utilize flanged or screwed connections for removal purposes and shall be rated for the system operating pressures.
- The venturi flowmeter shall be factory calibrated to provide a minimum of flow accuracy between actual and factory flow calibration data.
- Acceptable Manufacturers: Barco, Gerand, Aeroquip

RELAYS AND CONTACTORS

Relays other than those associated with digital output cards shall be general purpose, enclosed type and protected by a heat and shock resistant duct cover. Number of contacts and operational function shall be as required.

Solid State Relays (SSR): Input/output isolation shall be greater than lOE^{9} ohms with a breakdown voltage of 1500V root mean square or greater at 60 Hz. The contact life shall be 10 x 10 E^{6} operations or greater. The ambient temperature range of SSRs shall be -28 to +60°C. Input impedance shall not be less than 500 ohms. Relays shall be rated for the application. Operating and release time shall be for 100 milliseconds or less. Transient suppression shall be provided as an integral part of the relay.

Contactors: Contactors shall be of the single coil, electrically operated, mechanically held type. Positive locking shall be obtained without the use of hooks, latches, or semipermanent magnets. Contractor shall be double-break-silver-to-silver type protected by arcing contacts. The number of contacts and rating shall be selected for the application. Operating and release times shall be 100 milliseconds or less. Contactors shall be equipped with coil transient suppression devices.

TEMPERATURE CONTROL PANELS

Furnish temperature control panels of code gauge steel with locking doors for mounting all devices as shown. Panels shall conform to NEMA 1 standards, unless otherwise indicated.

Control panels shall meet all requirements of UL508A and shall be so certified.

All external wiring shall be connected to terminal strips mounted within the panel.

Provide engraved phenolic nameplates identifying all devices mounted on the face of control panels and the identification number of the panel.

A complete set of ‘as-built’ control drawings (relating to the controls within that panel) shall be furnished within each control panel.

PART 3 – EXECUTION

INSTALLATION

All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the Direct Digital Control System manufacturer or its exclusive factory authorized installing contracting field office (representative). The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package verifying longevity of the installing company's relationship with the manufacturer. Supervision, calibration and checkout of the system shall be by the employees of the local exclusive factory authorized temperature control contracting field office (branch or representative).

Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

Drawings of Direct Digital Control Systems are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative to the complete satisfaction of the Engineer and Owner shall be furnished and installed without additional cost.

Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the DDCS Contractor in accordance with these specifications.

Equipment furnished by the HVAC Contractor that is normally wired before installation shall be furnished completely wired. Control wiring normally performed in the field will be furnished and installed by the DDCS Contractor. All control devices mounted on the face of control panels shall be clearly identified as to function and system served with permanently engraved phenolic labels. All electrical control wiring and power wiring to the control panels shall be the responsibility of the DDCS Contractor.

The electrical contractor (Division 26) shall furnish all power wiring to electrical starters and motors.

All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All DDCS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where DDCS plenum rated cable wiring is allowed, it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

WIRING

GENERAL REQUIREMENTS

Install low voltage power and LON and LAN communication trunks in conduit in the following locations regardless of local building code allowances otherwise.

- Mechanical rooms.
- Electrical rooms.
- Vertical risers (exception: fire rated continuous closet like a telephone closet).
- Open Areas where the wiring will be exposed to view or tampering.

Splices:

- Splices in shielded cables shall consist of terminations and the use of shielded cable couplers which maintain the integrity of the shielding. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties as specified herein. Splices are not permitted in the FMS LAN or LON communication cables.
- Follow manufacturer suggested procedures for proper slicing.

Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls

Tag all equipment, panels, cables, conduits, junction boxes, etc., as called out in the “Identification” section of this specification and as shown on the drawings.

Perform installation of all devices in the manner specified by each manufacturer. Aside from product submittal requirements, provide manufacturer’s installation instructions for verification as requested by the DGS agent.

Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:

- Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
- All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.

Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

Where Class 2 wiring is run exposed, wiring to be run parallel along a surface or perpendicular to it, and NEATLY tied at 3m intervals.

All wire-to-device connections shall be made at a terminal blocks or terminal strip. All wire-to-wire connections shall be at a terminal block, or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

ETHERNET NETWORK REQUIREMENTS

Wired network communication shall be via channels consisting of Category 5E or Category 6 network cable installed in a 3/4" EMT.

Communication conduits shall not be installed closer than 2m from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible.

Ethernet network wiring shall be installed as shown on riser diagram.

There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring.

Recommended CAT 5E and CAT 6 Ethernet wiring guidelines shall be followed and in no case shall the distance between any Ethernet switch, NAC or other Ethernet LAN device exceed 100 meters.

Ethernet wiring shall installed and rated for communications at 100mb.

LON NETWORK REQUIREMENTS

Wired network communication shall utilize approved Lon cable as indicated on the drawings. No substitutions will be allowed.

Communication conduits shall not be installed closer than 2m from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible.

Lon network wiring shall be installed as shown on riser diagram.

There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring.

Recommended Lon wiring guidelines shall be followed for double-terminated bus topology, with repeaters provided as required, based on wiring distance and device quantity configuration. In no case shall the total network wiring distance from any NAC to the last Lon device on the network exceed 1,400 meters, with a maximum stub length of 3 meters.

INPUT / OUTPUT AND ANCILLARY HARDWARE WIRING

Input/Output Control Wiring:

- Thermistor wiring shall be two conductor, twisted, shielded, minimum 22 gauge.
- Other analog inputs shall be a minimum of number 22 gauge, twisted, shielded.
- Binary control function wiring shall be a minimum of number 18 gauge.
- Analog output control functions shall be a minimum of number 22 gauge, twisted, shielded cable, number of conductors as required.
- Binary input wiring shall be a minimum of number 22 gauge, twisted, shielded.
- 120V control wiring shall be #14 THHN in 1/2" conduit.

Provide interlock wiring between supply and return fans and electrical wiring for relays (including power feed) for temperature and pressure indication. Provide interlock wiring between refrigeration machines, pumps and condensing equipment as required for the specified sequence of operation and the refrigeration

system integral controller(s). Do not provide interlock wiring if a dedicated digital output has been specified for the equipment or the sequence of operation requires independent start/stop.

Provide power wiring, conduit and connections for low temperature thermostats, high temperature thermostats, alarms, flow switches, actuating and sensing devices for temperature, humidity, pressure and flow indication, point resets and user disconnect switches for electric heating appliances controlled by this Section.

CONDUIT AND FITTINGS

Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.

Outlet Boxes (Dry Location): Sheradized or galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.

Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.

Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National
Electrical Codes. Enclosure type shall be suited to location.

Plug or cap all unused conduit openings and stub-ups. Do not use caulking compound.

Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.

Set conduits as follows:

- Expanding silicone firestop material where conduit is run between floors and through walls of fireproof shaft.
- Oakum and lead, sealed watertight penetration through outside foundation walls.

Cap open ends of conduits until conductors are installed.

Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of 18 inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.
Where exposed to the elements or in damp or wet locations, waterproof flexible conduit shall be installed. Installation shall be as specified for flexible metal conduit.
Provide floor, wall, and ceiling plates for all conduits passing through walls, floors or ceilings. Use prime coated cast iron, split-ring type plates, except with polished chrome-plated finish in exposed finished spaces.

IDENTIFICATION

Wire Tags:

- All multi-conductor cables, including those for all I/O devices, in all pull boxes and terminal strip cabinets shall be uniquely tagged at both ends. Keep a catalog of wire identification for submittal to the City of Chicago at the project's completion.
- Provide wire Tags as per Division 16.

Conduit Tags: Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.

Miscellaneous Equipment Identification:

- Screwed-on, engraved black lamacoid sheet with white lettering on all control panels and remote processing panels. Lettering sizes subject to approval.
- Inscription, subject to review and acceptance, indicating equipment, system numbers, functions and switches. For panel interior wiring, input/output modules, local control panel device identification.

Automatic Control Valve Tags:

- For valves, etc., use metal tags with a 2 inch minimum diameter, fabricated of brass, stainless steel or aluminum. Attach tags with chain of same materials. For lubrication instructions, use linen or heavy duty shipping tag.
- Tag valves with identifying number and system. Number valves by floor level, column location and system served. • Prepare lists of all tagged valves showing location, floor level, tag number, use. Prepare separate lists for each system. Include copies in each maintenance manual.

WARRANTY

Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the DDCS Contractor at no expense to the Owner.

START-UP AND TESTING

It is the responsibility of the DDCS contractor to ensure the proper installation and performance of the Lon networks and to coordinate the start-up and testing of the networks with the Section 23 09 25 System Integrator to ensure the networks and attached devices are functioning properly. Once all devices are installed, programmed, configured and powered, the DDCS contractor shall notify the Section 23 09 25 System Integrator to schedule a start-up schedule. During the start-up, all IDC's supplied by the DDCS contractor shall be checked for proper communication, network bindings, and network traffic to ensure proper performance. The DDCS contractor shall correct any devices or performance found to be defective The DDCS contractor, along with the Section 23 09 25 System Integrator shall reconfigure nodes as necessary to maintain traffic to no more than 50% of channel bandwidth capacity.

WARRANTY ACCESS

The Owner shall grant to the DDCS Contractor, reasonable access to the DDCS during the warranty period.

ACCEPTANCE TESTING

The DDCS Contractor shall verify that all IDC's are ready for operation. This inspection shall verify that the following items have been properly installed.

- Network connection.
- Power connection.
- Proper power supply voltage and type.
- Electrical installation conforms to local code authorities.
- Valves (normally open or closed).
- Fail safe devices are equipped with spring return operators.
- Device or control unit in a standalone mode accomplishes the following:
    - Operate smoothly throughout entire control range without binding or cogging.
    - Sensors have been calibrated to specifications.
    - Differential pressure transmitters have been zero and span adjusted.
- With application code loaded, execute specific control loops effectively without hunting or hysteresis.
- Point to point check of all digital I/O for continuity and correct execution of the functional operation.

Submit an Inspection Log, which enumerates the above in a check list form for all IDC's. Indicate corrective action for non-conforming or defective products and/or product installations.

The DDCS 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.

The DDCS Contractor shall perform tests to verify proper performance of components, sequences of operation, 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.
Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

System Acceptance: Satisfactory completion is when the Temperature Control sub-contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

In conjunction with the work of other trades, thoroughly test all equipment and systems in a dynamic mode simulating all operating sequences including safety shutdown and emergency fire mode.

TESTING, ADJUSTING AND BALANCING REQUIREMENTS
SUMMARY:
This contractor shall work with the Section 23 05 93 test and balance contractor to secure the proper operation of all control systems and devices.

PART 4 - SEQUENCES OF OPERATION

SUMMARY
For each system listed, provide the sequence of operation as stated in Section 23 09 23.

CONTROL DIAGRAMS AND SCHEDULE
Refer to Drawings for information, which indicates the components and intended control functions and devices.
SI Contractor shall be responsible for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

All set points of sensors, controllers and the like, that are not factory preset, shall be preset by the SI Contractor before system startup.

SEQUENCES OF OPERATION
Program each ASC, CU, etc, to perform the sequences of operation printed on the control drawings. Provide all necessary hardware on each piece of equipment in order for the equipment to perform the specified sequence and to meet the requirements of the points lists. (Points on the points list may be for monitoring and alarm purposes. They may not be required to perform the sequence. DDCS Contractor is responsible for providing these as well.)

Refer to Section 23 09 25 for all control wiring connections, auxiliary devices and control wiring diagrams to complete the control system and attain the described sequence of operation.

END OF SECTION

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SECTION 23 09 25
INTEGRATED AUTOMATION SYSTEM (IAS)

PART 1 - GENERAL

SCOPE

This section describes the Systems Integration scope of work for the project. This section also coordinates the responsibilities of the Mechanical and Electrical trade contractors pertaining to control products or systems, furnished by each trade that will be integrated by this Section.

All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

WORK OF SECTI ONS 23 09 14, 23 09 27, 230925 AND 23 09 93 SHALL BE PERFORMED BY A SINGLE APPROVED MATERIAL VENDOR AND INSTALLING INSTALING CONSTRATOR.

SYSTEM DESCRIPTION

The Integrated Automation System (IAS) shall be comprised of Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each NAC shall communicate to LonTalk (IDC) controllers provided under Section 23 09 24.

Approved Vendors:
Environmental systems Inc. (ESI), 3410 Gateway Rd, Brookfield, WI 53045. 262-544-8860, 800-522-037
Mechanical Technologies, Inc. (MTI), 701 Morley Rd, Green Bay, WI 54303. 920.491.5860, 800.572.2063

SYSTEM INTEGRATION CONTRACTOR QUALIFICATIONS

General:
The System Integrator shall have a successful history in the design and installation of open control systems with browser based wide area network connectivity and shall provide evidence of this history as a condition of acceptance of bid.

The System Integrator shall have an office that is staffed with LONWORKS® and Internet Protocol (IP) trained engineers and technicians fully capable of providing instruction and routine emergency maintenance service on all system components within 24 hours of notification.

Contractor Service:
- System Integrator shall have a local service facility within a 90-mile radius of the job site, staffed with qualified service personnel, fully capable of providing instructions and routine or emergency maintenance service.

SUBMITTAL

Eight copies of shop drawings of the IAS system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings. A complete written Sequence of Operation shall also be included with the submittal package.

Submittal shall include a network cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.

Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk and on the Network Supervisor (NS) hard drive. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on magnetic floppy disk media or compact disk. Section 23 09 24 and Division 26 contractors shall provide as-builts for their portions of work. Section 23 09 25 contractor shall be responsible for as-builts pertaining to overall IAS architecture and network diagrams.

SPECIFICATION NOMENCLATURE

Acronyms used in this specification are as follows:
IAS Integrated Automation System
DDCS Direct Digital Control System
NAC Network Area Controller
NS Network Supervisor
IDC Interoperable Digital Controller
ASC Application Specific Controller
PCU Programmable Control Unit
IBC Interoperable BACnet Controller
GUI Graphical User Interface
WBI Web Browser Interface
POT Portable Operator's Terminal
PMI Power Measurement Interface
DDC Direct Digital Controls
LAN Local Area Network
WAN Wide Area Network
OOT Object Oriented Technology
PICS Product Interoperability Compliance Statement

DIVISION OF WORK

Note that the work required by Section 23 09 24 and Section 23 09 25 shall be performed by the same contractor. This paragraph only defines work included in each section.

The DDCS Contractor Section 23 09 24 shall be responsible for all controllers (IDC), control devices, control panels, controller programming, controller programming software, controller input/output wiring, power wiring, interlock and safety wiring, controller network wiring, and Ethernet LAN wiring, if applicable.

The System Integrator (SI) Section 23 09 25 shall be responsible for the Network Area Controller(s) (NAC), workstations, printers, servers, software and programming of the NAC, graphical user interface software (GUI), development of all graphical screens, setup of schedules, logs and alarms, LonWorks network management, global supervisory control applications, system integration and coordination of the NAC to the local or wide area network.

The point of demarcation for the products to be provided by the System Integrator shall be up to and including the Network Area Controller (NAC).

RELATED WORK SPECIFIED ELSEWHERE

Section 3 09 24, Mechanical: Providing control devices and systems including but not limited to:
• Interoperable Digital Controllers and programming
• Control panels, devices and wiring
• Control device networks

Division 26, Electrical:
• Providing motor starters and disconnect switches (unless otherwise noted).
• Power wiring and conduit (unless otherwise noted).
• Provision, installation and wiring of smoke detectors (unless otherwise noted).

AGENCY AND CODE APPROVALS

All products of the IAS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable: UL-916; Energy Management Systems, ULC; UL - Canadian Standards Association, FCC, Part 15, Subpart J, Class A Computing Devices.

SOFTWARE LICENSE AGREEMENT

The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

DELIVERY, STORAGE AND HANDLING

Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

JOB CONDITIONS

Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, pipe, duct and conduit runs, electrical outlets and fixtures, air diffusers, and structural and architectural features.

PART 2 – MATERIALS

GENERAL

The Integrated Automation System (IAS) shall be comprised of a network of interoperable, stand-alone Network Area Controllers, servers, operator workstations, graphical user interface software, printers, network devices and other devices as specified herein.

The installed system shall provide secure password access to all features, functions and data contained in the overall IAS.

OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate both the ANSI/ASHRAE Standard 135-1995 BACnet and LonWorks technology communication protocols in one open, interoperable system.

The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including ANSI / ASHRAE™ Standard 135-1995, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device’s compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet or MSTP.

All components and controllers supplied under this contract shall be true “peer-to-peer” communicating devices. Components or controllers requiring “polling” by a host to pass data shall not be acceptable. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter

storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

- Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
- Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

NETWORKS

The Local Area Network (LAN) shall be a 100 Megabits/sec Ethernet network supporting BACnet, Java, XML, and HTTP for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server. Local area network minimum physical and media access requirements:

- Ethernet; IEEE standard 802.3
- Cable; 10 Base-T, UTP-8 wire, category 5E or 6
- Minimum throughput; 10 Mbps, with ability to increase to 100 Mbps

NETWORK ACCESS

Remote Access: For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

NETWORK AREA CONTROLLER (NAC)

The Section 23 09 25 contractor shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of area controllers required is dependent on the type and quantity of devices provided under Section 23 09 24 and Division 26. It is the responsibility of the Section 23 09 25 contractor to coordinate with the Section 23 09 24 and Division 26 contractors to determine the quantity and type of devices.

The Network Area Controller (NAC) shall provide the interface between the LAN or WAN and the field control devices, and provide global supervisory control functions over the control devices connected to the NAC. It shall be capable of executing application control programs to provide:

- Calendar functions
- Scheduling
- Trending
- Alarm monitoring and routing
- Time synchronization
- Integration of LonWorks controller data and BACnet controller data
- Network Management functions for all LonWorks based devices

The Network Area Controller must provide the following hardware features as a minimum:

- One Ethernet Port – 10/100 Mbps
- One RS-232 port
- One LonWorks Interface Port – 78KB FTT-10A
- Battery Backup
- Flash memory for long term data backup (If battery backup or flash memory is not supplied, the controller must contain a hard disk with at least 1 gigabyte storage capacity)
- The NAC must be capable of operation over a temperature range of 0 to 55°C
- The NAC must be capable of withstanding storage temperatures of between 0 and 70°C
- The NAC must be capable of operation over a humidity range of 5 to 95% RH, non-condensing

The NAC shall support standard Web browser access via the Intranet/Internet. It shall support a minimum of 26 simultaneous users.

Event Alarm Notification and Actions:

- The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
- The NAC shall be able to route any alarm condition to any defined user location whether connected to a local network or remote via dial-up telephone connection, or wide-area network.
- Alarm generation shall be selectable for annunciation type and acknowledgement requirements including but limited to: To alarm, Return to normal, To fault.
- Provide for the creation of a minimum of eight of alarm classes for the purpose of routing types and or classes of alarms, i.e.: security, HVAC, Fire, etc.
- Provide timed (schedule) routing of alarms by class, object, group, or node.
- Provide alarm generation from binary object "runtime" and /or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

Control equipment and network failures shall be treated as alarms and annunciated.

Alarms shall be annunciated in any of the following manners as defined by the user:

- Screen message text
- Email of the complete alarm message to multiple recipients. Provide the ability to route and email alarms based on: Day of week, Time of day, Recipient.
- Pagers via paging services that initiate a page on receipt of email message
- Graphic with flashing alarm object(s)
- Printed message, routed directly to a dedicated alarm printer

The following shall be recorded by the NAC for each alarm (at a minimum):

- Time and date
- Location (building, floor, zone, office number, etc.)
- Equipment (air handler #, accessway, etc.)
- Acknowledge time, date, and user who issued acknowledgement.
- Number of occurrences since last acknowledgement.

Alarm actions may be initiated by user defined programmable objects created for that purpose.

Defined users shall be given proper access to acknowledge any alarm, or specific types or classes of alarms defined by the user.

A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

Provide a "query" feature to allow review of specific alarms by user defined parameters.

A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

An Error Log to record invalid property changes or commands shall be provided and available for review by the user.

DATA COLLECTION AND STORAGE T
the NAC shall have the ability to collect data for any object and store this data for future use. The data collection shall be performed by log objects, resident in the NAC that shall have, at a minimum, the following configurable properties:

- Designating the log as interval or deviation.
- For interval logs, the object shall be configured for time of day, day of week and the sample collection interval.

• 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.
• 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.
• Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

All log data shall be stored in a relational database and the data shall be accessed from a standard Web Browser.

All log data, when accessed from the Network Supervisor (NS), shall be capable of being manipulated using standard SQL statements.

All log data shall be available to the user in the following data formats:
• HTML
• XML
• Plain Text
• Comma or tab separated values

Systems that do not provide log data in HTML and XML formats at a minimum shall not be acceptable.

The NAC shall have the ability to archive it's log data to a Network Supervisor on the network. Provide the ability to configure the following archiving properties, at a minimum:
• Archive on time of day
• Archive on user-defined number of data stores in the log (buffer size)
• Archive when log has reached it's user-defined capacity of data stores
• Provide ability to clear logs once archived

AUDIT LOG

Provide and maintain an Audit Log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive the log based on time to the Network Supervisor. For each log entry, provide the following data:
• Time and date
• User ID
• Change or activity: i.e., Change setpoint, add or delete objects, commands, etc.

DATABASE BACKUP AND STORAGE

The NAC shall have the ability to automatically backup its database. The database shall be backed up based on a user-defined time interval.

Copies of the current database and, at the most recently saved database shall be stored on the Network Supervisor. The age of the most recently saved database is dependent on the user-defined database save interval.

The NAC database shall be stored, at a minimum, in XML format to allow for user viewing and editing, if desired. Other formats are acceptable as well, as long as XML format is supported.

WEB BROWSER CLIENTS

The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™ or Netscape Navigator™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.

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 IAS, shall not be acceptable.

The Web browser client shall support at a minimum, the following functions:

- 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.
- 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.
- Storage of the graphical screens shall be in the Network Area Controller (NAC), the Network Supervisor (NS) or both, without requiring any graphics to be stored on the client machine. Systems that require graphics storage on each client are not acceptable.
- Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
- Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:
  - Modify common application objects, such as schedules, calendars, and set points in a graphical manner. Schedule times will be adjusted using a graphical slider, without requiring any keyboard entry from the operator. Holidays shall be set by using a graphical calendar, without requiring any keyboard entry from the operator.
  - 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 entry of text shall be required.
  - View logs and charts
  - View and acknowledge alarms
  - Setup and execute SQL queries on log and archive information

- 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 limit a specific user to just their defined home page. From the home page, links to other views, or pages in the system shall be possible, if allowed by the system administrator.

- 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.

NETWORK SUPERVISOR FUNCTIONS AND HARDWARE

A Network Supervisor (NS) shall be provided. The NS shall support all Network Area Controllers (NAC) connected to the control LAN.

Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1 or dial-up connection.

It shall be possible to provide access to all Network Area Controllers via a single connection to the Network Supervisor. In this configuration, each Network Area Controller can be accessed from a remote Graphical User Interface (GUI) or from a standard Web browser (WBI) by connecting to the Network Supervisor.

The Network Supervisor shall provide the following functions, at a minimum:

- Global Data Access: The Network Supervisor shall provide complete access to distributed data defined anywhere in the system.
- Distributed Control: The Network Supervisor shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
- The Network Supervisor shall include a master clock service for its subsystems and provide time synchronization for all Network Area Controllers (NAC).
- The Network Supervisor shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
- The Network Supervisor shall provide scheduling for all Network Area Controllers and their underlying field control devices.
- The Network Supervisor shall provide demand limiting that operates across all Network Area Controllers. The Network Supervisor must be capable of multiple demand programs for sites with multiple meters and or multiple sources of energy. Each demand program shall be capable of supporting separate demand shed lists for effective demand control.

- The Network Supervisor shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to Network Area Controllers. Systems not employing this prioritization shall not be accepted.
- Each Network Area Controller supported by the Network Supervisor shall have the ability to archive its log data, alarm data and database to the Network Supervisor, automatically. Archiving options shall be user-defined including archive time and archive frequency. • The Network Supervisor shall provide central alarm management for all Network Area Controllers supported by the Network Supervisor. Alarm management shall include: Routing of alarms to display, printer, email and pagers, View and acknowledge alarms, Query alarm logs based on user-defined parameters.
- The Network Supervisor shall provide central management of log data for all Network Area Controllers supported by the Network Supervisor. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include: Viewing and printing log data, Exporting log data to other software applications, Query log data based on user-defined parameters.

Network Supervisor Hardware Requirements: The Network Supervisor hardware platform shall have the following requirements:

- The computer shall be an Intel Pentium based computer server-class machine (minimum processing speed of 2.8GHz with 2 MB RAM and a 120GB minimum hard drive). It shall include a 32X CD-ROM drive, 3.5" floppy drive, 2-asynchronous serial ports and 2-USB ports. A minimum 19", 28-dot pitch SVGA (1024 x 768) LCD color monitor with a minimum 80 Hz refresh rate shall also be included.
  - Acceptable manufacturers: Dell PowerEdge.
- The Network Supervisor operating system shall be compatible with established Dane County systems.
- Connection to the IAS network shall be via an Ethernet network interface card, 100Mbps.
- A system printer shall be provided. Printer shall be laser type with a minimum 600 x 600-dpi resolution and rated for 8-PPM print speed minimum.
- For dedicated alarm printing, provide a dot matrix printer, either 80 or 132 column width. The printer shall have a parallel port interface.

SYSTEM PROGRAMMING

The Graphical User Interface software (GUI) shall provide the ability to perform system programming and graphic display engineering as part of a complete software package. Access to the programming functions and features of the GUI shall be through password access as assigned by the system administrator.

A library of control, application, and graphic objects shall be provided to enable the creation of all applications and user interface screens. Applications are to be created by selecting the desired control objects from the library, dragging or pasting them on the screen, and linking them together using a built in graphical connection tool. Completed applications may be stored in the library for future use. Graphical User Interface screens shall be created in the same fashion. Data for the user displays is obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Systems requiring separate software tools or processes to create applications and user interface displays shall not be acceptable.

Programming Methods:

- Provide the capability to copy objects from the supplied libraries, or from a user-defined library to the user's application. Objects shall be linked by a graphical linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; i.e., internal, external, hardware, etc.
- Configuration of each object will be done through the object's property sheet using fill-in the blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration will not be accepted.
- The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.

• All programming shall be done in real-time. Systems requiring the uploading, editing, and downloading of database objects shall not be allowed.
• The system shall support object duplication within a customer's database. An application, once configured, can be copied and pasted for easy re-use and duplication. All links, other than to the hardware, shall be maintained during duplication.

LONWORKS NETWORK MANAGEMENT

The Graphical User Interface software (GUI) shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding". Systems requiring the use of third party LonWorks network management tools shall not be accepted.

Network management shall include the following services: device identification, device installation, device configuration, device diagnostics, device maintenance and network variable binding.

The Network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.

The network management database shall be resident in the Network Area Controller (NAC), ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident, at all times, within the control system, shall not be accepted.

OBJECT LIBRARIES

A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.

The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.

In addition to the standard libraries specified here, the supplier of the system shall maintain an on-line accessible (over the Internet) library, available to all registered users to provide new or updated objects and applications as they are developed.

All control objects shall conform to the control objects specified in the BACnet specification.

The library shall include applications or objects for the following functions, at a minimum:
• Scheduling Object. The schedule must conform to the schedule object as defined in the BACnet specification, providing 7-day plus holiday & temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphical sliders to speed creation and selection of on-off events.
• Calendar Object. . The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphical "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
• Duty Cycling Object. Provide a universal duty cycle object to allow repetitive on/off time control of equipment as an energy conserving measure. Any number of these objects may be created to control equipment at varying intervals

• Temperature Override Object. Provide a temperature override object that is capable of overriding equipment turned off by other energy saving programs (scheduling, duty cycling etc.) to maintain occupant comfort or for equipment freeze protection.
• Start-Stop Time Optimization Object. Provide a start-stop time optimization object to provide the capability of starting equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled un-occupancy time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start / stop time object properties based on the previous day's performance.
• Demand Limiting Object. Provide a comprehensive demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, and gas). The object shall provide the capability of monitoring a demand value and predicting (by use of a sliding window prediction algorithm) the demand at the end of the user defined interval period (1-60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment set points to effect the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the set point, a message shall be displayed on the users screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to effect both equipment protection and occupant comfort.

The library shall include control objects for the following functions. All control objects shall conform to the objects as specified in the BACnet specification.
• Analog Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
• Analog Output Object - Minimum requirement is to comply with the BACnet standard for data sharing.
• Binary Input Object - Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment run-time by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
• Binary Output Object - Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as interstart delay must be provided. The BACnet Command Prioritization priority scheme shall be incorporated to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide sixteen levels of priority as a minimum. Systems not employing the BACnet method of contention resolution shall not be acceptable.
• PID Control Loop Object - Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable as well as to be disabled to allow proportional control only, or proportional with integral control, as well as proportional, integral and derivative control.
• Comparison Object - Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
• Math Object - Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
• Custom Programming Objects - Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including math and logic functions, string manipulation, and e-mail as a minimum. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for re-use.
• Interlock Object - Provide an interlock object that provides a means of coordination of objects within a piece of equipment such as an Air Handler or other similar types of equipment. An example is to link the return fan to the supply fan such that when the supply fan is started, the return fan object is also started

automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming thereby eliminating nuisance alarms during the off period.

- Temperature Override Object - Provide an object whose purpose is to provide the capability of overriding a binary output to an "On" state in the event a user specified high or low limit value is exceeded. This object is to be linked to the desired binary output object as well as to an analog object for temperature monitoring, to cause the override to be enabled. This object will execute a Start command at the Temperature Override level of start/stop command priority unless changed by the user.
- Composite Object - Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering, or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphical shell of this container.

The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). At a minimum, provide the following as part of the standard library included with the programming software:

- LonMark/LonWorks devices. These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. All network variables defined in the LonMark profile shall be supported. Information (type and function) regarding network variables not defined in the LonMark profile shall be provided by the device manufacturer.
- For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file and documentation for the device to facilitate device integration.
- For BACnet devices, provide the following objects at a minimum: BACnet AI, BACnet AO, BACnet BI, BACnet BO, BACnet Device.
- For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.

PART 3 – EXECUTION

INSTALLATION

All work described in this section shall be performed by a system integrator that have a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

Install system and materials in accordance with manufacturer's instructions, and as detailed on the project drawing set.

Drawings of IAS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the Temperature Control sub-contractor in accordance with the specifications in Section 23 09 24 and Division 26.

WIRING

All electrical control wiring and power wiring to the NAC, computers and network components (routers, hubs, switches, etc.) shall be the responsibility of the Section 23 09 24, DDCS Contractor.

All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All IAS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where IAS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

WARRANTY

Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of "substantial completion".

Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the Section 23 09 25 contractor at no expense to the Owner.

WARRANTY ACCESS The Owner shall grant to the Section 23 09 25 contractor, reasonable access to the IAS during the warranty period. The owner shall allow the contractor to access the IAS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

ACCEPTANCE TESTING Upon completion of the installation, the Section 23 09 25 contractor shall load all system software and start-up the system. The Section 23 09 24 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. The Section 23 09 24 and Section 23 09 25 contractors are to coordinate the checkout of the system such that each Section has a representative present during system checkout.

The Section 23 09 24 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. The Section 23 09 25 contractor shall have a representative present during system checkout by the Section 23 09 24 contractor.

Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

System Acceptance: Satisfactory completion is when the Section 23 09 24, Division 26, and Section 23 09 25 contractors have performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

OPERATOR INSTRUCTION, TRAINING

During system commissioning and at such time acceptable performance of the IAS hardware and software has been established the Temperature Control sub-contractor shall provide on-site operator instruction to the owner's operating personnel. Operator instruction shall be done during normal working hours and shall be performed by a competent representative familiar with the system hardware, software and accessories.

The Section 23 09 25 contractor shall provide 40 hours of instruction to the owner's designated personnel on the operation of the IAS and describe its intended use with respect to the programmed functions specified. Operator orientation of the IAS 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.

The training shall be in three sessions as follows:

- Initial Training: 4 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.

- First Follow-Up Training: 2 hours total approximately two weeks after initial training, and before Formal Acceptance. These sessions will deal with more advanced topics and answer questions.
- Warranty Follow Up: 4 hours total in no less than 2 hour increments, to be scheduled at the request of the owner during the one year warranty period. These sessions shall cover topics as requested by the owner such as; how to add additional points, create and gather data for trends, graphic screen generation or modification of control routines.
- Completion of training shall be certified by the Owner
- All sessions will be videotaped by Owner and at owner's expense. This includes field installations, class room instruction and training on the computer.
- Sufficient advance notification of ALL training is required.

PART 4 - SEQUENCES OF OPERATION

SUMMARY

The Section 23 09 25 contractor shall refer to this Item under Section 23 09 24 to determine what level of control functionality the Network Area Controller, must provide, which is the responsibility of this Section. It is the responsibility of the Section 23 09 25 contractor to coordinate control functions, such as scheduling and supervisory-level global control with the Section 23 09 24 contractor.

PART 5 - POINT LISTS

SUMMARY

The Section 23 09 25 contractor shall refer to this Item under Section 23 09 24 to determine what data in the local controllers must be integrated into the Network Area Controller, which is the responsibility of this Section. It is the responsibility of the Section 23 09 25 contractor to coordinate control functions, such as scheduling and supervisory-level global control with the Section 23 09 24 contractor.

END OF SECTION

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SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

P A R T 1 - G E N E R A L

SCOPE
This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control.

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Section 23 09 14 - Electric Instrumentation and Control Devices for HVAC
Section 23 09 15 - Direct Digital Control Input/Output Point Summary Tables
Section 23 09 24 - Direct Digital Control System for HVAC
Section 23 09 25 – Integrated Automation System for HVAC
Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination
Division 26 - Electrical - Installation requirements

REFERENCE
Section 23 09 14 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.

Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators are also covered in Section 23 09 14.

DESCRIPTION OF WORK
Control sequences are hereby defined as the manner and method by which automatic controls function. Requirements for each type of operation are specified in this section.

Operation equipment, devices and system components required for automatic control systems are specified in other Division 23 control sections of these specifications.

All temperature, and pressure sensing, and all other control signal transportation for the control sequences shall be furnished under Section 23 09 14. All pneumatic, electronic, and electric input/output signals shall be extended under Section 23 09 14, with adequate lead length for termination within the appropriate control panel being provided under Section 23 09 24 or 23 09 25.

Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by hardware and software provided under Section 23 09 24 or 23 09 25. Sequences for equipment controlled by pneumatic or electric self-contained controls are accomplished by hardware provided under Section 23 09 14.

SUBMITTALS
Refer to Division 1, General Conditions, Submittals, Section 23 05 00 and Sections 23 09 24 or 23 09 25, and 23 09 14 for descriptions of what should be included in the submittals.

Shop drawings shall be provided by contractor(s) providing equipment under Sections 23 09 24 or 23 09 25 and 23 09 14. The contractor providing the DDC equipment shall provide a complete narrative of the sequence of operations for equipment that is controlled through the DDC system. The contractor providing the 23 09 14 equipment shall provide a complete narrative of the sequence of operation for equipment that is controlled directly from that equipment (without control logic through the DDC system). The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect the actual operation as applied by the contractor.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

12. All final set points and terminal unit air flow correction factors ("K" factors) shall be documented on the as-built control drawings as determined by working in conjunction with the balancing contractor.

P A R T 2 - P R O D U C T S

Not applicable to this Section – reference Sections 23 09 24 or 23 09 25 and 23 09 14 for product descriptions.

P A R T 3 - E X E C U T I O N

GENERAL:

SETPOINTS:

All set points indicated in the control specification are to be adjustable. The set points 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 set points may be provided on a lower software level. The set points indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that set point 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 user Owner to provide the final system set point adjustments and control loop tuning after the system is in operation and building is in use. Document all final set points 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 set points should be used as initial set points unless otherwise specified in the individual control sequences or instructed by the Owner.

Occupied Space Terminal Unit Heating: 68º F
Occupied Space Terminal Unit Cooling: 76º F
Entry Way Heating: 60° F
Mechanical or Unoccupied Space Heating: 60º F

ANTI-CYCLING:

When HVAC equipment or a sequence is specified to be started and stopped by a temperature set point or any other controlled variable, there shall be an adjustable differential set point that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential set points shall be set at 2º F and non-temperature set points shall be set at 10% of the controlled range unless otherwise specified. Unless otherwise specified in the individual control sequences, fans and pumps shall have a minimum runtime on timers of 15 minutes (adj.) and off timers of 5 minutes (adj.). Safeties shall override runtime timers.

DEADBANDS:

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 set point as follows unless otherwise specified in the individual control sequences:

Temperature Control: ±0.5º F
AHU Static Pressure Control: ±0.01 in. w.c.

ALARMS:

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 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.

EQUIPMENT START/STOP FAILURE STATES:
All start/stop points for equipment shall utilize normally open contacts unless called out specifically in the individual control sequences.

LEAD/LAG SEQUENCING:
For sequences that call for lead/lag of equipment connected to building automation systems, the lead device shall be able to be chosen through a selectable day of the week and time of day through the building automation system. Coordinate with the Owner for scheduling switchover and frequency. Unless otherwise directed, switchover shall occur at 10AM Tuesday and shall rotate the lead device on a weekly cycle rotating through all devices sequentially. For standalone lead/lag sequence controllers (non-DDC), the lead device shall be selected by a switch on the panel face.

VARIABLE FREQUENCY DRIVE (VFD) MOTOR RUN STATUS:
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. If a bypass contactor is provided with the VFD, provide an adjustable current switch and wire it in parallel with the VFD output for proving motor status.

VFD BYPASS & SAFETY INTERLOCKS:
VFD's equipped with bypass starters shall be interlocked so that the start/stop and safety circuits that are called out for VFD operation shall be functional when the VFD is indexed to the bypass starter mode. Unless otherwise specified in the sequence below, the switch from inverter to bypass starter modes shall be through a manual switch provided on the VFD/bypass starter package.

VFD MINIMUM SPEED & RAMP TIMERS:
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 and 60 seconds for motors 40 HP and greater.

CURRENT SWITCH SETUP:
When current switches are used for proving fan or pump 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 14 contractor after the balancer is complete.

FAN INTERLOCKING:
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.

THERMOSTATS AND SENSORS:
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. Consult the HVAC design engineer for the thermostat or sensor location.

ORIGINAL EQUIPMENT MANUFACTURER (OEM) CONTROLLER DDC INTEGRATION:
Provide DDC programming to define all equipment integral input/output points, set points, data points, calculations, etc. that are available through the manufacturers communication interface. Consult with the Owner operations personnel to determine if some of the points should be omitted (for clarity or lack of value). The following equipment shall be integrated into the DDC system:

- Variable Frequency Drives

CONTROLLED VARIABLE REQUIREMENTS

All controlled variables, i.e. static pressure, differential pressure, temperature, humidity, etc., shall be wired directly to the DDC controller in which the software PID loop or other similar software loop resides unless the control sequence specifically allows the controlled variable to be routed over the network. Where a controlled variable is used for reset of a PID loop, the controlled variable shall be allowed to be shared over the network unless specified to be directly wired to the DDC controller.

CALCULATED DATA POINTS

Provide calculated data points for actual dirty pressure drop for all variable volume air handling units with supply flow measurement based on the following equation:

- Actual Dirty Filter ΔP = (Measured Supply CFM/Design CFM)^2 x Design Dirty Filter ΔP

Provide a calculated data point for outside airflow for all fans that have return and outside air mixing dampers and the points required to allow for the following equation:

- Outside Airflow = Supply CFM x (MAT-RAT)/(OAT-RAT)

Where Supply CFM is measured either on variable volume fans or as balanced on constant volume units, MAT is Mixed Air Temperature, RAT is Return Air Temperature, and OAT is Outside Air Temperature. This point is designed as a check for outside air flow stations accuracy and outside air ventilation minimum damper positions. It should be noted that the accuracy of the calculated outside airflow will diminish as outside air temperature approaches return air temperature. It should be used as a check only when the RAT and OAT are greater than 20 Deg F and the accuracy of the RAT and OAT temperature sensors are assured.

BOILERS (B-1and B-2) AND BOILER PUMPS (BP-1 and BP-2) CONTROL

The boilers will have a manufacturer provided boiler controller that will control the modulation of the boilers, sequence multiple boilers and control associated boiler pumps. Boiler pumps shall operate whenever the respective boiler is firing and run for a delayed period to remove residual heat.

The system shall reset the hot water temperature based on outside air temperature and

The DDC control system shall enable the system as specified below and provide boiler monitoring as indicated in the points list.

BUILDING HEATING WATER PUMP (HWP-1) AND PUMP (HWP-2) CONTROL:

Start/Stop: The pumps shall operate in parallel. One pump shall operate at a speed controlled through a variable frequency drive controlled to maintain a pressure differential set point in the piping system. If the pressure cannot be maintained with one pump operating at full speed the second pump shall start and operate with both pumps operating at the same speed controlled through a variable frequency drives controlled to maintain the pressure set point The hot water pump start/stop relays shall utilize normally closed contacts so upon failure of the relay or DDC controller one pump shall fail on.

Lead / Lag Control: Current status switches, either integral to the VFD and/or discreet devices, shall prove lead and lag pump operation The DDC system shall index the lag pump to become the lead pump through weekly scheduling feature of the building automation system.

Speed Control: Install a differential pressure sensor across the supply and return piping at the point in the system as indicated on plans. The DDC system shall control the operating pump VFD to maintain a set point as described above. Final set point shall be optimized by the Balancing Contractor.

BOILERS AND BOILER PUMPS AND BUILDING HEATING HOTE WATER PUMP ENABLE:

The DDC control system shall enable the boilers and pumps based on outdoor air temperature. Below an Owner's operator determined outside air temperature (Initial set point of 55 deg. F) the system shall be enabled. Upon a rise above the set point the system shall be disabled. Provide a 5 degree (adjustable) temperature differential between enable and disable to prevent short cycling.

WALL FIN AND CONVECTOR RADIATION –RELOCATED OR EXISTING - STAND ALONE

Provide an electric thermostat and control valve to maintain the space temperature.

CABINET UNIT HEATER CONTROL: EXISTING UNITS

Provide a new electric space thermostat to control the control valve or fan operation as currently installed to maintain space temperature.

Verify operation of existing controls and notify the Owners Project Manager of any components that need to be replaced.

TERMINAL UNIT CONTROL – DDC and ELECTRIC:

GENERAL:

See the valve chart in Section 23 09 14 for requirements for type of valve, signal required, spring return requirements, and fail positions. The valve requirements specified in the Section 23 09 14 valve chart shall supersede what is called out in the terminal unit sequences.

DDC CONTROLLED TERMINAL UNIT MASTER COMMAND POINTS:

Provide individual master software points for each of the following functions that can be executed from a single command through the DDC system:

- Command all terminal unit heating valves open (i.e. reheat, radiation, fan coil, etc.).
- Command all terminal unit heating valves closed.
- Command all VAV terminals to scheduled MINIMUM FLOW Command all VAV terminals to scheduled maximum flow

SINGLE DUCT VAV TERMINAL UNIT WITH REHEAT DDC CONTROL:

Provide a DDC space temperature sensor to control, in sequence, a modulating electronic control valve for the hot water reheat coil and actuator for terminal air flow. When the space temperature is above the set point the air terminal damper shall modulate open to maintain the space temperature. When space temperature is below set point, the air terminal damper shall modulate toward the cooling minimum flow position. After the air terminal damper is at its minimum flow, the hot water valve shall modulate open to maintain space temperature. If the space temperature cannot be maintained at minimum air flow, air flow shall increase until the space temperature is maintained. The reverse shall occur when space temperature is below set point. The heating coil valve shall be commanded closed whenever the associated AHU is off. Provide a discharge air temperature sensor for monitoring purposes.

For VAV thermostats indicated as "NIGHT" if the unoccupied space temperature fall 5 degrees (adjustable) of set point the air handling unit shall operate to provide additional heat, with the outside air damper remaining closed until the space temperature reaches the set point.

For VAV units indicated on the plan to also control wall fin radiation:

- In the occupied mode if the space temperature falls the set point by 3 degrees (adjustable) the wall fin radiation valve shall open. Once the space temperature reaches the set point the radiation valve shall close
- In the unoccupied mode (air handling unit not operating) the wall fin radiation shall be controlled to maintain the unoccupied temperature set point.
- If the unoccupied set point cannot be maintained within 5 degrees (adjustable) of set point the air handling unit shall operate to provide additional heat, with the outside air damper remaining closed until the space temperature reaches the set point.

Provide separate adjustable minimum and maximum flow set points for both heating and cooling modes in the occupied mode and a separate set of set points for the unoccupied mode. Flow set points shall be set as scheduled on the plans and specifications.

Provide separate adjustable cooling and heating set points for both the occupied and unoccupied modes. When the space temperature is between the heating and cooling set points, the heating valve shall be closed and the airflow at heating and cooling minimum flow.

FAN POWERED VAV TERMINAL UNIT WITH REHEAT DDC CONTROL:

Provide a DDC space temperature sensor to control, in sequence, a modulating electronic control valve for the hot water reheat coil and actuator for terminal air flow.

The controller will start and run the fan continuously during the occupied mode and intermittently during the unoccupied mode.

In the occupied mode when the space temperature is above the set point the air terminal damper shall modulate open to maintain the space temperature. When space temperature is below set point, the air terminal damper shall modulate toward the cooling minimum flow position. After the air terminal damper is at its minimum flow, the hot water valve shall modulate open to maintain space temperature.
In the unoccupied mode when space temperature is below set point, the air terminal damper shall modulate toward the cooling minimum flow position. After the air terminal damper is at its minimum flow, the hot water valve shall modulate open to maintain space temperature.

In the unoccupied mode when space temperature is below set point the fan shall start the air terminal damper shall be closed, the hot water valve shall modulate open to maintain space temperature. When the space temperature reaches the unoccupied set point the fan shall stop and the hot water valve shall close.

Provide separate adjustable cooling and heating set points for both the occupied and unoccupied modes. When the space temperature is between the heating and cooling set points, the heating valve shall be closed and the airflow at heating and cooling minimum flow.

Provide separate adjustable minimum and maximum flow set points for both heating and cooling modes in the occupied mode and a separate set of set points for the unoccupied mode. Flow set points shall be set as scheduled on the plans and specifications.

VARIABLE VOLUME ROOF TOP HEATING /COOLING UNIT CONTROL (RTU-1):

GENERAL:
The Air Handling unit is variable air volume, packaged roof top unit.
The Air Handling unit is controlled by direct digital controller (DDC).
The Air Handling unit is equipped with the following:

- Supply fan with VFD.
- VFD furnished by manufacturer. (Refer to specification 23 74 00)
- Outside air damper furnished by manufacturer. (Refer to specification 23 74 00)
- Outside air damper furnished by manufacturer. (Refer to specification 23 74 00)
- Return air damper furnished by manufacturer. (Refer to specification 23 74 00)
- DX cooling coil and associated compressors and refrigerant accessories furnished by manufacturer. (Refer to specification 23 74 00)
- Modulating natural gas fired heating section furnished by manufacturer. (Refer to specification 23 74 00)
- Filter bank furnished by manufacturer. (Refer to specification 23 74 00)
- Damper Actuators furnished by Control Contractor. (Refer to specification sections 23 09 14 through 23 09 25)

FAN CONTROL:
Start/Stop: The DDC system shall start the supply and return fan via the VFD.

The above sequence may need to be modified to prevent static pressure variances as specified General, Parallel Fan Bumpless Transfer sequence. This may entail adjusting minimum speeds and/or ramping dampers or fans at different rates than specified above.

Current Status Switch: Provide as described under GENERAL, VFD Motor Run Status, in this Section for the supply fan.

Supply Fan Speed Control: The purpose of the supply fan control is to maintain a minimum static pressure in the supply ductwork to insure proper terminal air box operation. Install a static pressure sensing probe in the main supply duct located at approximately ¾ of the way down the main supply duct as shown on the plans and pipe to the differential pressure transmitter that shall be located in the unit temperature control panel. The inputs to the differential pressure transmitter shall be the static pressure inside of the duct and the reference input shall sense the actual space served by the air system located in the ceiling below the duct probe. The DDC system shall modulate the supply fan VFD to maintain the static pressure set point as sensed by the static pressure sensor Static pressure set point shall be as described in the Static Pressure Reset Control below.

Fan Static Pressure Set point Reset Control: Static pressure set point shall be reset using true Trim & Respond logic within the range 0.3 in wc (adj) to 1.2 in wc (adj). When the fan is off, the set point shall be

reset to 1 in. w.c. (adj.) and this set point shall be used on system start up. While the fan is proven on, every three minutes, (adj) trim the set point by 0.04 in. wc. downward if there are zero zone pressure requests. If there is more than one zone pressure requests, respond by increasing the set point upward by 0.06 in. wc. If there is exactly one zone pressure request, the static pressure set point shall not be adjusted.

Each zone VAV shall produce a zone pressure request analog value of 0, 1 or 2. When the VAV damper is less than 90% (adj) open the pressure request analog value shall be zero. If the VAV damper is greater than 90% (adj) and less than the pressure request two set point, then the pressure request analog value shall be one. If the VAV Damper is greater than 99% open for 60 seconds (adj) then the zone pressure request analog value shall be two. Zone pressure requests for each VAV zone associated with the AHU shall be summed in the supervisory controller.

Provide a binary data enable point for each zone to enable/disable the VAV damper in the trim and respond algorithm. All set points, timers, and zone pressure request threshold for the static pressure reset shall be adjustable. Tune the reset to prevent cyclic instability after the space is occupied. Provide a trend graph to show the relative stability of the static pressure set point. Final maximum set point shall be determined by the Balancing Contractor to satisfy the worst case zone at maximum design condition.
When more than 10% of the air terminals are indexed to occupied and the static pressure set point is below the fan start static set point, reset the static pressure to the fan start set point and release to trim and respond control. This is to prevent slow system recovery on scheduled start-up.

VENTILATION AIR CONTROL:

During the Occupied mode the AHU outside air ventilation rate shall be maintained at a minimum of 1850 CFM.

When the Dryer exhaust fan EF-5 is ensbled the building static pressure control shall increase the outside and volume to maintain a build pressure neutral compared to the building exterior.

Install a differential static pressure sensor across each filter bank. Ensure that the static probes do not impede filter removal.

DISCHARGE AIR TEMPERATURE CONTROL:
Install a temperature sensor in the supply duct downstream of the supply fan, all water coils.
Discharge Air Temperature Set point: Discharge air temperature set point shall be 55º F (adj.).

Discharge Air Temperature Control: The gas heating section, mixed air dampers, and the cooling coil shall be controlled in sequence to maintain the discharge air set point temperature. At no time shall gas heat be operating when the mixed air dampers are economizing or the DX cooling is operating. Whenever the discharge air temperature is above the set point, the following shall occur in sequence: The gas heat shall be disabled.. When heating is completely off and the economizer sequence is enabled, the economizer outside air damper, return air damper, and relief hood dampers shall be modulated together in sequence to maintain discharge air temperature set point. When the outside air economizer damper is completely open, or the economizer sequence is not enabled, the DX cooling shall modulate to maintain the discharge air temperature set point. When the discharge air set point is below set point the reverse shall occur. Cooling coil control shall be locked out below 50º F (adj.) outside air temperature.

Gas heat Control: enable gas heating and the unit furnace control shall control the heating section to provide the discharge air temperature.

ECONOMIZER CONTROL:
When the economizer sequence is enabled by the switchover sequence below, the outside air economizer damper, return damper, and relief damper shall modulate in sequence to provide outside air to be used for free cooling. The dampers shall modulate in sequence with the heating and cooling elements as described in the discharge air temperature control sequence above.

Dry Bulb Economizer Switchover: The economizer sequence shall be enabled whenever the outside air temperature is below 68º F (adj.).

SAFETIES:
General: All safeties shall be hard wired to the supply and return fan starters or VFD safety circuits. Starters shall not function in the “Hand” or “Auto” and VFD’s shall be disabled if they are indexed to the “Auto” or “Hand” position in either the VFD or bypass modes.

Freezestat: Install an electric freezestat (refer to specification Section 23 09 14 for location) to shut down the unit (see Unit Shutdown for additional information) if the temperature downstream of the heating coil drops below 35º F (adj.). The electric freezestat shall act independently of the DDC system via hardwire interlock and shall override the DDC system control signal to open the heating coil control valve(s). A freezestat trip shall notify the DDC system that shall send an alarm to the operator interface.

Supply Fan High Pressure Limit: Install a static pressure probe located in the air handling unit main discharge duct at least six feet or as far as physically possible downstream of the fan and upstream of any dampers and pipe to a differential pressure switch located in the temperature control panel. Wire in series with the safety circuit of the supply and return fan. Differential pressure switch shall be a manual reset type and the DDC system shall monitor the status of the differential pressure switch. Initial set point shall be +4.0" w.c. (adj.)

Supply Fan Low Pressure Limit: Install a static pressure probe located in the air handling unit immediately upstream of the prefilter and pipe to a differential pressure switch located in the temperature control panel. Wire in series with the safety circuit of the supply and return fans. Differential pressure switch shall be a manual reset type and the DDC system shall monitor the status of the differential pressure switch. Initial set point shall be -2.0" w.c. (adj.).

Fire Alarm Shutdown: Upon a Fire Alarm System alarm, the fire alarm control module provided by the electrical contractor at the temperature control panel shall change state of its contacts. This shall cause the unit to be shut down (see Unit Shutdown for additional information) and all fire/smoke and smoke dampers within this system shall close immediately through a hardwire interlock. An auxiliary contact shall be provided to notify the DDC system of a fire alarm shutdown. See Section 28 31 00 for fire alarm system programming requirements.

UNIT SHUTDOWN:
Whenever the air handling unit is indexed off, the supply fan shall stop. On a failure of the supply fan, an alarm shall be sent through the DDC system. Whenever supply fans is off for any reason the following shall occur:

The outside air dampers shall close and the return dampers shall open.

The cooling shall be disabled.

UNOCCUPIED CONTROL:
General: Occupied/unoccupied schedule shall be set at the DDC operator interface. When indexed to unoccupied the unit shall shutdown. Where provided, index DDC controlled heating and cooling terminal units associated with this air handling unit to maintain setback and setup temperature set points unless overridden by occupancy sensor or manual pushbutton.

Unit Cycling to Maintain Setback/Setup Temperatures: Cycle the air handling unit on to maintain the setback and setup temperature zone set points from terminal unit space sensors as indicated in the terminal unit sequence to maintain 58 ºF and 86 ºF respectively. In the heating mode, the outside air and relief air dampers shall close and the return air damper shall open and heating discharge temperature control shall function as specified. In the cooling mode, the economizer and DX discharge temperature control shall be allowed to function as specified. Minimum on runtime timer shall be set for 15 minutes (adj.) and the off timer for 30 minutes (adj.).

HEATING OPTIMUM START-UP:
This cycle shall override the unoccupied cycle. If the system was operating as a result of the unoccupied cycle, the system shall continue to operate. The DDC system shall measure the zone air temperature designated on the plans and the outside air dry bulb temperature to determine the minimum run time to warm the zone(s) to its set point. When the computed start time is reached, the DDC system shall start the air handling system and operate with the outside air and relief air dampers closed and the return air damper open. The air handling unit discharge air temperature shall be controlled as specified under Discharge Air Control. If a pneumatic thermostat dual air main is provided, the main shall be indexed to occupied (day) pressure when this mode is started. When the occupied time is reached, the unit shall be switch to occupied control and ventilation air shall be provided.

EXHAUST FAN CONTROL

Exhaust fans shall be controlled as follows:

EF-1, and EF-2 and EF-4: interlock with RTU-1 occupied/unoccupied modes of operation. The fans shall operate in the occupied mode and be off in the unoccupied mode. The motor operated damper shall be open in occupied mode and closed in unoccupied mode.

EF-3: manual controls integral to the unit.

EF-4: Interlock with RTU-1 occupied/unoccupied modes of operation. The fans shall operate in the occupied mode and be off in the unoccupied mode. The motor operated damper, located in the exhaust duct just below the rood deck, shall be open in occupied mode and closed in unoccupied mode

EF-5: Controlled by fan manufacturers controller. Controls shall be installed as required by the system manufacturer. The system shall be enabled by a pressure sensor located in the dryer exhaust air duct. When a positive pressure is sensed in the duct the exhaust system shall start and be controlled as specified by the manufacturer.

EF-6: Provide a reverse acting thermostat to start the fan when the space temperature is above the set point.

RELIEF HOOD DAMPER CONTROL

When the AHU (RTU) outside air dampers air open and the building pressure differential is a positive pressure (0.05”WC adjustable) the two relief hood dampers shall open. If the building becomes neutral or negative the dampers shall close.

The actual set point shall be field determined.

END OF SECTION

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SECTION 23 11 00
FACILITY FUEL PIPING

P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for fuel pipe and fuel pipe fittings for this project.

RELATED WORK

Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 05 15 - Piping Specialties
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI B16.3	Malleable Iron Threaded Fittings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

QUQLITY ASSURANCE.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

WELDER QUALIFICATIONS

Before any metallic welding is performed, Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.

Before any polyethylene fusion welding is performed, Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

The oWNER reserves the right to test the work of any welder employed on the project, at the Contractor's expense. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project.

NATURAL GAS SERVICE

All charges for the gas service as shown on the plans, including the connection from the main in the street or other location to the gas meter, shall be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

P A R T 2 - P R O D U C T S

NATURAL GAS

2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

VENTS AND RELIEF VALVES

Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

UNIONS AND FLANGES

2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star washers for grounding.)

GASKETS

Natural Gas Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978-C or approved equal.

P A R T 3 - E X E C U T I O N

PREPARATION

Remove all foreign material from interior and exterior of pipe and fittings.

ERECTION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment.

Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders in accordance with the Contractor's Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.
2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".
3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.
4. Girth Butt Welds:
    a. Girth butt welds shall be complete penetration welds.
    b. Concavity will not exceed 1/32"
    c. Under cuts will not exceed 1/32"
    d. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

Electrodes shall be with coating and diameter as recommended by the manufacturer for the type and thickness of work being done.

THREADED PIPE JOINTS

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

NATURAL GAS

Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

Teflon tape is acceptable on natural gas lines.

Do not install gas pipe in a ventilation air plenum.

If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

VENTS AND RELIEF VALVES

Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

UNIONS AND FLANGES

Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

GASKETS

Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.

Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the owners's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.
vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

System	Pressure	Medium	Duration
Natural gas	100 psig	Air	24 hr

All pressure tests are to be documented on a form included in this specification.

On piping that cannot be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

END OF SECTION

SECTION 23 21 13
HYDRONIC PIPING

P A R T 1 - G E N E R A L

SCOPE
This section contains specifications for all HVAC hydronic pipe and pipe fittings for this project.

RELATED WORK
Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 05 15 - Piping Specialties
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 07 00 - HVAC Insulation
Section 23 25 00 - HVAC Water Treatment.

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI B16.3	Malleable Iron Threaded Fittings
ANSI B16.4	Cast Iron Threaded Fittings
ANSI B16.5	Pipe Flanges and Flanged Fittings
ANSI B16.22	Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A74	Cast Iron Soil Pipe and Fittings
ASTM A105	Forgings, Carbon Steel, for Piping Components
ASTM A126	Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A181	Forgings, Carbon Steel for General Purpose Piping
ASTM A197	Cupola Malleable Iron
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures
ASTM A380	Practice for Cleaning and Descaling Stainless Steel Parts, Equipment, and Systems
ASTM B75	Seamless Copper Tube
ASTM B88	Seamless Copper Water Tube

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

TYPE F STEEL PIPE:
Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

COPPER TUBE:
Statement from manufacturer on his letterhead that the pipe furnished meets the ASTM specification contained in this section.

QUALITY ASSURANCE
Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING
Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where

end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 type F pipe is specified, ASTM A53 grade A type E or S, or ASTM A53 grade B type E or S may be substituted at Contractor's option. Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

Where ASTM B88, type L hard temper copper tubing is specified, ASTM B88, type K hard temper copper tubing may be substituted at Contractor's option.

WELDER QUALIFICATIONS

Before any metallic welding is performed, the Contractor shall submit his Standard Welding Procedure Specifications, Procedure Qualification Records and Qualification Test Records for each Welder along with associated continuity records to demonstrate compliance with ASME Section IX, paragraph QW-322.

The Contractor shall maintain a complete set of welder qualification documents at the jobsite, including Test Records and Continuity Records for each welder.

The Owner reserves the right to test the work of any welder employed on the project, at the Contractor's expense. Testing will include a visual examination of the pipe and weld and may include radiography of any suspect welds. If the work of the welder is found to be unsatisfactory, the welder shall be prevented from doing further welding on the project. Any welds deemed unacceptable will be repaired at the contractor’s expense.

P A R T 2 - P R O D U C T S

HEATING HOT WATER

2" and Smaller: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, class 125, standard weight cast iron threaded fittings.

2-1/2" and Larger: ASTM A53, standard weight (schedule 40) black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

Contractor may use ASTM B88 seamless, type L, hard temper copper tube with ANSI B16.22 wrought copper solder-joint fittings in lieu of steel pipe for all sizes. Mechanically formed tee fittings may be used in lieu of wrought copper solder-joint tee fittings for branch takeoff up to one-half (1/2) the diameter of the main.

MAKEUP WATER

Extend from where left by the Plumbing Contractor with the same materials.

CHEMICAL TREATMENT

Use pipe and pipe fittings as specified for the system to which the chemical treatment piping is connected. Plastic pipe furnished with the chemical treatment materials may also be used if its pressure/temperature rating is acceptable for the service.

VENTS AND RELIEF VALVES
Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

COOLING COIL CONDENSATE
ASTM B88, type L hard temper copper tubing with ASTM B145/ANSI B16.23 cast red bronze or ASTM B75/ANSI B16.29 wrought solder-type drainage fittings.

UNIONS AND FLANGES
2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use ANSI B16.18 cast copper alloy unions on copper piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 grade I or A105, grade III hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star washers for grounding.)

GASKETS
Water and Glycol Systems: Branded, compressed, non-asbestos sheet gaskets. Klingersil C4401, Garlock 3000, JM Clipper 978-C or approved equal.

MECHANICAL GROOVED PIPE CONNECTIONS
Manufacturers:
Victaulic, Anvil Corp., or Star Pipe Products, Inc.

Mechanical grooved pipe couplings and fittings may be used with steel pipe on the systems indicated below. Either cut-groove or equivalent roll-groove products are acceptable providing the system temperature and pressure requirements are met. Where malleable iron fittings are indicated, they shall conform to ASTM A47. Where ductile iron fittings are indicated, they shall conform to ASTM A 536. Where forged steel fittings are indicated, they shall conform to ASTM A106, Grade B. Where fabricated steel fittings are indicated, they shall conform to ASTM A53, type F in sizes 3/4" through 1-1/2" and type E or S, grade B in sizes 2" through 20". Do not use fabricated fittings where malleable or ductile iron or forged steel fittings are available. Gaskets in all cases shall be EPDM suitable for temperatures to 230 degrees F.

Acceptable fittings and couplings are listed below, based on Victaulic. When used on galvanized piping, fittings and couplings shall be galvanized. When used on black steel piping, fittings and couplings shall have an enamel coating.

Couplings: Ductile iron standard couplings, Style 77; lightweight couplings, Style 75; and rigid couplings. Reducing couplings are not acceptable.

Flanges: Ductile iron Style 741 or 742 except at lug type butterfly valves where standard welding flanges shall be used.

Fittings: Ductile iron elbows and tees of the manufacturer's standard line may be used in all sizes except bullhead tees will not be accepted. Fabricated steel fittings may be used in all sizes where fitting wall thickness conforms to standard weight pipe. Mechanical-T Style 920 fittings with malleable iron housings may be used for up to 2" outlet size.

PART 3 - EXECUTION

ERECTION

Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be rejected and removed from the job site immediately. Excluding minor surface rust, piping that exhibits significant oxidation or corrosion will be rejected.

Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any item that is not clean.

Remove all lose dirt, scale, oil, chips, burrs and other foreign material from the internal and external surfaces of all pipe and piping components prior to assembly, including debris associated with cutting, threading and welding.

During fabrication and assembly, remove slag and weld spatter from internal pipe surfaces at all joints by peening, chipping and wire brushing.

During construction, until system is fully operational, keep all openings in piping and equipment closed except when actual work is being performed on that item of the system. Use plugs, caps, blind flanges or other items designed for this purpose.

Furnish and install all flanges, caps, bypasses, drains, valves, etc. required to facilitate flushing and draining all heating and cooling system piping.

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Install drains throughout the systems to permit complete drainage.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves, control valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

WELDED PIPE JOINTS

Make all welded joints by fusion welding in accordance with ASME Codes, ANSI B31, and State Codes where applicable.

All pipe welding shall be completed by Qualified Welders in accordance with the Contractor's Procedure Specifications.

Contractor will ensure that these steps are followed where pipe sections will be joined by welding:

1. Cleaning – Welding surfaces will be clean and free of defects.
2. Alignment – Inside diameter of piping components will be aligned as accurately as possible. Internal misalignment shall not exceed 1/16".
3. Spacing – Pipe sections will be spaced to allow deposition of weld filler material through the entire weld joint thickness.

4. Girth Butt Welds:
    a. Girth butt welds shall be complete penetration welds.
    b. Concavity will not exceed 1/32”
    c. Under cuts will not exceed 1/32”
    d. As welded surfaces are permitted however surfaces will be free from coarse ripples, grooves, abrupt ridges and valleys.

THREADED PIPE JOINTS

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

COPPER PIPE JOINTS

Remove all slivers and burrs remaining from the cutting operation by reaming and filing both pipe surfaces. Clean fitting and tube with emery cloth or sandpaper. Remove residue from the cleaning operation, apply flux, and assemble joint. Use 95-5 solder or brazing to secure joint as specified for the specific piping service.

WATER SYSTEM

Run water mains level or pitch horizontal mains up 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.

Main branches and runouts to terminal equipment may be made at the top, top 45 degree, side, and/or bottom 45 degree of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located at all top and top 45 degree connections. Use top or top 45 degree connection to main for upfeed risers and bottom 45 degree connection to main for downfeed risers. Bottom connections are not acceptable unless approved by the engineer.

Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping systems.

Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.

MAKEUP WATER

Install where indicated and/or specified, including all valves, piping specialties and dielectric unions required for a functional system.

CHEMICAL TREATMENT

Install chemical treatment piping as indicated on the drawings, as detailed, and as recommended by the supplier of the chemical treatment equipment.

VENTS AND RELIEF VALVES

Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

UNIONS AND FLANGES

Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

GASKETS

Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or cracks. Replace defective materials.

Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60% full torque and two passes at full torque per ASME B16.5.

MECHANICAL GROOVED PIPE CONNECTIONS

Use pipe factory grooved in accordance with the coupling manufacturer's specifications or field grooved pipe in accordance with the same specifications using specially designed tools available for the application.

Lubricate pipe and coupling gasket, align pipe, and secure joint in accordance with the coupling manufacturer's specifications.

Support each horizontal pipe section at least once between couplings and whenever a change in direction of line flow takes place. Support vertical pipe at every other floor or every other pipe length, whichever is most frequent. Set the base of the riser or the base fitting on a pedestal or foundation.

Follow coupling manufacturer's installation recommendations if they are more stringent that the above requirements.

PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the A/E or Owner's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Do not insulate pipe until it has been successfully tested.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking. After testing is complete, slowly release the pressure in a safe manner.

System	Pressure	Medium	Duration
Heating hot water	100 psig	Water	8 hr

All pressure tests are to be documented on a form included in this specification.

HYDRONIC PIPING SYSTEM FLUSHING

All new heating hot water system piping shall be flushed thoroughly before the systems are put in to operation. Subsequent to executing the chemical cleaning processes specified in Section 23 25 00 – HVAC WATER TREATMENT, and prior to adding scale and corrosion inhibitors, flush all piping and components with a clean source of water until the discharge from the system is clean. Discharge shall be from drains provided at all low points in the piping, ends of headers and as otherwise necessary to flush and drain the entire system.

A clean water source shall be tapped into the system downstream of the main circulation pump(s). Provide connection between water source and hot water water systems including taps with ball valves (or line size tap and ball valve for piping systems smaller than 2"). Provide minimum 2" taps (or line size if mains are smaller than 2") at the ends of headers, the low pint of each of the mains on each floor and as otherwise necessary to flush and drain the entire system. Contractor shall identify proposed clean water source along with the method/location of drain discharge and review with the Project Representative prior to installing flushing connections to water source and drain outlets. Provide code required temporary backflow prevention

for the clean water source if needed. Provide all temporary taps, valves, piping, bypasses and hoses as needed to accomplish flushing procedures.

Flush piping systems using the following procedure:

Flushing sequence for hot water and chilled water systems is as follows:

1. Close isolation valves at all coils and wall fin.
2. Open the temporary bypasses that connect the ends of supply and return mains.
3. Flush mains by turning on flushing water source and sequentially opening drains on mains on each floor until the discharge is clean. This will flush the mains without forcing water/debris into the branches and run out pipes.
4. Close isolation valves located downstream of coils/wall fin.
5. Open isolation valves located upstream of coils/wall fin.
6. Open individual drain valves upstream of coils/wall fin until the discharge is clean. This will flush the supply branch and run out lines between the mains and the coils/wall fin without running water/debris through the TCV or coils/wall fin.
7. Close the individual drain valves upstream of coils/wall fin.
8. Open drain valves at low points in the return piping mains.
9. Open the individual isolation valves located downstream of the coils/wall fin. This will flush the return branch and run out lines located between the coils/wall fin and the mains back into the mains and out the drains on the return mains. The water going through the coil/wall fin should be already be clean since this section was flushed previously.
10. Repeat steps 1-3 to clean debris from the mains.

Isolate all coils while flushing risers and mains. After risers and mains have been flushed clean, individually open the drain valves in each branch circuit to discharge any debris that may have accumulated in the branch piping.

After flushing operations are complete, drain and/or blow out any residual water, clean and replace all strainers, and add scale and corrosion inhibitors as specified in Section 23 25 00.
All flushing procedures shall be documented by completing and submitting the report form included at the end of this Section.

INITIAL FILL AND VENT

Fill hydronic systems with appropriate working fluids as specified. All system fluids shall be chemically treated as specified in Section 23 25 00 – HVAC WATER TREATMENT.

For closed piping systems, all air trapped at high points shall be relieved through the manual air vents prior to notifying that the systems are ready to be tested and balanced.

END OF SECTION

PIPING SYSTEM LEAKAGE TEST REPORT

Dane County, Wisconsin
Department of Public Works

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other** _____

Test performed per specification section No. _____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____ **PSIG**

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____ **PSIG**

Stop Test Time: _____ **Final Pressure:** _____ **PSIG**

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments: _____

_____

_____

PIPING SYSTEM FLUSHING REPORT

Dane County, Wisconsin
Department of Public Works

Date Submitted: _____

Project Name: _____

Location: _____ **Project No:** _____

Contractor: _____

System Identification (check one):

❒ **Chilled Water** ❒ **Process Chilled Water** ❒ **Heat Reclaim**

❒ **Heating Hot Water** ❒ **Other** _____

Describe procedure: _____

_____

_____

_____

_____

_____

Flush Date: _____ **Start Time:** _____ **Stop Time:** _____

Pressure of Water Source: _____ **PSIG**

Describe water source and method of connection to source:

_____
_

_____
_

_____
_

PIPING SYSTEM FLUSHING REPORT (page 2)

Flushed By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Company: _____ **Agency:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Describe results: _____

_____

_____

END OF SECTION

SECTION 23 21 23
HYDRONIC PUMPS

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for water pumps used for HVAC applications.

RELATED WORK
Section 23 05 13 - Common Motor Requirements for HVAC Equipment

REFERENCE
Applicable provisions of Division 1 shall govern work under this section.

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, materials of construction, ratings, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

Pump curves shall identify design point of operation.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA

Pump sizes, capacities, pressures and operating characteristics shall be as scheduled.

Pumps shall meet or exceed operating efficiencies scheduled.

Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard, and other accessories specified. Statically and dynamically balance all rotating parts. Provide flanged connections on all pumps unless specified otherwise. Service or repair of base mounted pumps shall not require breaking piping connections or removal of motor.

Where a pump is specified for parallel operation, the scheduled conditions are for that pump with both pumps operating; i.e., total system flow rate is twice that scheduled for a single pump. When only one of the parallel pumps is operating, the operating point of that pump must fall within the manufacturer's recommended operating range.

Provide pump with a motor sized for non-overloading over the entire pump curve. Motors to be 1750 rpm unless specified otherwise.

Furnish each pump and motor with a nameplate giving the manufacturer's name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current.

Test all pumps, clean and paint before shipment. The manufacturer shall certify all pump ratings.

All pumps to operate without excessive noise or vibration.

After completion of balancing, provide replacement of impellers, or trim impellers to provide specified flow at actual pumping head, as installed.

Furnish one spare seal and casing gasket for each pump to user agency.

P A R T 2 - P R O D U C T S

IN-LINE CENTRIFUGAL PUMPS

MANUFACTURERS:
Bell and Gossett, Armstrong, Thrush, Taco, Grundfos, or approved equal.

TYPE:
Single stage, direct connected, resiliently mounted motor for in-line mounting, oil lubricated, or wet rotor 175 psig maximum working pressure at operating temperature of 225 ° F. continuous, 250 ° F. intermittent.

Wet rotor circulators, for in-line mounting, 150 psig maximum working pressure at operating temperature of 225 ° F. continuous. Noryl impeller, ceramic shaft, double –sintered carbon bearings.

CASING:
Cast iron or stainless steel; flanged suction and discharge connection; with plugged taps for vent, drain, suction and discharge gauges.

IMPELLER:
Brass or bronze, keyed to the shaft, single suction enclosed type, hydraulically and dynamically balanced.

BEARINGS:
Two, oil lubricated bronze sleeves or ball bearings capable of being greased.

SHAFT:
Stainless steel or carbon steel with stainless steel or bronze sleeve, integral thrust collar.

SEAL:
Mechanical type, carbon rotating against a stationary ceramic seat, 225°F maximum continuous operating temperature.

DRIVE:
close coupled.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install all pumps in strict accordance with manufacturer's instructions. Access/service space around pumps shall not be less than minimum space recommended by pump manufacturer.

Support piping adjacent to pump such that no weight is carried on pump casings.

Decrease from line size at pump connections with concentric reducers/increasers in the vertical piping, and eccentric reducers/increasers for horizontal piping.

All valves and piping specialties must be full line size as indicated on the drawings

Lubricate pumps before startup.

Install a full line size spring loaded check valve and balancing valve in the pump discharge piping. Reference section 23 05 23.

END OF SECTION

SECTION 23 25 00
HVAC WATER TREATMENT

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for chemical treatment of all water systems.

Appendix
Pipe Cleaning and Treatment Report

REFERENCE
Applicable provisions of Division 1 shall govern work under this Section.

RELATED WORK
Section 23 05 15 - Piping Specialties

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Required for all equipment and chemicals specified including data concerning dimensions, capacities, materials of construction, weights, operating sequence, composite wiring diagrams and appropriate identification. Chemical data to include the description of the chemical, its composition, its function, and the associated material safety data sheet.

OPERATION AND MAINTENANCE DATA
Provide for the services of the manufacturer's trained representative to approve the installation and instruct the user agency in the operation of each system.

Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

DESIGN CRITERIA
Recommend a periodic test procedure and chemical treatment program for each system.

Treat the following systems:
* Hot water

Provide the initial chemical treatment for all systems based on a complete system fluid analysis prior to the equipment installation. The initial chemical treatment supply of chemicals for each system shall be adequate for the start-up and testing period, for the time the systems are being operated by the Contractor for temporary heating and cooling, and for one year after start-up of the system.

The chemicals used in the condenser water treatment system shall use only liquid chemicals and shall contain no phosphates or chromates.

P A R T 2 - P R O D U C T S

MANUFACTURERS
Betz Entac, Dearborn Div. - W. R. Grace & Co., Fremont Industries, Mitco Water Labs, Mogul Corporation, Nalco Chemical Co., Western Water Management, or approved equal.

SYSTEM CLEANER
Blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors that remove grease and petroleum products from the interior of piping systems. Cleaners that contain trisodium phosphate are specifically not acceptable.

.

CLOSED WATER SYSTEM TREATMENT
Coordinate with Dane County Facilities Department for closed system treatment after system cleaning. Treatment shall be consistent withexisting county treatment.

TREATMENT EQUIPMENT

BYPASS FEEDER:
5 gallon minimum capacity, 125 psig working pressure, either a screw type cover or a valved funnel opening to feed chemical into the system, prime coat of paint.

P A R T 3 - E X E C U T I O N

PREPARATION
Prior to cleaning, verify that systems are operational, filled, started, and vented. Use water meter to record capacity in each system.

Place terminal control valves in the full-open position

CLEANING SEQUENCE
GENERAL:
Systems are to be cleaned before they are used for any purpose except conduct pressure test before cleaning. Add cleaner to closed systems at concentrations as recommended by the manufacturer. Remove water filter elements from the system before starting circulation. For steam systems, fill boilers only, using the water and cleaner solution.

Use neutralizer agents on recommendation of the system cleaner supplier and approval of the Architect/Engineer.

Flush open systems with clean water for one hour minimum. Drain completely and refill.

Remove, clean, and replace strainer screens.

Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

Use attached form to document system cleaning, flushing, and proper startup.

HOT WATER HEATING SYSTEMS:
Add cleaner to the system water until the M alkalinity value is 250 above that of the initial fill water. Verify the M alkalinity level before and after the addition of the cleaner by means of chemical tests that are observed by the Owner's construction representative; include results of all tests in the Operating and Maintenance manuals. Apply heat while circulating, slowly raising temperature to 160°F and maintain for 12 hours minimum; vent all high points to assure 100% system circulation. Remove heat and circulate to 100°F or less; drain system as quickly as possible and refill with clean water. Circulate for 6 hours at design temperature, vent air at all high points, then drain. Refill with clean water and repeat until the system cleaner is removed and the M alkalinity level returns to normal. Remove and clean all strainers. Re-vent the system and install clean filter elements in water filters. Treat with scale and corrosion inhibitors before using the system for building heating or cooling.

CLOSED WATER SYSTEMS
Install a separate bypass type feeder at the pumps for each closed hot water system. Provide a separate set of supply and return lines from the system and install ball valves in each of these lines. Locate the system connection that supplies the feeder upstream of the discharge shutoff valve for the pump. Locate the system connection that returns treatment back to the system at a convenient point downstream of the pump discharge shutoff valve. Provide a drain valve at the bottom of the feeder.

END OF SECTION

PIPE CLEANING AND TREATMENT REPORT

Dane County, Wisconsin

Project Number:_____

Department of Public Works

Date Submitted:_____

ProjectName:_____

Location:_____

Contractor:_____

System Tested: Hot Water___ Glycol Water___ Chilled Water___ Fuel Oil____

Condensor Water___ Steam___ Condensate___

System Volume:_____

Materials Used (Provide MSDS for each)

Cleaner:_____Quantity Used:_____

Inhibitor:_____ Quantity Used:_____

Sequestering Agent:_____ Quantity Used:_____

Algaecide:_____ Quantity Used:_____

Neutralizer:_____ Quantity Used:_____

Glycol:_____ Quantity Used:_____

Glycol Solution Water Source:_____Percent glycol by volume:___

M Alkalinity

Prior to Cleaning:_____During Cleaning:_____After Flushing:_____

System Temperature

Prior to Cleaning:_____ During Cleaning:_____

Date/Time Duration	Date/Time Start	Stop
Initial Circulation	_____	_____
Draindown	_____	_____
System Refill	_____	_____
Final Circulation	_____	_____
Heating system Warmup	_____	_____

Component Checklist (Describe procedures performed at each)

Strainers:_____

Filters:_____

Vents:_____

Drains:_____

Traps:_____

BranchLines:_____

TerminalUnits:_____

Boilers:_____

Chillers:_____

Comments:_____

_____

_____

_____

END OF SECTION

SECTION 23 31 00
HVAC DUCTS

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for all duct systems used on this project.
APPENDIX
Duct Leakage Test Report
Duct Structural Test Report

RELATED WORK
Section 23 01 30.51 – HVAC Air Duct Cleaning
Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC
Section 23 33 00 – Air Duct Accessories

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings
ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
ASTM C 916	Standard Specification for Adhesives for Duct Thermal InsulationNFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.
NAIMA	Fibrous Glass Duct Liner Standard

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include manufacturer's data and/or Contractor data for the following:

* Fabrication and installation drawings.
* Duct sealant and gasket material.
* Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

DESIGN CRITERIA

Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

* HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
* HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
* HVAC Systems - Duct Design, 4th Edition, 2006
* Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
* Round Industrial Duct Construction Standards, 2nd Edition, 1999

Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

DELIVERY, STORAGE AND HANDLING

Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

Protect Ductwork against damage.

Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

Offsite storage agreements do not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

P A R T 2 - P R O D U C T S

GENERAL

All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

DUCTWORK PRESSURE CLASS

Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply duct upstream of VAV boxes	___2_ in. calc. S.P.	_3___ in. pressure class
Supply duct downstream of VAV terminals	___1_ in. calc. S.P.	_2___ in. pressure class
Transfer air ducts	___1_ in. calc. S.P.	_1___ in. pressure class
Exhaust air ducts	___1_ in. calc. S.P.	_2___ in. pressure class
Return air ducts	___2_ in. calc. S.P.	3___ in. pressure class
Relief air ducts	___1_ in. calc. S.P.	_2___ in. pressure class

MATERIALS

GALVANIZED STEEL SHEET:

Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or galvanneal sheetmetal for ductwork that will be painted.

ALUMINUM SHEET:

Use ANSI/ASTM B209 aluminum sheet, alloy 3003H-14, capable of double seaming without fracture.

HIGH PRESSURE DUCTWORK (Pressure class 3 inch and over)

Manufacturers: Ajax, Semco, United Sheet Metal, Sheet Metal Connectors or approved equal.

Machine formed round and/or flat oval spiral lock seam duct constructed of galvanized steel.

Rectangular high pressure duct using a transverse joint system as manufactured by Ductmate, Nexus, TDC, TDF, or approved equal, may be used at contractor's option. Duct to be flanged, gasketed and sealed.

Contractor fabricated ductwork meeting specified construction standards is acceptable with prior approval of Architect/Engineer. Submit construction details, a description of materials to be used, type of service, reinforcing methods, and sealing procedures.

Use a perforated inner liner on double wall high-pressure duct. Annular space between inner liner and outer duct to be filled with 1 inch glass fiber insulation.

Use cemented slip joints with 2 inch minimum overlap, flanged connections, or welded/brazed connections, unless noted otherwise for special applications. Prime coat welded joints.

Provide standard 90 degree conical tee takeoffs except for exhaust at velocities over 2000 feet per minute, use 45° lateral connections; straight taps or bullhead tees are not acceptable.

Internal bracing will not be accepted on ductwork below 48 inches.

Use turning vanes as specified in Section 23 33 12.

Provide bellmouth fittings or expanded fittings at each duct connection to air plenums.

Provide pressure relief fittings as indicated on the plans and/or details.

Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.

LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)

Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

Button punch snaplock construction will not be accepted on aluminum ductwork.

Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

EXHAUST DUCT (Moisture laden air)

Moisture laden ductwork systems include restroom and shower room exhaust.

Exhaust ducts conveying moisture laden air, other than dishwasher exhaust, to be constructed of sheet aluminum in accordance with SMACNA standards.

Seal all joints and seams watertight

DUCT SEALANT

Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.

Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

GASKETS

2 INCH PRESSURE CLASS AND LOWER:
Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

3 INCH PRESSURE CLASS AND HIGHER:
Butyl gaskets.

P A R T 3 - E X E C U T I O N

INSTALLATION

Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

Test openings for test and balance work will be provided under Section 23 05 93.

Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.

Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

Provide adequate access to ductwork for cleaning purposes.

Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

Install prefabricated grease ductwork assemblies in accordance with manufacturer requirements and NFPA 96.

During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

DUCTWORK SUPPORT

Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except supporting ductwork with secure wire method is not allowed.

Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching serrated spring loaded wedge mechanism fasteners rated for actual load. Steel cable hanging systems will be allowed on round ductwork under 12 inches diameter if installed utilizing two fasteners with two cable loops. Comply with the manufacturer's installation instructions.

HIGH PRESSURE DUCT (Pressure class 3 inch and over)

Seal all duct in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

LOW PRESSURE DUCT (Maximum 2 inch pressure class)

Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

CLEANING

Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

LEAKAGE TEST

When requested by the Owner or A/E test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Leakage rate shall not exceed more that 1% of the system air quantity for high pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Leakage test for ductwork downstream of air terminal devices may be omitted but will not relieve the contractor from duct sealing requirements.

Submit a signed report to the Division's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates

.

DUCT LEAKAGE TEST REPORT

State of Wisconsin Department of Administration Division of Facilities Development	**DFD Project Number:**_____ **Date Submitted:**_____

Project	**Name:**_____ **Location:**_____ **Contractor:**_____	
System Data	**Fan No:**_____ **Fan Design CFM:**_____	**Leakage Class (C_L):**_____ **Duct Pressure Class (P_C):**_____ **Test Pressure (P_T):**_____
Test Equipment	**Manufacturer:**_____	**Model No:**_____ **Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter desigations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers seperately prior to enclosing chases.

Design Data					Field Test Data							
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft^2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM

TOTAL												

1
2

DUCT STRUCTURAL TEST REPORT

State of Wisconsin	**DFD Project Number:**_____
Department of Administration	
Division of Facilities Development	**Date Submitted:**_____

Project **Name:**_____

Location:_____

Contractor:_____

System Data **Fan No:**_____

Describtion of Test Method:_____

_____

_____

Test Equipment **Manufacturer:**_____ **Model No:**_____ **Serial No:**_____

_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter desigations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers seperately prior to enclosing chases.

Design Data								**Field Test Data**						
Duct Test Location	**Ductwork Shape**		**Duct Pressure Class**	**Allowable Ductwork Wall Deflection**		**Allowable Joint/ Reinforcement Deflection**		**Pressure (in. wc.) In Duct**	**Measured Ductwork Wall Deflection**		**Measured Joint/ Reinforcement Deflection**		**Per-formed By/ Date**	**Wit-nes By/ Dat**
	H	**W**		**H**	**W**	**H**	**W**		**H**	**W**	**H**	**W**		

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES

P A R T 1 - G E N E R A L

SCOPE
This sections includes accessories used in the installation of duct systems.

RELATED WORK
Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment
Section 23 31 00 – HVAC Ducts

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

NFPA 90A	Standard for Installation of Air Conditioning and Ventilating Systems
SMACNA	HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
UL 214	
UL 555 (6th edition)	Standard for Fire Dampers and Ceiling Dampers
UL 555S (4th edition)	Leakage Rated Dampers for Use in Smoke Control Systems

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

MANUAL VOLUME DAMPERS
Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

TURNING VANES
Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

CONTROL DAMPERS
Control dampers are specified in section 23 09 14.

SMOKE DETECTORS
Smoke detectors are furnished and installed by the Electrical Contractor.

ACCESS DOORS
Access doors to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be aluminum or steel full length continuous piano type. Doors in concealed spaces shall be secured in place with cam sash latches. For both hinged and non-hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

Use insulated, 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

FLEXIBLE DUCT
Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

DUCT LINING

Manufacturer: Manville, Owens-Corning, Knauf, or approved equal.

1 inch thick, flexible, mat faced insulation made from inorganic glass fibers bonded with a thermosetting resin with thermal conductivity of .25 Btu inch / hour sq.ft. deg F.
Meet erosion testing per UL 181 or ASTM C 1071 for 5000 fpm maximum air velocity. ASTM C 411 maximum operating temperature rating of 250 deg F. ASTM E84 flame spread less than 25 and smoke developed less than 50.

Meet requirements of ASTM C 1338 and ASTM G21 for fungi resistance.

Install liner using adhesive conforming to ASTM C 916.

FLASHINGS

Flashing and counterflashing for roof curbs will be provided by others.

Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

DUCT FLEXIBLE CONNECTIONS
Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon¿,air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal wight of 26 ounces per square yard.

P A R T 3 - E X E C U T I O N

MANUAL VOLUME DAMPERS

Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

TURNING VANES

Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

CONTROL DAMPERS

Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

SMOKE DETECTORS

Installation and wiring of detectors will be by the Electrical Contractor. Install an access door at each detector location.

ACCESS DOORS

Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

FLEXIBLE DUCT

Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

Penetration of any partition, wall, or floor with flexible duct will not be accepted.

DUCT LINING

Apply lining to the following ductwork:

- Transfer air ducts as detailed and noted on drawings

Install liner in compliance with the latest edition of NAIMA's Fibrous Glass Duct Liner Standard. Locate longitudinal joints at the corners of duct only. Cut and fit to assure lapped, compressed joints. Coat all transverse and longitudinal joints and edges with adhesive. Provide metal nosing on leading edge where lined duct is preceded by unlined duct. Adhere liner to duct with full coverage area of adhesive. Additionally secure liner to duct using mechanical fasteners spaced as recommended by the liner manufacturer without compressing liner more than 1/8" with the fasteners.

FLASHINGS

Flashing for roof curbs, equipment supports or rails located on roof, will be installed by others.

DUCT FLEXIBLE CONNECTIONS

Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

END OF SECTION

SECTION 23 34 00
HVAC FANS

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for fans that are not an integral part of a manufactured device.

RELATED WORK
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 05 13 - Common Motor Requirements for HVAC Equipment
Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

AMCA 203	AMCA Fan Application Manual - Troubleshooting
AMCA 210	Laboratory Method of Testing Fans for Rating
AMCA 300	Reverberant Room Method for Sound Testing of Fans
NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
NFPA 96	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
UL 762	Power Roof Ventilators For Restaurant Exhaust Appliances

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.

Submit color selection charts for equipment where applicable.

Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

For variable air volume application, include data which indicates the effect of capacity control devices, such as inlet vanes, on performance.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
Tested and certify all fans in accordance with the applicable AMCA test code.

Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions.

Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to prevent uneven airflow or improve mixing.

All internal insulation and other components exposed to the airstream are to meet the flame spread and smoke ratings contained in NFPA 90A.

All roof mounted equipment to be provided with curbs or equipment stands in accordance with specification in Section 23 05 29.

P A R T 2 - P R O D U C T S

GENERAL
Use fan size, class, type, arrangement, and capacity as scheduled.

Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection.

Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.

All fans handling grease laden vapors shall meet the requirements of UL 762 and NFPA 96.

Provide a corrosion resistant coating on all surfaces exposed to fume and other corrosive exhaust air. Coating to be as scheduled.

POWER ROOF EXHAUST FANS
Manufacturers: Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME, S&P or approved equal.

Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.

CEILING EXHAUST FANS
Manufacturers: Carnes, Greenheck, Broan, Cook, or approved equal.

Finish to be brushed Centrifugal blower wheel, steel housing with acoustical lining, integral exhaust grille, adjustable mounting brackets to allow for any ceiling thickness, permanently lubricated motor, integral junction box with permanently lubricated and thermally protected motor factory wired

For fans discharging to the exterior an electrically operated contol damper with blade edge and jamb seals, and damper operator shall be provided at the location of duct building exit..
The shutoff damper will be provided by the temperature control contractor.

Provide wall, eave, or roof discharge assembly, as indicated on the drawings.

KITCHEN RANGE HOOD
Manufacturers: Broan, Cook, or approved equal.

Finish to be brushed stainless steel.

Centrifugal blower wheel, permanently lubricated motor, integral junction box with permanently lubricated and thermally protected motor factory wired. Fan to be controlled with integral push button control. Include filters. Include internal locatd lighting.

For fans discharging to the exterior an electrically operated contol damper with blade edge and jamb seals, and damper operator shall be provided at the location of duct building exit..
The shutoff damper will be provided by the temperature control contractor.

LAUNDRY DRYER EXHAUST FANS

Manufacturers: Enervex or prior approved equavilent

The entire system must conform to UL705, Standard for power exhausters and bear a certification mark from UL, ETL or other nationally recognized testing laboratory.

DESCRIPTION

The fan design must be a Type B, Spark Resistant Construction in compliance with AMCA Standard 99-0401. The fan shall be of a clamshell design with vertical discharge and manufactured in a heat and corrosion resistant material rated for an operating temperature of 350°F.

The backward inclined impeller shall be made in non-ferrous material to eliminate the possibility of sparks and the potential of igniting explosive materials. It must be balanced statically and dynamically with balancing weights being an integral and non-removable part of the impeller.

The motor must be a maintenance-free, variable speed motor with pre-lubricated and sealed ball bearings. The motor shall be factory warranted by the fan manufacturer to operate at frequencies as low as 8Hz for three-phase motors. The motor shall be Class H insulated with a temperature rating of min. 356°F and rated as shown on schedule. The motor must be a totally enclosed, fan-cooled (TEFC) motor that does not need an exterior cooling fan. To assure motor longevity the motor shall be inverter-duty rated and not operate at speeds above 1720 RPM.

The modulating fan control, MEC 18, must maintain a draft set-point between 0.00" W.C. and 0.6" W.C. with a tolerance of 0.01" W.C. The control enclosure is NEMA 12 rated.

The system shall provide automatic draft maintenance, draft proving and lockout.

Interlock with with the laundry dryers to provide adequate draft as dryers start and stop. .

Potentiometer to set the required draft set point (" W.C.) and a LCD-panel to display the value. The LCD-panel must also be able to show the actual draft pressure.

Electrical terminals monitored constantly via LED-diodes for verification of proper operation.

LED-diode to verify fan operation and cycling.

LED-diode to indicate alarm.

Safety function to in case of insufficient draft or fan failure, will be indicated this with a visual alarm.

Built in triac to modulate a single-phase fan.

PERFORMANCE, CHIMNEY AUTOMATION SYSTEM

The dryer exhaust system shall ensure that the draft set-point (in. W.C.) is maaintained

Ramp-up and ramp-down time of the fan will be no more than 20 seconds.

The Automation System will maintain the draft set-point to within +/- 0.01" W.C.

The control will shut down the appliance(s) within 15 seconds if draft is not maintained as stated above.

SEQUENCE OF OPERATION

Dryers shall be interlocked with the manufacturers stand control system ol. Upon activation the control will activate the power venter to establish draft in the exhaust system.

P A R T 3 - E X E C U T I O N

INSTALLATION
Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions

LAUNDRY DRYER EXHAUST FANS
Install draft fan and controls in accordance with manufacturers requirements.

POWER ROOF EXHAUSTERS
Coordinate installation with General Contractor for installation of curbs or curb modificaitons

CEILING FANS
Locate fan in center of layin ceiling panel. Fas shall be supported from the building structure, not from ceiling panel or ceiling panel grid.

RANGE HOOD
Coordinate installation of fan with General Contractor.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS

PART 1 - GENERAL

SCOPE
This section includes specifications for air terminal equipment.
RELATED WORK
Section 23 09 14 - Electric Instrumentation and Control Devices for HVAC
Section 23 09 93 – Sequence of Operation for HVAC Controls
Section 23 31 00 - HVAC Ducts
Section 23 33 00 - Air Duct Accessories
Section 23 82 00 - Convection Heating TerminalUnits

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Contractor shall submit air terminal unit data including materials of construction, dimensions, scheduled flow rates, pressure drops, radiated and discharge sound power levels, reset volume controller data, actuator spring range and torque data.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.
DESIGN CRITERIA
Select sizes, capacities, configuration, and operating characteristics as shown on the plans and/or as scheduled.

PART 2 - PRODUCTS

SINGLE DUCT SUPPLY AIR TERMINAL BOXES

Units shall be single duct and pressure independent.

MANUFACTURERS:
Carnes, Envirotec, Metal-Aire, Titus, Trane, Price, Nailor or equal.

CONSTRUCTION:
Unit casing shall be minimum 22 gauge steel and internally insulated. . Construction to meet UL 181 and NFPA 90A. Casing shall be sealed to limit leakage to a maximum of 15 cfm at 6.0 inches of static pressure. Casing outlet shall have slip and drive joint for connection to discharge ductwork.

Air Valve Round—
The primary air inlet connection is an 18-gage galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring is provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart is provided. The damper blade is constructed of a closed-cell foam seal that is mechanically locked between two 22-gage galvanized steel disks. The damper blade assembly is connected to a cast zinc shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking. At 4.0 in. wg, air valve leakage does not exceed 1% of cataloged airflow. Round inlet collar shall be equipped with a multi-point flow sensor that shall amplify the measured velocity pressure. Pneumatic tubing from flow sensor to differential pressure transducer shall be UL listed, fire retardant (FR) type.

Outlet Conection
Slip & Drive Connection—Terminal units come standard with slip & drive connection.

HOT WATER REHEAT COIL**:**
Reference section 23 82 00 for hot water reheat coil specifications.

1" (25.4 mm) Foil-faced Insulation— The interior surface of unit casing is acoustically and thermally lined with 1-inch, 1.0 lb/ft3 (25.4 mm, 16.0 kg/m3) density glass fiber with foil facing. Insulation R-Value is 3.85. Insulation is UL listed and meets NFPA-90A and UL 181 standards and bacteriological standard ASTM C 665. There are no exposed edges of insulation (complete metal encapsulation).

Unit manufacturer shall provide only an electric actuator. The owners control vendor shall provide all required VAV controls for field installation.

SERIES FAN POWERED AIR TERMINAL BOXES

Casing
22-gage galvanized steel. Hanger brackets, side access (standard height—V model numbers) or bottom access (low height—L model numbers) and plenum filter are provided as standard.

Agency Listing
The unit is UL and Canadian UL Listed as a room air terminal unit. Control # 9N65.
AHRI 880 Certified.

Air Valve Round
The primary air inlet connection is an 18-gage galvanized steel cylinder sized to fit standard round duct. A multiple-point, averaging flow sensing ring is provided with balancing taps for measuring +/-5% of unit cataloged airflow. An airflow-versus-pressure differential calibration chart is provided. The damper blade is constructed of a closed-cell foam seal that is mechanically locked between two 22-gage galvanized steel disks. The damper blade assembly is connected to a cast zinc shaft supported by self-lubricating bearings. The shaft is cast with a damper position indicator. The valve assembly includes a mechanical stop to prevent over-stroking. At 4 in. wg, air valve leakage does not exceed 1% of cataloged airflow.

Fan Motor
Electrically commutated motor (ECM) is designed for high-efficient operation with over 70% efficiency throughout the operating range.

Outlet Connection
Flanged connection—Rectangular opening on unit discharge to accept 90° flanged ductwork connection.

Transformer
The 50-VA transformer is factory installed in the fan control box to provide 24 VAC for controls.

Filter
A 1" (25 mm) filter is provided on the plenum inlet and attaches to the unit with a filter frame.

1" (25.4 mm) Foil-faced Insulation - The interior surface of the unit casing is acoustically and thermally lined with 1-inch, 1.5 lb/ft3 (25.4 mm, 24.0 kg/m3) density glass fiber with foil facing. The insulation R-Value is 4.1. The insulation is UL listed and meets NFPA-90A and UL 181 standards as well as bacteriological standard ASTM C 665. There are no exposed edges of insulation (complete metal encapsulation

HOT WATER REHEAT COIL**:**
Reference section 23 82 00 for hot water reheat coil specifications.

PART 3 - EXECUTION

INSTALLATION
Install air terminal units as indicated on project drawings and in accordance with the manufacturer's installation instructions.

Mount air terminal boxes with a minimum 3 feet of straight ductwork upstream of inlet flow sensor for sizes 12" diameter and below. Provide a minimum of 3X the inlet diameter of straight duct upstream of the inlet flow sensor for inlet sizes above 12" diameter.

Where hot water reheat coils are provided with air terminal boxes the following two options may be used.

Provide at least 24" of clearance on controller side of the air terminal unit. The clearance area shall extend the full length of the supply air terminal unit and the full length (including the access door) of the exhaust/return air terminal unit

Support air terminal units from building structure using sheet metal straps or trapeze hanger with rods. Do not mount air terminal units off of adjacent ductwork or piping.

ACCESS DOORS

DUCT ACCESS DOORS – SQUARE DUCT:

Provide duct access doors in duct or extended supply air terminal downstream of the reheat coil. Duct access doors shall be as large as duct allows with a maximum size of 18"x18

INSULATION

RIGID FIBERGLASS INSULATION:
All rigid duct insulation edges shall be covered with metal nosing. Foil scrim face must completely separate the rigid fiberglass duct material from the air stream.

POLYOLEFIN INSULATION:
Apply full cover coat of adhesive to surface to be insulated, insulation and edge butt joints. Place insulation with edge joints firmly butted pressing to surface for full adhesion. Seal seams and joints vapor tight.

For supply air terminal units, provide five feet of 1" thick lining immediately downstream from air terminal unit discharge. Where hot water reheat coils are field or factory installed, provide five feet of 1" thick

lining in ductwork immediately downstream of reheat coil. Refer to specification section 23 33 00 – Air Duct Accessories for liner specification.

ADJUSTING

Coordinate adjustment of air terminal units with section 23 05 93 - Testing, Adjusting and Balancing.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

SCOPE
This section includes specifications for air terminal equipment.

PART 3 - EXECUTION
Installation

RELATED WORK
Section 01 91 01 or 01 91 02 – Commissioning Process
Section 23 08 00 - Commissioning of HVAC
Section 23 31 00 - HVAC Ducts and Casings
Section 23 33 00 - Air Duct Accessories
Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
UL 181 - Factory-Made Air Ducts and Connectors.
ARI-ADC Standard 880

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Furnish submittal information including, but not limited to, the following:
- Manufacturer's name and model number
- Identification as referenced in the documents
- Capacities/ratings
- Materials of construction
- Sound ratings
- Dimensions
- Finish
- Color selection charts where applicable
- Manufacturer's installation instructions

DESIGN CRITERIA
All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

PART 2 – PRODUCTS

LINEAR SLOT DIFFUSERS
Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price

Extruded aluminum with frame type appropriate to installation with diffuser elements being removable from frame. Both air pattern and flow rate adjustment with air pattern having full 180-degree adjustment. Single slot diffuser vanes segmented on 2 or 3 foot centers.

Coordinate frame & border type with Architectural ceiling / mounting details.

Diffuser lengths and slot sizes as shown on drawings and/or as scheduled.

Black enamel finish or powder coat finish, unless otherwise indicated. Flat black diffuser vanes and frame interior.

Provide diffusers with uninsulated galvanized steel plenum. Plenums constructed for specific diffuser frame & border type. Provide round or oval inlet collar designed to fit standard flexible duct sizes.

SQUARE CEILING DIFFUSERS – Plaque

Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price

Aluminum or Steel unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

Directional blow pattern as shown on the drawings and/or as scheduled.

One-piece removable square face plaque with one-piece backpan.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

SIDE-WALL REGISTERS AND GRILLES

Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price

Aluminum or Steel as scheduled unless otherwise indicated, with frame type appropriate to installation.

Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

Opposed blade volume control damper supply registers, operable from face when scheduled.

Fixed blade (0 degree or 45 degree) core return and exhaust registers and grilles.

Opposed blade volume control damper return registers, operable from face when scheduled.

Register and grille sizes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

Screw holes on surface counter sunk to accept recessed type screws.

Provide tamper proof screw for grilles or registers installed in restrooms or shower rooms.

EGGCRATE GRILLE

Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price

Aluminum construction with frame type appropriate to installation.

Grille face 1/2" x 1/2" or 1" x 1" grid pattern 1/2" or 1" deep with a minimum of 85% free area.

Grille sizes and finishes as shown on drawings and/or as scheduled.

White, baked enamel finish or powder coat finish, unless otherwise indicated.

Screw holes on surface counter sunk to accept recessed type screws.

PART 3 - EXECUTION

INSTALLATION

Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

Seal connections between ductwork drops and diffusers/grilles airtight.

Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

END OF SECTION

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SECTION 23 52 00
HEATING BOILERS

PART 1 - GENERAL

SCOPE
This section includes specifications for hot water heating equipment.

RELATED WORK
Section 23 21 13 – Hydronic Piping
Section 23 05 23 – General Duty Valves for HVAC Piping

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
ASME CSD-1 Control and Safety Devices for Automatically Fired Boilers
ASME Boiler and Pressure Vessel Code I V - Rules for Construction of Heating Boilers
NFPA 70 Electrical wiring and devices
National Electric Code

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions

ENERGY EFFICIENCY
All boilers with a capacity of less than 300,000 btu/hr input must be labeled as Energy Star by its manufacturer.

All boilers with a capacity of 300,000 btu/hr input must meet the efficiencies specified. Minimum boiler efficiencies are based on Federal Energy Management Program (FEMP) recommendations.

SUBMITTALS
Refer to division 1, General Conditions, Submittals.

Include data concerning dimensions, capacities, and material of construction, ratings, weights, manufacturer's installation requirements and performance limitations.

Submit manufacturer's installation instructions including required clearance to combustible materials.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

REGISTRATION
Complete Boiler and Unfired Pressure Vessel (UPV) Installation Registration and forward to the Department of Safety and Professional Services in accordance with the Wisconsin Administrative Code Chapter SPS 341.24.

WARRANTY
5year Boiler pressure vessel warranty against leakage due to defective workmanship. 5 year period heat exchanger tubes/combustion chamber assembly warranty against failure due to thermal stress or failure of condensate corrosion. All other boiler, burner and control parts warranted for five year from startup.

Sealed combustion boiler, condensing, hi-efficiency, (modular,) helical heat exchanger/combustion chamber design that will be self-supporting, and warranted for a period of10 years to withstand thermal shock. Heat exchanger shall be warranted against leakage for a period of 10 years.

PART 2 - PRODUCTS

SEALED COMBUSTION BOILER, STAINLESS STEEL WATER TUBE, CONDENSING, HI-EFFICIENCY, MODULAR

Manufactures: –NTI or IBC or prior approved equivalent.

Provide units with capacity and operating characteristics indicated on schedules.

Single pass wate rtube boiler with stainless tubes & tubesheet. Boiler ASME H stamped and constructed for 125 psig and designed per ASME section IV. Furnish a relief valve in compliance with ASME section IV, and set at (30) (50) (75) (100) (160) psig. All internal combustion chamber, and internal burner components, shall be manufactured with stainless steel materials suitable to withstand constant operation under condensing conditions. Combustion chamber shall have a condensate drain to discharge any condensate buildup. CSA certified as an indirect or direct vent boiler and comply with ASME CSD-1.

Boiler minimum efficiency of 94%+ per BTS 2000, and operation in the condensing mode with inlet temperatures as low as 90 F.

Combustion ai intake capable of direct outside air through a sealed intake pipe. Provide inlet/outlet combustion vent temperature fittings with direct outside air application.

Category II, III, or IV flu vent connection as appropriate for installation, condensing positive pressure, for both horizontal and sidewall venting. The vent outlet shall be compatible with installation.

Baked enamel finish or stainless steel insulated boiler sheet metal jacket with removal panels for maintenance access.

Inlet and outlet temperature gauge to monitor and limit inlet and outlet water temperatures.

Pressure gauge mounted on water outlet.

Provide each boiler with a low water cutout operationally testable, manually reset on loss of low-water and auto-rest on loss of power in accordance with ASME Section IV and CSD-1.

Provide each boiler with dual over temperature protection, including manual reset, in accordance with ASME Section IV and CSD-1.

Provide remote fault alarm contact for flame sensor and high temperature limit failure.

Provide single point wiring for controls and fan.

Natural gas-fired burners, forced draft power type with a positive pressure at the boiler discharge. Stainless steel burner mixer or Alloy Fiber. Maximum Nox emissions under 20 PPM. Pre-mix design to allow modulation of fuel and air for a minimum of 5:1 turndown.

Furnish units with fuel trains and operating controls conforming to the latest UL or equivalent agency approval, ASME CSD-1 requirements, Boiler/burner package shall be factory assembled, wired, mounted, and factory fire tested.

Provide a Boiler controller with capability of burner sequencing, flame supervision, safety shutdown, burner modulation control, gas pressure supervision, combustion air proving, pump control,

Provide a multiple boiler sequencing panel (BMS) or integral boiler control capable of staging boilers to maintain peak seasonal efficiency. BMS shall include a sensor to monitor main loop system temperature, and a sensor to monitor outside air temperature. BMS shall be capable of outdoor reset, loop temperature span, and set loop temperature. BMS shall have the capability to stage boilers based on loop temperature and outdoor reset for highest operating seasonal efficiencies. BMS shall have the capability to controlling boiler circulating pumps to operate when the boiler is firing and operate on a delay after firing, BMS shall be capable of starting and stopping the system based on a remote contact closure, and have the ability to change set-point from a remote location.

PART 3 - EXECUTION

INSTALLATION

Install units as shown on plans, as detailed, and according to manufacturer's installation instructions.

Set units on concrete housekeeping pads.

Install all items shipped loose by equipment manufacturer under supervision of equipment manufacturer's field service personnel.

BOILERS

After piping system has been flushed, boil out boilers using chemical and procedure as recommended by boiler manufacturer. Contractor shall verify in writing that boilers have been cleaned according to their recommendations and are ready for operation.

Pipe vents from gas train to atmosphere. Size of each vent shall not be less than connection size to device.

Pipe boiler drains to nearest floor drains.

Owner's representative and/or Engineer will observe boil-out. Contractor must notify Engineer at least 72 hours prior to boil-out.

Install gas pressure gauges at downstream of gas pressure regulators.

If remote control panels are used, install all interconnecting wiring and pneumatic tubing if used between panels and units.

OWNER TRAINING

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of ½ hour.

END OF SECTION

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SECTION 23 74 00
PACKAGED ROOFTOP HEATING AND COOLING UNITS

P A R T 1 - G E N E R A L

DESCRIPTION
This section includes specifications for rooftop gas – electric heating and cooling equipment.

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

RELATED WORK
Section 23 11 00 - Facility Fuel Piping
Section 23 05 13 – Common Motor Rééquipements for HVAC Equipment
Section 23 31 00 – HVAC Ducts
Section 23 33 00 - Air Duct Accessories
Section 23 09 14, 23 09 24, 23 09 25 and 23 09 93 for Temperature Controls

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

The rooftop unit(s) shall be certified in accordance with UL Standard 1995 and ANSI Standard Z21.47

The rooftop unit(s) shall be safety certified by an accredited testing laboratory and the nameplate shall carry the label of the certification agency.

Unit and components shall be designed, manufactured, and independently analyzed, rated, and certified to meet with the seismic compliance standards of the International Building Code, 2003 edition, Section 1621.

SUBMITTALS
Refer to division 1, General Conditions, Submittals.

Include unit dimensions, weights, materials of construction, thermal characteristics, ratings, fabrication methods, manufacturer's installation requirements, and appropriate identification.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
Capacity, efficiency, and operating characteristics as indicated on the drawings and/or as scheduled.

P A R T 2 - P R O D U C T S

PACKAGED GAS/ELECTRIC OUTDOOR HEATING AND COOLING UNITS

MANUFACTURERS:
Trane, AAON, Inc., Carrier, McQuay, or approved equal.

DESCRIPTION
Self-Contained - Factory assembled and tested; designed for roof and consisting of compressors, condensers, evaporator coils, condenser and evaporator fans, refrigeration and temperature controls, gas heaters, exhaust fans, filters, and dampers.

GENERAL
The units shall be down flow supply and return. The operating range shall be between 115°F and 0°F in cooling as standard from the factory for all units. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A refrigerant and 100% run tested to check cooling operation, fan and blower rotation and control sequence before leaving the factory. Wiring internal to the unit shall be numbered for simplified identification. Units shall be UL listed to U.S. safety standards.

CASING
Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel phosphatized, and finished with a pre-applied baked enamel. Cabinet surface shall be tested minimum of 250 hours in salt spray in compliance with ASTM B117. Fully gasketed removable access panels. Provide 1/2 inch thick foil faced fiberglass insulation on all exterior panels and roof in contact with the return and conditioned air stream. Service panels shall have handles and shall be removable while providing a water and air tight seal. Control box access shall be hinged. The indoor air section shall be completely insulated with fire resistant, permanent, odorless, foil faced glass fiber material.

FILTERS
MERV 13, four inch “high efficiency” filters.

COMPRESSORS
Scroll shall include a direct-drive, suction gas cooled hermetic motor. Motor shall be provided by either a patented against incorrect phase sequence, excess motor temperatures, over current protection, and phase loss. The compressor shall include centrifugal oil pump, scroll tips seals, internal heat shield that lowers the heat transfer from discharge and suction gas, oil level sight glass and oil charge valve. Each compressor shall have a crankcase heater installed.

HIGH EFFICIENCY UNIT
The High Efficiency, option shall provide five stages of mechanical cooling with the ability to be at or below 25% compressor displacement at stage one.

EVAPORATOR AND CONDENSER COILS
Condenser coils shall have all Aluminum Microchannel coils. Evaporator coils shall be internally finned Copper tubes mechanically bonded to high performance Aluminum plate fins. All coils shall be leak tested at the factory to ensure pressure integrity. The evaporator coil is pressure tested to 450 psig and the condenser coil at 650 psig. All dual circuit evaporator coils shall be of intermingled configuration. Sloped condensate drain pans are standard.

OUTDOOR FANS
The outdoor fan shall be direct-drive, statically and dynamically balanced, draw through in the vertical discharge position. The fan motor(s) shall be permanently lubricated and have built-in thermal overload protection in a weather tight casing.

Motors shall be premium efficiency. Motors shall have ball bearings rated for 200,000 hours service and external lubrication connections.

INDOOR FAN

Units shall have belt driven, FC, centrifugal fans with fixed motor sheaves. Complete fan assemblies shall be statically and dynamically balanced. Fan shaft shall be mounted on grease lubricated ball bearings. All motors shall be circuit breaker protected. All 60 Hz indoor fan motors meet the Energy Independence & Security Act of 2007 (EISA).meet the U.S. Energy Policy Act of 1992 (EPACT)

Motors shall be premium efficiency. Motors shall have ball bearings rated for 200,000 hours service and external lubrication connections.

GAS HEATING SECTION

The heating section shall have a drum and tube heat exchanger(s) design with primary and secondary surfaces of corrosion resistant aluminized steel or optional stainless steel (**all modulating gas heat units shall have stainless steel**).A forced combustion blower shall supply premixed fuel to a single burner ignited by a hot surface ignition system. On an initial call for heat, the combustion blower shall purge the heat exchanger(s) before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat.

MODULATING GAS HEAT

Modulating Gas Heaters shall be made from grades of stainless steel suitable for condensing situations. The heater shall have a turn down ratio of 2.5 to 1 for low heat and 5 to 1 for high heat.

VARIABLE FREQUENCY DRIVES (VFDS)

VFDs shall be factory installed and tested to provide supply fan motor speed modulation. If the unit is configured for traditional VAV control, the VFD shall receive a 0-10 Vdc signal from the controls based upon supply static pressure and shall cause the drive to accelerate or decelerate as required to maintain the supply static pressure set-point. When subjected to high ambient return conditions the VFD shall reduce its output frequency to maintain operation.

OUTSIDE AIR ECONOMIZER

Economizer control of the OA and RA dampers will be provide by the control contractor.

MOTOR SHAFT GROUNDING RING

Motors with internal Shaft grounding rings can be used with VFDs to provide a conductive discharge path away from the motor bearings to ground.

POWER

A factory installed non-fused disconnect switch with external handle shall be provided for a service disconnect. The non-fused disconnect shall be mounted inside the unit control box.

WIRING DIAGRAMS

Unit specific color coded wiring diagrams shall match the unit color coded wiring and will be provided in both point-to-point and ladder form to enable the controls contractor to make PROPER connections to the unit controls.

SMOKE DETECTOR

Smoke detectors will be provided and installed by the manufacturer and this unit will be controlled on smoke detection by the fire alarm system provided by the Electrical Contractor. A terminal block shall be provided to allow a field connection to the smoke detector.

Detector to be 120V with two output relays, one for trouble and one for alarm.

ROOF CURB

The roof curb shall be designed to mate with the unit and provide support and a water tight installation when installed properly. The roof curb design shall allow field-fabricated rectangular supply/return ductwork to be connected directly to the curb when used with down flow units. Curb design shall comply with NRCA requirements. Curb shall ship knocked down for field assembly and include wood nailer strips

Contractors shall determine if they wish to use a roof curb on the existing raised structure to accommodate duct connections and unit placement.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install units in accordance with unit manufacturer's installation requirements in locations indicated on the drawings and as detailed.

NOTE:
The existing unit is mounted on a site built raised curb to permit bottom connection to the units supply air discharge and return air inlet and offsetting to connect to the ductwork to the floors below.
The HVAC contractor shall provide modifications to the existing high curb to accommodate the new unit including any required structural steel and demolition of existing ductwork and installation of new ductwork required to connect the new unit to the existing duct risers.

Contractors shall determine if they wish to use a roof curb on the existing raised structure to accommodate duct connections and unit placement.

Install gasketed access doors on entering and leaving side of both airstreams for inspection and cleaning.

Deliver rooftop units as factory-assembled units with protective crating and covering as recommended by the manufacturer.

Handle rooftop units to comply with manufacturer's written rigging and installation instructions for unloading and moving to final location.

END OF SECTION

SECTION 23 82 00
HEATING TERMINAL UNITS

P A R T 1 - G E N E R A L

SCOPE
This section includes specification for heating and cooling terminal equipment using water and/or steam as the source.

RELATED WORK
Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 36 00 – Air Terminal Units

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS
ARI 210 Standard for Unitary Air-Conditioning Equipment
ARI 410 Standard for Forced-Circulation Air-Cooling and Air-Heating Coils
CS 140

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include dimensions, capacities, materials of construction, ratings, weights, wiring diagrams, and appropriate identification for all equipment in this section. Include color selection chart where applicable.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

REHEAT COILS
Manufacturers: Carrier, Trane, McQuay, or approved equal.

Construct coils of copper tubes and aluminum fins in a serpentine arrangement with piping connections on the same end. Provide galvanized steel casing, end supports, top and bottom channels to allowance for expansion of finned tube section. Factory test coils at 200 psig.

Headers may be cast iron with tubes expanded into the header, steel pipe with tubes brazed to the header, or seamless copper with tubes brazed to the header.

Frames to be flanged for a gasketed connection to adjacent ductwork or constructed for slip and drive connection to the ductwork.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install units in accordance with manufacturer's installation instructions.

Install branch water or steam/condensate piping to each unit with a minimum of three elbows to allow for expansion and contraction of the piping system.

Coordinate location of units with other trades to assure correct recess size for recessed units.

After installation, provide protective covers to prevent accumulation of dirt on units during balance of construction.

REHEAT COILS

Comb bent or crushed fins and clean dust and debris from each coil before enclosing coils in ductwork. Pitch coil casings in accordance with manufacturer's instructions. Install a drain valve on the coil side of the shutoff valves for each reheat coil.

END OF SECTION

SECTION 25 00 00

INTEGRATED ACCESS CONTROL SYSTEM (IACS)

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. This section describes the Systems Integration (SI) scope of work for the access control system project. This section also coordinates the responsibilities of the Section 28 13 00 - Access Control System Peripheral Device (ACS-PD) and Electrical trade contractors pertaining to control products or systems, furnished by each trade, that will be integrated by this Division.

B. All labor, material, equipment and software not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

1.03 SYSTEM DESCRIPTION

A. The Integrated Access Control System (IACS) shall be comprised of enterprise level server/software, master access control modules (ACM) with network connectivity; two door expansion units (ACEM) connected to master control modules via an RS-485 and power trunk; card readers, door status devices, request to exit devices, emergency door releases and electronic locking hardware that in turn are connected to either master access control modules or expansion modules; power supplies and back up batteries that support the electronic locking hardware as required. The ACM shall connect to the owner's local or wide area network, depending on configuration. Access to the system, either locally in each building, or remotely from a central site or sites, shall be accomplished through standard Web browsers, via the Internet and/or local area network. Each ACM shall be capable of communicating with a Niagara^{AX} Building Automation System server and enterprise level software.

B. The SI shall provide all ACMs, ACEM's, control module enclosures, wiring riser, termination diagrams, access credentials (card or fobs), programming, and training for the IACS.

C. The Division 28 ACS-PD Contractor shall provide all peripheral devices including but not limited to; electronic locking hardware (EL), door status sensors (DSS), proximity card readers (PCR), request to exit devices (REX), emergency door releases (EDR), fire alarm system interface (FASI), surge suppressors (SS), power supplies (PS), back up batteries (Batt), cable, cable support and labor for; mounting all enclosures/devices (including Division 25 enclosures), installation of all cabling, termination of all devices (including Division 25 devices) and 120VAC power installation as needed.

1.04 SYSTEM INTEGRATOR QUALIFICATIONS

A. General:

1. The SI shall have a successful history in the design and installation of open control systems with browser based wide area network connectivity and shall provide evidence of this history as a condition of acceptance of bid.
2. The SI shall have an office that is staffed with trained engineers and technicians fully capable of providing instruction and routine emergency maintenance service on all system components within 24 hours of notification.

3. Contractor Service:

a. The SI shall have a local service facility within a 90-mile radius of the job site, staffed with qualified service personnel, fully capable of providing instructions and routine or emergency maintenance service.

b. Experience (Submit the following information as part of the proposal package):

i. Submit a list of no less than five similar projects that have Integrated Automation Systems (IAS) installed by the System Integrator. These projects must be on-line and functional such that the owner's representatives can observe the IAS in full operation. Include proper references and contact numbers.

c. Submit an organizational diagram indicating the key technical staff proposed for the project including Project Manager, Application Engineer, etc.

d. Qualified Bidder: Environmental Systems, Inc., 262-544-8860

1.05 SUBMITTAL

A. Shop drawings of the IACS system shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, software descriptions, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system. Terminal identification for all control wiring shall be shown on the shop drawings.

B. Submittal shall include a network cable schematic diagram depicting, control panel locations and a description of the communication type, media and protocol.

C. Upon completion of the work, provide a complete set of 'as-built' drawings and application software on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on compact disk. Division 28 and 25 contractors shall provide as-builts for their portions of work. Division 25 contractor shall be responsible for as-builts pertaining to overall IACS architecture and network diagrams.

1.06 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1.	ACS	Access Control System
2.	ACM	Access Control Module
3.	ACEM	Access Control Expansion Module
4.	ACS-PD	Access Control System-Peripheral Device
5.	AWG	American Wire Gauge
6.	BAS	Building Automation System
7.	DSS	Door Status Sensor
8.	EDR	Emergency Door Release
9.	EL	Electronic Locking Hardware
10.	FASI	Fire Alarm System Interface
11.	FMCS	Facility Management Control System
12.	IACS	Integrated Access Control System
13.	IOM	Input/Output Module
14.	LAN	Local Area Network
15.	NS	Network Supervisor
16.	PCR	Proximity Card Reader
17.	PD	Peripheral Device

18. PR Proximity Card Reader
19. PS Power Supply
20. REX Request to Exit Device
21. SI Systems Integrator
22. SSI Sub System Interface
23. WAN Wide Area Network

1.07 DIVISION OF WORK

A. The SI shall be responsible for providing all ACMs, ACEMs, control panels, controller programming, controller programming software, enterprise level servers and wiring diagrams.

B. The SI shall be responsible for integration sequences between the ACS and BAS, global supervisory control applications as may be required, system integration and coordination of the point to point check out with the ACS-PD Contractor.

C. The point of demarcation for the products to be provided by the SI shall be up to and including the ACMs, ACEMs, enterprise level software/licensing and associated enclosures.

1.08 WORK INCLUDED

A. Furnish and install the following application software as outlined in this section.
   1. User Interface software
   2. License upgrade software

B. The following will be coordinated with the owner:
   1. Provide set-up and development of the software to provide the functional and performance requirements specified herein.
   2. Provide development of access levels, time schedule, naming conventions, user rights and integration sequences as may be required.

1.09 AGENCY AND CODE APPROVALS

A. All products of the IACS shall be provided with the following agency approvals. Verification that the approvals exist for all submitted products shall be provided with the submittal package. Systems or products not currently offering the following approvals are not acceptable.
   1. FCC, Part 15, Subpart J, Class A Computing Devices

1.10 RELATED WORK SPECIFIED ELSEWHERE

A. Section 28 13 00, ACS-PD Contractor:
   1. Providing peripheral devices and interfaces including but not limited to:
      a. Proximity Card Readers
      b. Electronic Locking Hardware
      c. Door Status Sensors
      d. Request to Exit Devices
      e. Emergency Door Releases
      f. Surge Suppression
      g. Fire Alarm System Interface
      h. Power Supplies
      i. Sub-system Interface
      j. Cabling
      k. Installation Labor
      l. Device wiring terminations

1.11 SOFTWARE LICENSE AGREEMENT

A. The Owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to Owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software.

B. It is the owner's expressed goal to implement an IACS that shall allow access control and occupancy data to be integrated into a FMCS in order to provide improved energy management and security. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive use of all job specific configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the ACM and any related LAN / WAN / Intranet and Internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the owner.

1.12 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.13 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this division with that of other divisions to insure that the Work will be carried out in an orderly fashion. It shall be the SI's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, conduit runs, electrical feeds and structural or architectural features.

PART 2 - MATERIALS

2.01 GENERAL

A. The Integrated Access Control System (IACS) shall be comprised of a network of interoperable, stand-alone ACMs/ACEMs, servers, operator workstations, network devices and other devices as specified herein.

B. The installed system shall provide secure password access to all features, functions and data contained in the overall IACS.

2.02 OPEN, INTEROPERABLE, INTEGRATED ARCHITECTURES

A. The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed access control system with the capability to integrate to the existing building automation system via Ethernet using one of the following protocols: BACnet IP, oBIX, or Niagara^{AX} Fox.

B. The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs and shall employ component-oriented technology (COT) for representation of all data and control devices within the system. In addition, adherence to industry standards is required to assure interoperability between all system components. For each BACnet ANSI / ASHRAE™ Standard 135-2004 system, the system supplier must provide a PICS document showing the installed systems compliance level. Physical connection of BACnet devices shall be via Ethernet using BACnet/IP. BACNet MSTP shall not be acceptable as a means to integrate the IACS with a FMCS or BAS

C. A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

2.03 NETWORKS

A. The Local Area Network (LAN) shall be a 100 Mb minimum Ethernet network for maximum flexibility for integration of building data with enterprise information systems and providing support for multiple ACMs, user workstations and, a local server.

B. Local area network minimum physical and media access requirements:

1. Ethernet; IEEE standard 802.3
2. Cable; 10 Base-T, UTP-8 wire, category 5E or 6
3. Minimum throughput; 10 MB, with ability to increase to 1 GB

2.04 NETWORK ACCESS

A. Remote Access.

1. For Local Area Network installations, provide access to the LAN from a remote location, via the Internet. The owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's Intranet, to a corporate server providing access to an Internet Service Provider (ISP). Owner agrees to pay monthly access charges for connection and ISP.

2.05 ACCESS CONTROL MODULE (ACM)

A. The SI shall supply one or more ACMs as part of this contract. The number of ACMs required is dependent on the type, location and quantity of peripheral devices provided under Section 28 13 00. It is the responsibility of the SI to coordinate with the Section 28 13 00 ACS-PD Contractor to determine the quantity and type of devices.

B. The ACM shall be a Tridium Vykon model SEC-J-601 or equal

C. The ACM shall provide the interface between the LAN/WAN, ACEMs and remote input/output devices as well as provide global supervisory access control functions over the all devices connected to the ACM. The ACM shall provide multiple user access to the system. The ACM shall support standard Web browser access via the Intranet/Internet.

D. The ACM shall be capable of executing common application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Event and Credential database reporting.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration via BACnet, Niagara^{AX} Fox or Obix.

E. The ACM must provide the following hardware features as a minimum:

1. IBM/AMCC PowerPC 405EP 266 MHz processor or equal.
2. 128MB SDRAM & 64MB NAND Flash.
3. Two (2) Ethernet ports – 10/100 Mbps.
4. One (1) RS-485 port.
5. Capable to operate over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.
6. Optional Autodial 56 Kbps modem slot.
7. Support fifteen (15) additional remote modules, mix and match any combination of ACEMs and Input/Output Modules (IOM).
8. Support two (2) card readers, 6 supervised inputs, 4 digital output relays, 1 unsupervised input for cabinet tamper detection, 1 unsupervised input for external power source AC power fail and 1 unsupervised input for battery low detection.

9. The ACM shall provide an integrated battery backup to provide sufficient time for an orderly system shutdown in the event of a power failure. The NSC shall provide a minimum 4 hours backup operation to the IACS while operating on battery backed power.

10. The ACM shall be mounted in a key locked, tamper switch protected metal enclosure with the following requirements:

    a. The cabinet shall be suitable for wall mounting and contain a removable door for ease of installation.

    b. The cabinet shall be suitably sized to allow installation of the controller and additional expansion modules if required.

2.06 ACCESS CONTROL EXPANSION MODULE

A. The SI shall supply one or more ACEMs as part of this contract. The number of ACEMs required is dependent on the type, location and quantity of devices provided under Section 28 13 00. It is the responsibility of the SI to coordinate with the Section 28 13 00 ACS-PD Contractor to determine the quantity and type of devices.

B. The ACEM shall be Tridium Vykon model SEC-R2R or equal.

C. The ACEM shall support 2 access control reader ports, 4 supervised inputs and 2 digital output relays.

D. The ACEM shall communicate with the ACM via an RS-485 bus.

E. The ACEM shall be capable of operation over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.

2.07 INPUT/OUTPUT MODULE (IOM)

A. The IOM shall be Tridium Vykon model SEC-RIO or equal.

B. The IOM shall provide inputs and outputs to monitor and control non-reader-based system points, such as door contacts, motion sensors, gate actuators, etc.

C. The IOM shall support 8 supervised four-state inputs (open, closed, short and cut), 8 digital output Form C relays, 1 alarm input point for cabinet tamper detection and 1 alarm input point for external power source AC fail / battery low detection.

D. The IOM shall communicate with the ACM via an RS-485 bus.

E. The IOM shall be capable of operation over a temperature range of +35F to +122F (+2C to +50C) and a humidity range of 0 to 95% RH, non-condensing.

2.08 Backup Batteries (Batt)

A. Backup battery power shall be provided for all system components such that the entire system will function normally for a period of no less than 4 hours from the loss of AC power.

2.09 WEB BROWSER CLIENTS

A. The system shall be capable of supporting no less than ten (10) concurrent users and up to twenty-five (25) with the use of a network supervisor, using a standard Web browser such as Internet Explorer™, Mozilla Firefox™, etc. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-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 IAS, shall not be acceptable.

C. 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.

2.10 NETWORK SUPERVISOR FUNCTIONS AND HARDWARE

A. A Network Supervisor (NS) shall be provided, where more than two ACMs are applied to an enterprise application. The NS shall support all Access Control Modules (ACMs) connected to the control LAN/WAN.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1. The owner's wide area network (WAN) shall not be used.

C. It shall be possible to provide access to all ACMs via a single connection to the Network Supervisor.

D. The Network Supervisor shall provide the following functions, at a minimum:

1. Global Data Access: The Network Supervisor shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The Network Supervisor shall provide the ability to execute global control strategies based on control and data objects in any ACM in the network, local or remote.
3. The Network Supervisor shall include a master clock service for its subsystems and provide time synchronization for all ACMs.
4. The Network Supervisor shall accept time synchronization messages from trusted precision Atomic Clock Internet sites and update its master clock based on this data.
5. The Network Supervisor shall provide scheduling for all ACMS and their ACEMs.
6. The Network Supervisor shall provide central alarm management for all ACMs supported by the Network Supervisor. Alarm management shall include:
   a. Routing of alarms to display, printer, email and pagers
   b. View and acknowledge alarms
   c. Query alarm logs based on user-defined parameters
7. The Network Supervisor shall provide central management of log data for all ACMS supported by the Network Supervisor. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:
   a. Viewing and printing log data
   b. Exporting log data to other software applications
   c. Query log data based on user-defined parameters

E. Network Supervisor Hardware Requirements: The Network Supervisor hardware platform shall have the following requirements:

1. The computer platform shall comply with the current server standards as defined by the Owner's BIS department.
2. When attaching the Network Supervisor to the owner's wide area network, the Network Supervisor must be equipped with Network Client software that conforms to the Owner's BIS standard.
3. The Network Supervisor operating system shall be Microsoft Windows XP Professional. Include Microsoft Internet Explorer 6.0 or later.
4. Connection to the IAS network shall be via an Ethernet network interface card, 100Mbps.

2.11 ENTERPRISE SYSTEM CAPACITIES

A. The IACS software shall support the following features and be configured for a minimum of the following:

1. 1,000,0000 Personnel Records
2. 50,0000 Buffered Transactions of System Events

3. 16 Programmable Wiegand Card Formats
4. 25,000 Access Levels (15 per card holder)
5. 25,000 Access Zones
6. 1,500 Schedules
7. 6 ACM Supported (Max 500)

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work described in this section shall be performed by a system integrator that has a successful history in the design and installation of integrated control systems. The installing office shall have a minimum of five years of integration experience and shall provide documentation in the submittal package verifying the company's experience.

B. Install system and materials in accordance with manufacturer’s instructions, and as detailed on the project drawing set.

C. Drawings of IACS network are diagrammatic only and any apparatus not shown, but required to make the system operative to the complete satisfaction of the Architect shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to control equipment shown specified or shown on the control diagrams shall be furnished and installed by the ACS-PD contractor in accordance with the specifications in Section 28 13 00.

3.02 WIRING

A. All electrical control wiring and power wiring to the ACMs/ACEMs, computers and network components (routers, hubs, switches, etc.) shall be the responsibility of the Section 28 13 00, ACS-PD Contractor.

B. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local codes. All IAS wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where IACS plenum rated cable wiring is allowed it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

3.03 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the System Integrator at no expense to the Owner.

3.04 WARRANTY ACCESS

A. The Owner shall grant to the System Integrator, reasonable access to the IAS during the warranty period. The owner shall allow the contractor to access the IAS from a remote location for the purpose of diagnostics and troubleshooting, via the Internet, during the warranty period.

3.05 ACCEPTANCE TESTING

A. Upon completion of the installation, the System Integrator shall load all system software and start-up the system. The ACS-PD contractor (Section 28 13 00) shall perform all necessary testing and de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The ACS-PD Contractor (Section 28 13 00) and the System Integrator (Section 25 00 00) are to coordinate the checkout of the system such that each Division has a representative present during system checkout.

B. The ACS-PD Contractor shall perform tests to verify proper performance of components 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 IACS operation. The System Integrator shall have a representative present during system checkout by the ACS-PD Contractor. The System Integrator shall coordinate and comply with the start-up and checkout schedule of the ACS-PD Contractor. The ACS-PD Contractor shall give a minimum of two (2) weeks advance notice to the System Integrator, of the startup schedule and plan.

C. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

D. System Acceptance: Satisfactory completion is when the ACS-PD Contractor and the System Integrator have successfully performed all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.06 OPERATOR INSTRUCTION, TRAINING

A. The System Integrator shall provide a minimum of 16 hours of instruction to the owner's designated personnel on the operation of the IACS and describe its intended use with respect to the programmed functions specified. Operator orientation of the IACS 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.

B. The training shall be in two sessions as follows:

1. Initial Training: One day session (8 hours) after system is started up and at least one week before first acceptance test.

2. Follow-Up Training: One day session (8 hours) approximately two weeks after final system commissioning. This session will deal with more advanced topics and answer questions as requested by the owner. Topics covered will include but are not limited to: how to add credentials/users, create time schedules and access levels, generate user activity reports, etc…

PART 4 - SEQUENCES OF OPERATION - SPECIAL

4.01 SUMMARY

A. The System Integrator shall refer to this Item under Section 28 13 00 to determine what level of control functionality the ACM/Network Supervisor (NS), must provide. It is the responsibility of the System Integrator to coordinate control functions, such as scheduling and supervisory-level global control with the ACS-PD contractor.

END OF SECTION 25 00 00

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SECTION 26 05 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 GENERAL PROVISIONS

A. In general, the work includes: Electrical work and the kindred materials and operations as indicated on the drawings and as specified in the following articles of Sections:

25 00 00	Integrated Access Control System
26 05 00	General Electrical Requirements
26 05 11	Basic Materials and Methods
26 09 23	Occupancy Sensor
26 43 13	Transient Voltage Surge Suppression
26 51 13	Lighting
27 10 00	Telecommunications Distribution
27 52 23	Help Call System
28 13 00	Access Control and Intrusion Detection
28 23 00	Video Surveillance System
28 31 00	Fire Alarm System

B. Job Information: Obtain at building including:

1. Conditions affecting this Section of the Work.
2. Accessibility
3. Storage space.

1.03 GENERAL REQUIREMENTS

A. This Section of the Specifications applies to all electrical work. Sections 01 00 00 and 01 91 00 form a part of these specifications and the Contractor shall consult them in detail. Electrical work indicated in other Sections of the Specifications to be done by the Electrical Contractor shall be included in the Work of this Section.

1.04 DEFINITIONS

A. Certain terms used herein; on the drawings; and in the contract documents, shall be defined as follows:

B. Provide: Furnish and install complete and ready for service.

C. Exposed: Exposed to view in any room, hallway, passageway, or outside.

D. Approval: The approval of the Architect in writing or by signed rubber stamp applied to drawings, illustrations, etc.

1.05 INTENT OF DRAWINGS AND SPECIFICATIONS

A. These specifications and attendant drawings are intended to cover a complete installation of systems. The omission of expressed reference to any item of labor or material necessary for the proper execution of the work in accordance with present practice of the trade shall not relieve the Contractor from providing such additional labor and materials.

1.06 DRAWINGS

A. The Electrical drawings do not attempt to show the complete details of building construction which affect the electrical installation. The Contractor shall refer to the architectural, civil, structural and mechanical drawings for additional details which affect the proper installation of this work. The Contractor is cautioned that diagrams showing electrical connections and/or circuiting are diagrammatic only and must not be used for obtaining lineal runs of wire to conduit. Wiring diagrams do not necessarily show the exact physical arrangement of the equipment.

1.07 MATERIAL AND EQUIPMENT

A. All material and equipment shall be new and of the quality used for the purpose in good commercial practice, and shall be standard product of reputable manufacturers. Each major component of equipment shall have the manufacturer's name, catalog number, and capacity or rating on a nameplate, securely affixed on the equipment in a conspicuous place.

1.08 SUBSTITUTION AND APPROVAL OF MATERIAL

A. See Section 01 00 00.

B. Such requests shall be accompanied by three copies of all necessary illustrations, cuts, drawings and descriptions of material proposed for substitution and shall fully describe all points in which it differs from the articles specified. Two copies will be retained by the Architect and one copy returned to the Contractor with approval or revisions indicated thereon.

1.09 DAMAGE TO OTHER WORK

A. The Electrical Contractor will be held rigidly responsible for all damages to the work of his own or any other trade resulting from the execution of his work. It shall be the Contractor's responsibility to adequately protect his work at all times. All damages resulting from his operations shall be repaired or the damaged portions replaced by the party originally performing the work, (to the entire satisfaction of the Architect), and all cost thereof shall be borne by the Contractor responsible for the damage.

1.10 COOPERATION WITH OTHER TRADES

A. This Contractor shall completely cooperate with all other trades in the matter of planning and executing of the work. Every reasonable effort shall be made to prevent conflict and interferences as to space requirements, dimensions, locations, openings, sleeving or other matters which tend to delay or obstruct the work of any trade.

1.11 NEGLIGENCE

A. Should the Contractor fail to provide materials, templates, etc., or other necessary information causing delay or expense to another party, he shall pay the actual amount of the damages to the party who sustained the loss.

1.12 FIELD CHANGES

A. Should any change in drawings or specifications be required to comply with local regulations and/or field conditions, the Contractor shall refer same to Architect for approval before any work which deviates from the original requirements of the drawings and specifications is started. In the event of disagreements as to the necessity of such changes, the decision of the Architect shall be final.

1.13 CUTTING AND PATCHING IN NEW CONSTRUCTION

A. As necessary and with approval to permit the installation of conduit or any part of the work under this branch. Any cost caused by defective or ill-timed work shall be by the party responsible therefor. Patching of holes, openings, etc. resulting from the work of this branch shall be furnished by this contractor.

B. See Section 01 00 00 for additional requirements.

1.14 COMPLETION DATES

A. This Contractor shall be in a position to meet all completion dates established by the Architect and shall furnish all labor of all classes required to meet such schedules and completion dates.

1.15 STANDARDS, CODES AND PERMITS

A. All work shall be installed in accordance with National, State and Local electrical codes, laws, ordinances and regulations. Comply with all applicable OSHA regulations.

B. All materials shall have a U.L. label where a U.L. standards and/or test exists.

C. Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them.

D. Secure and pay for all permits and licenses required.

1.16 CLEAN-UP

A. This Contractor shall at all times keep the premises free from excessive accumulation of waste material or rubbish resulting from his work, including tools, scaffolding and surplus materials, and he shall leave his work broom clean or its equivalent.

B. In case of dispute, Architect may order the removal of such rubbish and charge the cost to the responsible contractor as determined by the Architect. At the time of final clean-up all fixtures and equipment shall be thoroughly cleaned and left in proper condition for their intended use.

1.17 TESTS

A. The Contractor shall provide all instrumentation, labor and conduct all tests required by the Architect. All tests shall be made before any circuit or item of equipment is permanently energized. Circuits shall be phased out and loads shall be distributed as evenly as possible on all phases. All phase conductors shall be entirely free from grounds and short circuits. All instrumentation and personnel required for testing shall be provided by the Contractor and all tests shall be conducted in the presence of the Architect or his authorized representative.

B. System Tests:

1. The following tests are required prior to energization of the electrical system:
    a. Service and building ground tests.
    b. Secondary feeders shall have an insulation resistance test utilizing a megger applying a test potential of 500 volts DC minimum.
    c. Establish secondary phase to ground voltages.
    d. Establish proper phase relationship and motor rotation.
2. The following tests are required under normal load condition:
    a. Record secondary phase to phase and phase to ground voltages and phase currents at all major equipment, apparatus, and on all secondary feeders. Voltage readings shall be taken at line side terminals of distribution centers and panelboards.
    b. Confirm proper phase relationship and motor rotation.
    c. Confirm load balance at distribution centers and panels. Rebalance load if necessary such that the minimum unbalance between phases shall not exceed 7-1/2%.

d. Confirm operation of all electrically operated apparatus, such as circuit breakers, transfer switches, etc., by exercising same under load.

e. Record all settings and calibrations of circuit breakers, transfer switches, transformers, meters, timing devices, etc.

C. Records:

1. All test data obtained by the E.C. or manufacturer/supplier shall be recorded and filed with the maintenance manual as part of permanent job records. Test data shall include identification of instruments employed (field test only), condition of test (time, date, weather, etc.), parameters of test, personnel conducting test, and any pertinent information or conditions noted during the test.

1.18 SHOP DRAWINGS

A. Submit to Engineer for review, copies of manufacturer's shop drawings and/or equipment brochure depicting:

1. Lighting Fixtures
2. Panelboards
3. Timeclocks
4. Telecommunications Cabling
5. Surge Protection
6. Access Control
7. Fire Alarm
8. Camera Surveillance
9. Help Call
10. Wiring Devices
11. Other materials at the request of the Engineer

B. Shop drawings shall bear the Contractor's stamp indicating approval.

C. Any equipment fabrication prior to shop drawing review shall be at the Contractor's risk.

1.19 WORKMANSHIP

A. The installation of all work shall be made so that its several component parts will function as a workable system complete with all accessories necessary for its operation, and shall be left with all equipment properly adjusted and in working order. The work shall be executed in conformity with the best accepted standard practice of the trade so as to contribute to efficiency and appearance. It shall also be executed so that the installation will conform and adjust itself to the building structure, its equipment and its usage.

1.20 DRAWINGS OF OTHER TRADES

A. The Contractor shall consult the drawings of the work for the various other trades; field layouts of the parties performing the work of the other trades; their shop drawings, and he shall be governed accordingly in laying out his work.

B. Specifically examine shop drawings to confirm voltage, current characteristics, and other wiring requirements for utilization equipment. Bring any discrepancies to the attention of the A/E.

1.21 FIELD MEASUREMENTS

A. The Contractor shall take all field measurements necessary for his work and shall assume the full responsibility for their accuracy.

1.22 STRUCTURAL INTERFERENCES

A. Should any structural interferences prevent the installation of the outlets, running of conduits, etc., at points shown on drawings, the necessary minor deviation therefrom, as determined by the Architect, may be permitted. Minor changes in the position of the outlets or equipment if decided upon before any work has been done by the Contractor shall be made without additional charge.

1.23 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

A. Before submitting a bid, the Contractor shall visit the site and familiarize himself with all features of the building and site which may affect the execution of his work. No extra payment will be allowed for the failure to obtain this information. If in the opinion of the Contractor there are omissions or errors in the plans or specifications, the Contractor shall clarify these points with the Architect before submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the greater quantity or better quality.

1.24 GUARANTEE

A. The Contractor shall unconditionally guarantee his work and all components thereof, excluding lamps, for a period of one year from the date of his final payment. He shall remedy any defects in workmanship and repair or replace any faulty equipment which shall appear within the guarantee period to the entire satisfaction of the Architect at no additional charge.

1.25 TEMPORARY WIRING AND SERVICE

A. Temporary electrical services include all electric service required up to the time of substantial completion.

B. Extend power from existing service. Service shall be extended into the building as work progresses and panels provided as necessary to provide a minimum of two weatherproof sockets per 1000 sq. ft. of floor space. Sockets shall be utilized for interior lighting and small fractional HP motors only. Cost of temporary service shall be by the Electrical Contractor. In addition, install and maintain lamps as required to provide illumination of 1/4 watt per sq. ft. throughout, or as required by any codes or ordinances. Maintain and replace all defective sockets, fuses and wiring. Remove temporary installation upon completion of permanent service. All temporary wiring shall conform all applicable codes including NEC and OSHA. Install permanent service as soon as practical.

C. All contractors shall provide and maintain their own extension cords and additional lamps as required to perform his work properly. Contractors requiring temporary connections to 3 phase power service and single phase feeders for other than lighting and small fractional horsepower motorized tools shall make arrangement with the Electrical Contractor. Contractors requiring lighting outside of the building shall make their own arrangements with the Electrical Contractor and pay all costs for installation, maintenance and removal. Contractors requiring electrical equipment over one HP, including welders, hoists, heaters and coolers shall make their own arrangements for such service beyond the main switch and shall pay all costs thereof.

D. No permanent electrical equipment or wiring shall be used for temporary connections, unless authorized by this Section, upon signed order and with approval by the Architect in behalf of the Owner. Such approvals shall not shorten guarantee period.

E. Electrical energy to be paid for by owner.

1.26 ELECTRICAL SERVICE

A. Electric service is existing and provides 208Y/120 volts, three phase, four wire.

1.27 BRANCH CIRCUIT WIRING

A. See plans for general arrangement of circuits, conduit runs, and ratings of branch circuits and special circuits.

B. Provide everything necessary to comply with the general scheme shown, including all types of control.

C. Circuit numbers as shown on plans are for contractor to plan his wiring and for estimating purposes. These numbers are not necessarily consecutive numbers of the panelboard breakers. Balanced load on bus is to be the determining factor in arrangement of circuits. Balance loading to within 7 1/2%.

D. Minimum size of lighting system branch circuit conductors to be #12 AWG.

E. Conductors terminating at wired outlets shall extend at least eight (8) inches beyond outlet box conduit fitting.

F. 120 volt circuit home runs greater than 50 feet in length shall have #10 AWG minimum size between panel and first receptacle or fixture outlet.

G. The use of single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

1.28 MOTOR WIRING

A. Unless otherwise indicated on the drawings or elsewhere in these specifications, all motors shall be furnished by others.

B. Motors shall be set in place by others and the associated motor starters and controllers shall be turned over to this Contractor for erection and line voltage power wiring.

C. Any contractor supplying starters and controllers that are not part of this contract shall index same and provide this Contractor with instructions as to proper location in sufficient time to permit the installation of a concealed raceway system.

D. Where this Contractor is required to provide control wiring, the Contractor supplying the controllers shall provide all necessary and required wiring diagrams for proper installation.

E. Low voltage (less than 115 volts) control wiring shall be by others, unless noted elsewhere in the specifications except that this Contractor shall extend circuit to associated transformers, wire and connect to same.

F. This Contractor shall examine the plans and specifications of other sections and shall include in his bid all control wiring, as referenced to be performed by Section 26 05 00.

G. Required disconnect switches furnished by other sections shall be installed by Section 26 05 00. Furthermore, this Contractor shall provide all disconnect switches required by code that are not furnished by other sections.

1.29 SPECIAL OUTLETS

A. General: Furnish and install outlets, wiring and receptacles accordingly, at locations required by equipment serviced or otherwise as directed. Extend wiring to outlets on equipment and make final connection.

1.30 IDENTIFICATION

A. General:

1. Materials and equipment installed under this Section shall be clearly identified as listed below.
2. Locate identification conspicuously.
3. Terminology to be approved by Architect.
4. See plans for any additional items to be identified.

5. Loads such as motors shall be described by function rather than by the system of arbitrary number as shown on electrical plans.

6. Use abbreviations sparingly.

B. Laminated Bakelite Plates: Engraved plastic nameplate shall be securely screwed or riveted to the following equipment. Size 1" x 4" with 3/8" high letters; unless space available dictates differently.

1. Each panelboard, contactor, time switch, starter or disconnect switch. Locate on inside cover of panels.

2. Each feeder at all accessible locations.

3. Each end of empty conduit runs to indicate the intended use of the conduit and the location of opposite end. Use room numbers that are permanently assigned.

C. Typewritten Directory: Each panelboard both new and existing shall be provided with a typewritten directory attached to the inside of panel door and covered with clear plastic indicating load served and rooms served by each protective device in the respective panel. Spares and spaces shall be clearly identified.

D. Switch Station:

1. All key switches shall be engraved indicating controlled item.

2. All remote switches shall be engraved indicating controlled item.

E. Conductor Identification:

1. Identify each conductor at each wiring device, connector or splice point with permanently attached wrap-around adhesive markers as manufactured by Brady Co. or 3M.

2. This identification shall include branch circuit number, control circuit, or any other appropriate number or lettering that will expedite future tracing and trouble shooting.

1.31 LOCATIONS OF OUTLETS AND WIRING DEVICES

A. Outlets:

1. Locations of outlets and electrical equipment on the drawings are approximate only. Unless otherwise indicated on the drawings or established in the specifications, the exact locations of electrical outlets shall be established in the field by directive from the Architect. Generally, outlets shall be located as required for proper installation of equipment served and otherwise locations shall be established by construction or code requirements and such as to be coordinated with equipment of other trades.

2. This Section shall consult with the Architect and refer to all details, sections, elevations and equipment plans and the plans of other trades for exact location.

3. The Architect reserves the right to make reasonable changes in the location of outlets, apparatus or equipment up to the time of roughing in. Such changes as directed shall be made by the Contractor without additional compensation.

4. Dimensions taken by scale shall not be used to establish rough-in locations.

B. Wiring Devices:

1. The approximate location of wiring devices are indicated on the drawings; the specific location shall be determined in accordance with "Location of Outlets" of these specifications and as follows.

2. This Section is referred to equipment plans, equipment shop drawings, elevation drawings and other detail or dimensional drawings, and he shall consult with the Architect before installation of proceeding with any work dependent upon this information.

3. Generally, wiring devices shall be located as follows:

a. Wall receptacles shall generally be centered 15" above the finished floor and 6" above surface of built-in counters and tables where same abuts wall and 4" above backsplashes if counters are so equipped.

b. Special purpose receptacles shall be located as required by equipment served.

c. Switches shall be centered 48" above finished floor on latch side of door opening with edge of plate not more than 12" from door frame, except as noted on the drawings.

d. In hazardous areas, the location of wiring devices shall be established by Code requirements which shall take precedence over conflicting information on the drawings or included herein.

1.32 TELEPHONE SYSTEM

A. Outlets, wiring, jacks and conduit shall be installed under this contract. See Section 27 10 00.

B. Telephone instruments, switching equipment, and other accessories shall be furnished and installed by the Owner's telephone vendor.

C. Coordinate all work regarding underground telephone service with the telephone utility and comply with all of their requirements.

D. All charges by the Telephone Company shall be paid by the Owner.

E. This Contractor shall supply all required conduit, sleeves, and service fittings for the telephone system.

F. All conduits shall be complete with fish wire by this Contractor, and all telephone outlets shall be fed by a minimum 1" conduit.

G. All telephone boxes shall be two gang boxes with one gang plaster cover.

H. Verify all phone locations with the Architect in the field.

1.33 SEALING AND FIREPROOFING

A. Sealing and fireproofing of openings between conduit, cable tray, wireway, trough, cablebus, busduct, etc. and fire rated surfaces shall be the responsibility of the contractor whose work penetrates the opening.

B. Sealing and fireproofing shall use materials and methods complying with ASTM E814 requirements appropriate to the rating of the material penetrated.

C. Materials by Dow-Corning, 3M, Specified Technologies, Inc., and Chase-Foam are acceptable if in accordance with (B) above.

D. Submit manufacturer’s penetration details to authority having jurisdiction. Details shall confirm method’s compliance with ASTM E814.

E. Include copies of penetration details in Project Operation and Maintenance Manuals.

1.34 ALTERNATE BIDS

A. See Section 01 00 00 for descriptions of alternates required.

END OF SECTION 26 05 00

SECTION 26 05 11

BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 REFERENCES

A. National Electrical Manufacturer's Association (NEMA).

B. Underwriters Laboratories, Inc. (UL).

C. American Society for Testing and Materials (ASTM).

D. National Fire Protection Association (NFPA).

1.03 SUBMITTALS

A. Product Data

1. Submit for disconnects, motor starters, panelboards, circuit breakers, overcurrent protective devices, transformers, and mini-power centers.
2. Product data sheets with printed installation instructions.

B. Shop Drawings:

1. Submit for motor starters.
2. Show enclosure dimensions, nameplate nomenclature, electrical ratings, and thermal unit schedule.
3. Wiring diagrams and schematics.

C. Approval of equipment supplied in this section is contingent upon Contractor verification of available fault current from electric utility.

1. Notify ENGINEER if available fault current is higher than specified equipment.

D. Submit in accordance with Division 1.

E. Operation and Maintenance (O&M) Data:

1. Maintenance data for materials and products for inclusion in Operating and Maintenance Manuals.

F. Test Results:

1. Report of field tests and observations certified by Contractor.

1.04 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.
2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.
2. Local codes and ordinances.

PART 2 - PRODUCTS

2.01 ELECTRICAL METALLIC TUBING (EMT)
INTERMEDIATE METALLIC CONDUIT (IMC)
GALVANIZED RIGID STEEL CONDUITS (GRS)

A. Manufacturers:
   1. Allied Steel
   2. Omega
   3. Wheatland
   4. Columbia

B. Manufacturer's standard lengths and size.

C. Protected inside and out by hot-dipped galvanized or electrogalvanized coating.

D. Minimum size: 1/2 inch.

E. Do not use aluminum conduit.

2.02 PLASTIC CONDUIT (PVC)

A. Manufacturers:
   1. Carlon.
   2. Genova.
   3. Certainteed.

B. Standard lengths and sizes.

C. Schedule 40 or 80, heavy wall rigid plastic (PVC) conduit manufactured to NEMA TC2 standards, UL listed, and as required by NEC.

D. Rated for 90 degree C cable.

E. Minimum size: 1" inches.

2.03 PVC COATED GALVANIZED RIGID STEEL CONDUIT (PVC-GRS)

A. Manufacturers:
   1. Perma-Coat Plastics, Inc.
   2. Robroy Industries

B. NEMA RN1.

C. Galvanized rigid steel conduit with PVC coating.

D. Full weight 40 mil thick PVC coating, bonding to galvanized metal shall be stronger than plastic tensile strength.

2.04 FLEXIBLE CONDUIT

A. Manufacturers:
   1. Triangle PWC, Inc.
   2. Anaconda
   3. Flexsteel
   4. American Flexible Conduit

B. Galvanized flexible steel.

C. Standard conduit sizes.

D. Minimum Size: 1/2 inch.

2.05 LIQUIDTIGHT FLEXIBLE CONDUIT

A. Manufacturers:
   1. O-Z/Gedney Company
   2. American Flexible Conduit
   3. Flex-Guard, Inc.
   4. Liquatite
   5. Anaconda

B. Galvanized flexible steel.

C. Standard conduit sizes.

D. Minimum Size: 1/2 inch.

E. Heavy wall PVC jacket.

2.06 FITTINGS

A. Manufacturers:
   1. Appleton Electric Company.
   2. Steel City, American Electric.
   3. Oz-Gedney Co.

B. Steel or malleable iron, zinc galvanized or cadmium plated.

C. Do not use set screw or indentor type fittings.

D. Do not use aluminum or die cast fitting.

E. EMT IMC and GRS Connectors and Couplings:
   1. Threaded.
   2. Gland compression type.
   3. Insulated throat.
   4. Rain and concrete type.

F. Flexible Conduit Connectors and Couplings:
   1. Threaded.
   2. Insulated throat.
   3. Grounding type.
   4. Gland compression type.

G. Liquidtight Flexible Conduit Fittings:
   1. Liquidtight.
   2. Insulated throat.
   3. Threaded.
   4. Gland compression type.
   5. Grounding type.

H. Expansion Joints:
   1. Conduit expansion fittings complete with copper bonding jumper, Crouse-Hinds Type XJ.
   2. Conduit expansion/deflection fittings with copper bonding jumper, Crouse-Hinds Type XD.

I. Seals:
   1. Wall entrance, Appleton Type FSK or FSC.

J. Drain Fittings:
1. Automatic Drain Breather:
a. Explosionproof.
i. Safe for Class I, Groups C and D.
b. Capable of passing minimum 25 cc water/minimum and minimum 0.05 cubic foot air/minimum at atmospheric pressure.
2. Condensate Drain:
a. Conduit outlet body, Type T.
b. Threaded, galvanized plug with 3/16 inch drilled holed through plug.

K. Hazardous Areas:
1. Explosionproof.
2. Horizontal seal fittings, Crouse-Hinds Type EYS.
3. Vertical seal fittings, Crouse-Hinds Type EYD.
4. Vertical seal fittings shall have drain plug.

2.07 SURFACE METAL RACEWAY

A. Manufacturers:
1. Wiremold Co.
2. Hubbell Co.
3. Steel City, American Electric

B. General:
1. Wiremold Series series or equal.
2. Base and cover section to accommodate pulling conductors through raceway.
3. Capable of being over painted.
4. Full complement of fitting must be available.

2.08 WIRES, CABLES, AND CONNECTORS

A. Manufacturers:
1. Wire and Cable:
a. Continental
b. Southwire.
c. Rome Cable.
d. Houston Wire and Cable.
e. Beldon.
f. Dekoron.
g. Royal
h. South
i. General
2. Connectors:
a. Burndy.
b. Thomas and Betts.
c. Blackburn, American Electric.
3. Electrical Tape:
a. 3M Scotch Brand.
b. Plymouth.

c. or equal.

B. Copper wire only.

C. 600 v insulation (ASTM standard compounds) and color code conductors for low voltage (secondary feeders and branch circuits) as required by NEC.

1. Type THWN-2 Stranded: Single conductor No. 12 AWG minimum for branch circuit and feeder conductors size No. 8 AWG and smaller.

2. Type XHHW-2 Stranded: Single conductor for branch circuits, feeders and service conductors larger than No. 8 AWG.

3. Provide grounding conductor with same insulation as circuit conductors when run with circuit conductors.

4. Type USE Stranded: Single conductor for under-ground direct burial.

5. Type THWN-2 Stranded: Single conductor No. 12 AWG minimum for 120 v control wiring and No. 14 AWG minimum for graphic indication, nonshielded instrumentation and other control wiring operating at less than 120 v unless otherwise noted on Drawings.

a. Provide high density polyethylene jacketed multi-wire cable assemblies in underground conduit or duct.

6. Vinyl insulated, tinned copper, solid, twisted pair, cabled conductors and silver gray vinyl jacket for telephone inter-communications.

a. Up to 4 conductors/cable, 22 AWG solid wire.

b. Over 4 conductors/cable, 24 AWG solid wire.

c. Provide high density polyethylene jacketed multi-wire cable assemblies in underground conduit or duct.

D. Joints, Taps, and Splices:

1. Joints, Taps, and Splices in Conductors No. 10 AWG and Smaller: UL listed compression spring-type solderless connectors with plastic cover.

2. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless two or four-bolt compression type connectors of type that will not loosen under vibration or normal strains.

3. Terminations: Compression-type crimp lugs.

2.09 BOXES

A. Manufacturer:

1. Interior Outlet Boxes:

a. Appleton Electric Company.

b. Raco.

c. Steel City, American Electric.

2. Weatherproof Outlet Boxes:

a. Appleton Electric Company.

b. Crouse-Hinds Company.

c. O-Z/Gedney company.

d. Perfect-Line, American Electric.

3. Junction and Pull Boxes:

a. Hoffman Engineering Company.

b. Keystone Columbia, Inc.

c. Electromate.

B. Outlet Boxes - Flush Mounted:

1. Wall Outlets: Square corner, galvanized masonry type with internally mounted ears or 4-inches square with raised cover having square corners and internally mounted ears.

2. Ceiling Lighting Fixture Outlet Boxes: 4-inch square galvanized box with raised cover set flush with finished surface, complete with 3/8 inch fixture stud.

C. Outlet Boxes - Surface Mounted:

1. General Use: 4-inches square with raised device cover.
2. Weatherproof: Cast galvanized with threaded hub.
3. Safety outlet enclosure - Tay Mac Co. - Verify outlet configuration.
4. Hazardous Locations: Cast galvanized approved for classification of area.

D. Junction and Pull Boxes:

1. Fabricate from code gauge galvanized steel, with covers held in-place by corrosion resistant machine screws.
2. Size as required by code for number of conduits and conductors entering and leaving box.
3. Provide with welded seams where applicable, and equipment with corrosion resistant nuts, bolts, screws, and washers.
4. Finish with rust inhibiting primer.

2.10 FLOOR BOXES

A. Manufacturers:

1. Hubbell Electric Co.
2. Thomas and Betts Co.
3. Steel City, American Electric.

B. General:

1. Waterproof, adjustable floor boxes with vertical adjusting rings, gaskets, and floor plates.
   a. Carpet flanges for carpeted floors.
   b. Flush covers as required for floor type.

C. Accessories:

1. Standard brushed aluminum service fitting to accommodate devices as shown on Drawings.
2. Required accessories for complete system.

2.11 WIRING DEVICES

A. Manufacturers:

1. Arrow-Hart, Inc.
2. Hubbell Wiring Device Division.
3. Pass and Seymour, Inc.
4. Appleton Electric Co.
5. Leviton
6. Sierra Electric.
7. Crouse-hinds Company
8. Eagle Electric Co.
9. Tay Mac Corp.

B. Fabricated Devices:

1. Factory-fabricated, specification grade wiring devices in type, color, and electrical rating for service indicated. Ivory color or as selected by ENGINEER OR OWNER.
2. Wiring devices of one manufacturer.
3. See Drawing symbol schedule for identification of device type.

C. Switches:

1. General Use Lighting Switches: 20 amp toggle, equal to Hubbell No. 1221-I series.
2. Switches controlling equipment, operation of which is not evident from switch position, shall include flush neon pilot light in conjunction with proper switch. Each switch shall be complete with engraved plate to identify equipment being controlled (white letters on black, 1/8 inch high minimum).

D. Receptacles:

1. General use duplex receptacles: NEMA No. 5-20R, grounding type, 20 amp Hubbell 5362 Specification Grade.
2. Special purpose receptacles as shown on Drawings and schedules.
3. GFI receptacles shall be Hubbell HGF8300I.

E. Wiring Device Plates and Covers:

1. Wall plates for wiring devices with ganging and cut-outs as indicated, provided with metal screws for securing plates to devices, screw heads colored to match finish of plate.
2. Plates for Flush Mounted Devices: Type No. 430 brushed stainless steel.
3. Telephone outlet configuration to match telephone outlet jack or cable.
4. Device plates for surface mounted Type FS or FD boxes to be Type FSK galvanized steel.
5. Device plates for surface mounted, 4-inch square bossed to be ½ inch raised galvanized steel covers.
6. Weatherproof outlet enclosure for exterior devices or devices in damp locations to be marked galvanized gray cast malleable with gasketed lift cover plate as shown on Drawings. Suitable for wet locations while in use. Enclosure must be gasketed. Provide Intermatic WP1010MC, WP1010HMC, or WP1030MC with appropriate mounting base(s) and inserts.

2.12 MOTOR STARTERS

A. Manufacturers:

1. Square D only

B. Manual Starters:

1. Minimum short circuit withstand rating in combination with motor circuit protective device shall be 10,000 symmetrical amps or as indicated on Drawings.

C. Manual Motor Starter Construction:

1. Quick make and break toggle action.
2. Double break silver alloy contacts.
3. 1-piece melting alloy type thermal overload units.
4. Starter inoperative unless thermal unit in position.
5. Padlock provision.
6. Pilot light.
7. NEMA standards for size and horsepower rating.

D. Magnetic Starters:

1. Minimum short circuit withstand rating in combination with motor circuit protective device shall be 22,000 symmetrical amps or as indicated on Drawings.

E. Magnetic Motor Starter Construction:

1. Mounted in vertical position, gravity dropout.
2. Double break silver alloy contacts.
3. Molded coil.

4. Contacts and/or coil replacement without removing starter from enclosure or power wiring from starter.
5. Straight-through wiring.
6. Overload Relay:
    a. 1-piece thermal unit construction.
    b. One melting alloy type overload relay per phase, manually reset.
    c. Interchangeable thermal units.
    d. Thermal units must be in-place to operate starter.
    e. Replaceable overload relay circuit contacts.
    f. Trip at 6 times LRC in 20 seconds.
7. Overload relay submersible pumps and hermetically sealed motors.
    a. Same as above except trip at 6 times LRC in 3 to 5 seconds.
8. NEMA standards for size and horsepower rating.
9. NEMA Size 1 minimum.

F. 2-Speed Motor Starters:
1. Provide separate winding type with two 3-pole starters unless otherwise specified.
2. For remote 2-stage thermostat control, provide cutout of low speed signal on high speed operation.

G. Reduced Voltage Motor Starter Construction:
1. Closed transition autotransformer type.
2. 2-coil construction with 50%, 65%, and 80% starting voltage taps.
3. Additional as applicable.

H. Combination Starter:
1. Fusible Motor circuit protector type.
2. Three-pole, three-phase NEMA size as indicated with three melting alloy overload relays.
3. Hand-Off-Auto selector switch.

I. Control Circuits:
1. Voltage not to exceed 120 v.
2. Control transformer mounted in starter enclosure.
3. Fuses on one secondary line.
4. One secondary line grounded.
5. Transformer sized for device, accessories connected thereto, and 25% extra capacity minimum.

J. Controls:
1. Reset button mounted in enclosure cover.
2. Heavy duty, oiltight green push to test pilot lights mounted in enclosure cover when indicated.
3. Heavy duty, oiltight pushbuttons and selector switches mounted in enclosure when indicated.
4. 6-digit type elapsed time meters in tenths of hour mounted in enclosure cover when indicated.

K. Enclosures:
1. Manual Starters:
    a. General purpose flush mounted in finished areas.
    b. NEMA 1 surface in unfinished areas.
    c. NEMA 4 outdoors and wet locations.
2. Magnetic Starters:
    a. NEMA 12 indoors.

b. NEMA 4 outdoors and wet locations.

2.13 MOTOR AND CIRCUIT DISCONNECTS

A. Manufacturers:
1. Square D only

B. Enclosed Circuit Breaker Construction:
1. Dual cover interlock.
2. External trip indication.
3. Provisions for control circuit interlock.
4. Padlock provisions for padlock in Off position.
5. Handle attached to box, not cover.
6. Handle position indicates On, Off or Tripped.
7. Provisions for insulated or groundable neutral.

C. Safety Switches:
1. NEMA heavy duty Type HD.
2. Dual cover interlock.
3. Visible blades.
4. Provisions for control circuit interlock.
5. Pin type hinges.
6. Tin plated current carrying parts.
7. Quick make and break operator mechanism.
8. Handle attached to box, not cover.
9. Handle position indication, On in up position and Off in down position.
10. Padlock provisions for up to 3 padlocks in Off position.
11. UL listed lugs for type and size of wire specified.
12. Spring reinforced fuse clips for Class R fuses.
13. Provisions for insulated or groundable neutral.
14. UL listed short circuit rating 200,000 RMS amp with Class R fuses.

D. Enclosures:
1. Indoor: NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish.
2. Outdoor: NEMA 3R code gauge zinc coated steel with baked enamel finish.

2.14 FUSES

A. Manufacturers:
1. Bussmann
2. Gould Shawmut
3. Littlefuse
4. Brush

B. 250 v. Fuses:
1. Class RK-1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000-amp interrupting rating.
a. Gould Shawmut Tri-Onic TR-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder, and main service protection.

C. 600v Fuses:

1. Class RK-1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000-amp interrupting rating.
    a. Gould Shawmut Tri-Onic TR-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder and main service protection.
2. Class L, bolt-in 601 to 6,000 amps, 200,000-amp interrupting rating.
    a. Gould Shawmut A48Y, time delay for overload and short circuit protection for motor, transformer, feeder, and main service protection.
3. Class CC, fast acting, single element, 1/10 to 30 amps, 200,000-amp interrupting rating.
    a. Gould Shawmut ATDR, UL listed for motor control circuits, lighting ballasts, control transformers, and street lighting fixtures.

D. Spare Fuses:

1. 10%, minimum of 3, of each type and rating of installed fuses.

E. Spare Fuse Cabinet:

1. Cabinet: Wall-mounted, 18-gauge minimum steel unit with full-length, recessed piano-hinged door with key coded cam lock and pull.
2. Size: Provide for orderly storage of spare fuses of this project plus 15% spare capacity, minimum.
3. Finish: Gray baked enamel.
4. Cabinet Door: Bear legend in stencilled 1-1/2 inch high letters, "Spare Fuses."

2.15 PANELBOARDS

A. Manufacturers:

1. Square D only

B. Panelboard Ratings:

1. UL listed short circuit rating (integral equipment rating):
    a. Up to 240 v: 10,000 RMS symmetrical amp minimum.
    b. Up to 480 v. 14,000 RMS symmetrical amp minimum.
    c. As shown on Drawings.

C. Panelboard Construction:

1. Main breaker or main lugs only, per panelboard schedule.
2. Molded case circuit breakers.
3. Terminals:
    a. UL listed for type or wire specified.
    b. Anti-turn solderless compression type.
4. Bussing:
    a. Distributed phase sequence type.
    b. 225 amps, 98% conductivity hard drawn copper or as shown on panelboard schedule or Drawings.
    c. Copper.
    d. Mounting hardware behind usable space.
5. Gutters adequate for wire size used, 4-inch minimum.
6. Boxes:
    a. Code gauge galvanized steel.
    b. Without knockouts.

7. Fronts:
    a. Panel front cover shall have piano hinge to allow access to wiring gutters without removal of panel trim. Hinged trim held in place with screw fasteners. Door shall be built into trim, which allows access to breakers as well as to hinged trim screw fasteners. Breaker access door shall have the following features:
        i. Concealed piano hinge.
        ii. Flush stainless steel cylinder tumbler type locks with spring loaded door pulls.
        iii. Locks keyed alike.
        iv. Rust inhibiting primer, baked enamel finish.
        v. Dead front safety type.
        vi. Concealed hinges and trim clamps..
        vii. Circuit Directory:
        viii. Suitable for complete descriptions.
        ix. Clear plastic cover.
8. Typewritten card inside panel door.
9. Special features as shown on Drawings.
10. Code gauge steel.
11. Engraved laminated nameplate in accordance with Section 16001.

2.16 MOLDED CASE CIRCUIT BREAKERS

A. Manufacturers:
1. Square D only

B. Permanent Trip Circuit Breakers:
1. Lighting Panel Circuit Breakers:
    a. Thermal and magnetic protection.
    b. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
    c. Bolt-on type unless otherwise noted on Drawings.
    d. Quick make and break toggle action.
    e. Handle trip indication.
    f. Handle position indication, On, Off, and Tripped centered.
    g. UL listed for type of wire specified.
    h. UL listed short circuit rating (integrated equipment rating).
        i. Up to 240 v: 10,000 RMS symmetrical amp minimum.
        ii. Up to 480 v: 14,000 RMS symmetrical amp minimum.
    i. UL SWDL switching duty on 120 v. circuits for switched circuits.
    j. Switch neutral common trip per NEC 514-5 for fuel pumps.
2. Power Panel Circuit Breakers:
    a. Thermal and magnetic protection.
    b. Magnetic protection only in combination with motor starters and motor circuit protectors (MCP).
    c. Single magnetic trip adjustment.
    d. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
    e. Push-to-trip test button.
    f. Bolt-on type.
    g. Quick make and break toggle action.
    h. Handle trip indication.

i. Handle position indication, On, Off, and Tripped centered.
j. UL listed for type of wire specified.
k. UL listed short circuit rating (integrated equipment rating).
i. Up to 240 v: 10,000 RMS symmetrical amp minimum.
ii. Up to 480 v: 14,000 RMS symmetrical amp minimum.

C. Current Limiting Circuit Breakers:
1. One current limiter per pole.
2. Blown current limiter to trip all poles.
3. UL Listed Short Circuit Rating: 100,000 RMS symmetrical amps.

2.17 GROUND-FAULT CIRCUIT INTERRUPTER RECEPTACLES (GFCI)

A. Ratings:
1. 120 vac.
2. 20 amp.

B. Tripping Requirement:
1. UL Class A.

C. Construction:
1. Shallow depth.
2. Line and load terminal screws.
3. Noise suppression.
4. Feed through.
5. Standard duplex wall plates shall fit.
6. NEMA 5-20R configuration.

D. Meet requirements of UL 943 ground-fault circuit interrupters.

2.18 GROUNDING AND BONDING

A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.

B. Conductor Materials: Copper.

C. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

D. Equipment Grounding Conductor: Green insulated.

E. Grounding Electrode Conductor: Stranded cable.

F. Bare Copper Conductors:
1. Solid Conductors: ASTM B3.
2. Assembly of Stranded Conductors: ASTM B8.
3. Tinned Conductors: ASTM B33.

G. Ground Bus: Bar annealed copper bars of rectangular cross section.

H. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bar copper wire, terminated with copper ferules.

I. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inches thick and 2 inches wide, except as indicated.

J. Connector Products

1. General: Listed and labeled as grounding connectors for materials used.
2. Pressure Connectors: High-conductivity-plated units.
3. Bolted Clamps: Heavy-duty units listed for application.
4. Exothermic Welded Connections: Provide in kit form and select for specific types, sizes, and combinations of conductors and other items to be connected.

K. Grounding Electrodes

1. Ground Rods: Copper-clad steel with high-strength steel core and electrolytic-grade copper outer sheath, molten welded to core.
   a. Size: 3/4 inch by 10 feet unless otherwise indicated.

PART 3 - EXECUTION

3.01 GENERAL

A. Install products in accordance with NEC, manufacturer's instructions, applicable standards, and recognized industry practices to ensure products serve intended function.

3.02 CONDUITS AND CONDUIT FITTINGS

A. Complete conduit installation prior to installing cables.

B. Install Schedule 40 PVC with green ground when conduit is installed in concrete. Use rigid steel elbows when emerging from the slab.

C. Provide watertight conduit system where installed in wet places, underground or where buried in masonry or concrete.

D. Use Schedule 40 PVC with green ground when conduit is run below slabs on grade or in earth, unless otherwise noted on Drawings.

1. Exterior underground conduit shall be minimum of 1 1 inch, buried at depth of not less than 30 inches below grade.
2. Provide conduits or ducts terminating below grade with means to prevent entry of dirt or moisture.

E. EMT conduit may be used for conduit sizes up to 2 inches. Use rigid galvanized steel conduit for sizes 2 ½ inches and larger.

F. Conduit shall be run concealed except exposed surface conduit may be installed where noted on Drawings or where concealment found to be impractical or impossible, and only with approval of ENGINEER.

G. Continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes.

H. Enter and secure to boxes ensuring electrical continuity from point of service to outlets.

I. Conduit runs extending through areas of different temperature or atmospheric conditions or partly indoors and partly outdoors shall be sealed, drained, and installed in manner preventing drainage of condensed or entrapped moisture into cabinets, motors or equipment enclosures.

J. Run conduits within concrete structures parallel to each other and spaced on center of at least three times conduit trade diameter with minimum 2-inch concrete covering. Conduits over 1 inch may not be installed in slab without approval of ENGINEER.

K. Run exposed conduits parallel to or at right angles with lines of building.

L. Route conduit runs above suspended acoustical ceilings not interfering with tile panel removals.

M. Secure conduit in-place with not less than 1 malleable corrosion proof alloy strap or hanger per 8 feet of conduit.

1. Do not use perforated strapping.

N. Connections to Motors and Equipment Subject to Vibration:

1. Flexible steel conduit not over 3 feet long or where exposed in mechanical and utility areas and not subjected to moisture, dirt, and fumes.

2. Liquidtight flexible conduit not over 3 feet long where exposed in finished areas or where subject to moisture, dirt, fumes, oil, corrosive atmosphere, exposed or concealed, with connectors to ensure liquidtight, permanently grounded connection. Locate where least subject to physical abuse.

O. Use double lock nuts and insulated bushings with threads fully engaged.

P. Connectors at fixture bodies and boxes shall be rigidly secured with galvanized lock nut and bushing.

Q. Cap conduits after installation to prevent entry of debris.

R. Use explosionproof fittings and seals in hazardous areas in accordance with NEC.

S. Install conduit expansion fittings complete with bonding jumper in following locations.

1. Conduit runs crossing structural expansion joint.

2. Conduit runs attached to two separate structures.

3. Conduit runs where movement perpendicular to axis of conduit may be encountered.

T. Install 4 feet-0 inch to 6 feet-0 inch flexible steel conduit drops from independent junction box mounted above ceiling and accessible from below ceiling to recessed ceiling mounted equipment. Allow for positioning of equipment to tile increments.

U. Negotiate beams and changes in ceiling heights with LB conduit fittings on outside corners and ells on inside corners. Arrange bends and offsets in parallel conduits to present neat symmetrical appearance.

V. In precast areas, run conduits in insulation space or in floor topping without crossing conduits, using 3/4 in. maximum conduit size.

W. Core drill through reinforced concrete with approval of ENGINEER.

X. Split, crushed or scarred conduit not acceptable.

Y. Do not route over boiler, incinerator or other high temperature equipment.

Z. Flexible metal conduit can only be used for final connections to motors, transformers, or to light fixtures above suspended ceilings.

AA. Type MC cable is not permitted.

3.03 SURFACE METAL RACEWAY

A. Mount to surface with No. 8 flathead fasteners or approved support clips.

B. Do not pinch wires.

C. Remove metal burrs and sharp edges.

D. Provide bushing.

E. Install in accordance with manufacturer's recommendations.

F. Provide covers where two lengths come together.

3.04 WIRE AND CABLE

A. Run wire and cable in conduit unless otherwise indicated on Drawings.

B. On branch circuits, use standard colors.

C. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with 2 half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape, where required by code.

D. Run ground wire with power circuits; conduit shall not be grounding path.

E. Color Coding: Conductors for lighting and power wiring as indicated below.

Phase	208/120v	480/277v
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

3.05 BOXES

A. Install knockout closures to cap unused knockout holes where blanks have been removed.

B. Locate boxes to ensure accessibility of electrical wiring.

C. Secure boxes rigidly to subsurface upon which being mounted or solidly embed boxes in concrete or masonry. Do not support from conduit.

D. Do not burn holes, use knockout punches or saw.

E. Provide outlet box accessories as required for each installation such as mounting brackets, fixture study, cable clamps, and metal straps for supporting outlet boxes compatible with outlet boxes being used and meeting requirements of individual wiring situations.

F. Location of outlets and equipment shown on Drawings is approximate. Verify exact location.

G. Minor modification in location of outlets and equipment is considered incidental up to distance of 10 feet with no additional compensation, provided notification of modification is given prior to roughing in of outlet.

H. Flush outlets shall have edges or plaster flush with finished wall or ceiling surfaces so plates can be drawn tightly to wall or ceiling surfaces.

I. Mounting heights:

1. Shall conform to ADA guidelines.
2. In general, unless otherwise shown on Drawings:
    a. Switches: 48 inches above floor to top of box.
    b. AC Receptacles and Telephone Outlets: 15 inches above floor to bottom of box or 6 inches above counters, counter backsplashes in finished areas; 48 inches to top of box above floor in unfinished areas.
    c. Wall Bracket Lighting Fixtures: 8 inches above mirrors or 6 feet-6 inches above floor.
    d. Pushbuttons: 48 inches above floor to top of box.
    e. Motor Starters and Disconnect Switches: 60 inches above floor.
        i. Thermostats: 48 inches above floor.
    f. Bells and Horns: 8 feet-0 inches above floor.
    g. Clocks: 8 ft.-0 inches above floor.
    h. Fire Alarm visual signals 80" above floor.
    i. Emergency Battery Units: 8 ft. - 0 inches above floor or 12" below ceiling.

J. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall, minimum 12 inches.

K. Where emergency switches occur adjacent to normal light switches, install in separate boxes in accordance with NEC and device plate color coding separation.

L. Light Fixture Outlet Boxes:

1. Securely mount with approved type bar hangers spanning structural members to support weight of fixture.
2. Do not support from conduit.
3. Equip with 3/8-inches fixture stud and tapped fixture ears.

3.06 FLOOR BOXES

A. Adjust box to align with finish floor.

B. Install in accordance with manufacturer's recommendations.

3.07 WIRING DEVICES

A. Do not install devices until wiring is complete.

B. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise. Make circuit connections by using wire connectors and pigtails.

C. Install gasket plates for devices or system components having light emitting features such as switch with pilot light and dome lights. Where installed on rough textured surfaces, seal with black self-adhesive polyfoam.

D. Ground receptacles with insulated green ground wire from device ground screw to bolted outlet box connection or as shown on Drawings.

E. Wrap wiring devices with insulating tape.

F. Install emergency switches which occur adjacent to normal light switches in separate boxes to maintain systems isolation in accordance with NEC.

3.08 MOTOR STARTERS

A. Examine area to receive motor starters to ensure adequate clearance for starter installation.

B. Install on equipment rack in MCC or anchor firmly to wall or structural surface.

3.09 MOTOR AND CIRCUIT DISCONNECTS.

A. Locate disconnect switches as shown on Drawings and required by NEC.

B. Provide control circuit interlock as required by NEC.

3.10 OVERCURRENT PROTECTIVE DEVICES.

A. Install fuses just prior to energizing equipment.

B. Locate circuit breakers as shown on Drawings.

C. Install GFCI receptacles as required by NEC.

3.11 PANELBOARDS

A. Flush or surface mount as specified on Drawings and schedules.

B. Support panel cabinets independently to structure with no weight bearing on conduits.

C. Install recessed Panelboards to allow cover to be drawn tight against wall to provide neat appearance.

D. Install panelboards so top breaker is not higher than 6 feet-0 inches above floor.

E. Adjacent panel cabinets shall be same size and mounted in horizontal alignment.

F. Install typewritten directory in each panelboard, accurately indicating rooms or equipment being served after final circuit changes have been made to balance circuit loads.

G. Install four spare 1 inch conduits from top of each flush mounted panelboard to area above ceiling for future use. On flush mounted panelboards located on first and higher level floors, provide two spare 1 inch conduits from bottom of panelboard to ceiling area of floor below for future use.

3.12 GROUNDING AND BONDING

A. Application

1. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and quantities of equipment grounding conductors, except where larger sizes or more conductors are indicated.
   a. Install separate insulated equipment grounding conductors with circuit conductors. Raceway may be used as equipment ground conductor where feasible in non-hazardous areas and permitted by NEC for lighting circuits. Install insulated equipment ground conductor in nonmetallic raceways unless designated for telephone or data cables.
2. Underground Conductors: Bare tinned, stranded copper except otherwise indicated.
3. Signal and Communications: For telephone, alarm, instrumentation and communication systems, provide #4 AWG minimum green insulated copper conductor in raceway from grounding electrode system to each terminal cabinet or central equipment location.
4. Ground separately derived systems required by NEC to be grounded in accordance with NEC paragraph 250-26.
5. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to grounding electrode as indicated in addition to separate equipment grounding conductor run with supply branch circuit.
6. Connections to Lighting Protection System: Bond grounding conductors or grounding conductor conduits to lighting protection down conductors or grounding conductors in compliance with NFPA 78.

B. Installation

1. General: Ground electrical systems and equipment in accordance with NEC requirements except where Drawings or Specifications exceed NEC requirements.
2. Ground Rods:
   a. Locate minimum of one-rod length from each other and at least same distance from any other grounding electrode.
   b. Interconnect ground rods with bare conductors buried at least 24 inches below grade.
   c. Connect bare-cable ground conductors to ground rods by means of exothermic welds except as otherwise indicated.
   d. Make connections without damaging copper coating or exposing steel.
   e. Use 3/4-inch by 10-foot ground rods except as otherwise indicated.
   f. Drive rods until tops are 6 inches below finished floor or final grade except as otherwise indicated.
3. Metallic Water Service Pipe:
   a. Provide insulated copper ground conductors, sized as indicated, in conduit from building main service equipment, or ground bus, to main metallic water service entrances to building.
   b. Connect ground conductors to street side of main metallic water service pipes by means of ground clamps.
   c. Bond ground conductor conduit to conductor at each end.
4. Braided-Type Bonding Jumpers:
   a. Use elsewhere for flexible bonding and grounding connections.
5. Route grounding conductors along shortest and straightest paths possible without obstructing access or placing conductors where they may be subjected to strain, impact, or damage, except as indicated.

C. Connections

1. General: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   a. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
   b. Make connections with clean bare metal at points of contact.
   c. Aluminum to steel connections: stainless steel separators and mechanical clamps.
   d. Aluminum to galvanized steel connections: tin-plated copper jumpers and mechanical clamps.
   e. Coat and seal connections involving dissimilar metals with inert material such as red lead paint to prevent future penetration of moisture to contact surfaces.
2. Exothermic Welded Connections:
   a. Use for connections to structural steel and for underground connections except those at test wells.
   b. Install at connections to ground rods and plate electrodes.
   c. Comply with manufacturer's written recommendations.
   d. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
3. Terminations:
   a. Terminate insulated equipment grounding conductors for feeders and branch circuits with pressure-type grounding lugs.
   b. Where metallic raceways terminate at metallic housings without mechanical and electrical connection to housing, terminate each conduit with grounding bushing.
   c. Connect grounding bushings with bare grounding conductor to ground bus in housing.
   d. Bond electrically noncontinuous conduits at both entrances and exist with grounding bushings and bare grounding conductors.

3.13 FIELD QUALITY CONTROL

A. Control Circuits, Branch Circuits, Feeders, Motor Circuits, and transformers:
1. Megger check to phase-to-phase and phase-to-ground insulation levels.
   a. Do not megger check solid state equipment.
2. Continuity.
3. Short circuit.
4. Operational check.

B. Wiring Devices:
1. Test receptacles with Hubbell 5200, Woodhead 1750 or equal tester for correct polarity, proper ground connection, and wiring faults.

3.14 ADJUSTMENT AND CLEANING

A. Motor Starters and Disconnects:
1. Adjust covers and operating mechanisms for free mechanical movement.
2. Tighten wire and cable connections.
3. Verify overcurrent protection thermal unit size with motor nameplate to provide proper operation and compliance with NEC.
4. Clean interior of enclosures.
5. Touch up scratched or marred surfaces to match original finish.

B. Circuit Breakers:

1. Adjustable settings shall be set to provide selective coordination, proper operation, and compliance with NEC.

C. Restore damaged areas on PVC jacketed rigid conduit with spray type touch-up coating compound or as directed by manufacturer.

D. Pull cleaning plug through conduits to clear of dirt, oil, and moisture.

END OF SECTION 26 05 11

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SECTION 26 09 23

OCCUPANCY SENSOR LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 GENERAL PROVISIONS

A. In general, the work includes:

1. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.
2. Contractor/Supplier shall examine all general specification provisions and drawings for related electrical work required as work under Division 16.
3. Contractor must submit data sheets on sensors, control units and all junction boxes and mounting accessories, including all wiring diagrams.

1.03 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years.

B. All components shall be UL listed, offer a five (5) year warranty and meet all state and local applicable codes requirements.

1.04 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Contractor shall warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The suppliers obligation shall include repair or replacement, and testing without charge to the owner, all or in parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

1.05 SUBMITTALS

A. Manufacturer shall substantiate conformance to this specification by supplying the necessary documents, performance data, and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by manufacturer showing proper product, location, and orientation of each sensor.

C. Submit any interconnection diagrams per major sub-system showing proper wiring.

D. Submit standard catalog literature which includes performance specifications indicating compliance to the specification.

1.06 SYSTEM OPERATION

A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the occupancy system.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The Watt Stopper, Inc.

B. Or Equivalent Devices by the Following Manufacturers

1. Hubbell
2. Leviton
3. Sensor Switch

2.02 SYSTEM OPERATION

A. All products shall be Watt Stopper product numbers:

1. Ceiling Sensors: W-500A, W-1000A, W-2000A, W-2000H, W-PIR, DT-100L, CI-100, CI-200.
2. Wall Sensors: WI-120A, WI-277A, WS-120, WS-277, WM-120, WM-277.
3. Power and Slave Packs: A-120E, A-277E, S-120/277.
4. Low Temperature: CB-100, CB-200.
5. Daylight Sensors: LS-102.

B. Wall switch sensors shall be capable of detection of motion at desk top level up to 300 square feet, and gross motion up to 1,000 square feet.

C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,000 watts at 277 volts, and shall have 180 degree coverage capability.

D. Bi-level wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,000 watts to 277 volts.

E. Passive Infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

F. Passive Infrared and Dual Technology sensors shall have fully automatic operation, offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

G. All sensors shall be capable of operating normally with electronic ballast, PL lamp systems, and rated motor loads.

H. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

I. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity. Controls shall be recessed to limit tampering.

J. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

K. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance to assure reliable performance and eliminate sensor cross talk. Sensors using multiple frequencies are not acceptable.

L. All sensors shall provide a method of indication to verify that motion is being detected during testing and that the unit is working.

M. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging, and other control options. Sensors utilizing separate components to achieve this function are not acceptable.

N. All sensors shall have no leakage current to load in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

O. The Contractor shall certify in writing that installed sensors comply with the specified California Energy Commission criteria for ultrasonic sound.

P. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.03 CIRCUIT CONTROL HARDWARE - CU

A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to mount on external J boxes and be integrated self-contained unit consisting internally of load switching control relay and a transformer to provide low-voltage power to a minimum of two (2) sensors.

B. Relay Contacts shall have ratings of:

1. 13A - 120 VAC Tungsten
2. 20A - 120 VAC Ballast
3. 20A - 277 VAC Ballast

2.04 CONTROL WIRING

A. Control wiring between sensors and controls units shall be Class II, 18-24 AWG stranded U.L. Classified, PVC insulated or Teflon jacketed cable approved for use in plenums, where applicable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It shall be the contractor's responsibility with the supplier’s assistance to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within in the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

C. Proper judgment must be exercised in executing the installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

END OF SECTION 26 09 23

SECTION 26 43 13

TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 QUALITY ASSURANCE

A. Surge suppressors shall be listed and labeled under UL 1449 Third Edition 2009.

B. Surge suppressors shall be tested to ANSI/IEEE standards C62.41 and C62.45.

C. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five (5) years.

D. Electrical Parameters defined in this specification shall be limited to those in NEMA TVSS Specification LS1-1992 and do not include "irrelevant terminology" such as response time.

1.03 MANUFACTURERS

A. Surge Suppressors: Current Technology, Inc. or equals approved previous to bid time.

PART 2 - PRODUCTS

2.01 SERVICE ENTRANCE TVSS - MEDIUM EXPOSURE AREAS

A. Protection Modes: SVR(6kV, 500A) and UL1449 3rd Edition VPR(6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltage of 208Y/120 shall be as follows and comply with test procedures outlined in UL1449 3rd Edition section 37.6:

System Voltage	Mode	MCOV	B3 Ringwave	B3/C1 Comb. Wave	C3 Comb. Wave	UL 1449 Second Edition SVR Rating	UL 1449 Fourth Edition VPR Rating
120/240	L-N	150	420	642	1040	400	800
120/208	L-G	150	480	690	1300	400	800
	N-G	150	340	620	1240	400	800
	L-L	300	610	1010	1420	700	1200

B. Electrical Noise Filter- each unit shall include a high performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220B insertion loss test method.

C. 100 kHz at 33 db or better.

D. All other frequencies should be 32 db or better.

E. Each Unit shall provide the following features:

1. Phase Indicator lights, Form C dry contacts, surge counter and audible alarm.
2. Field testable while installed.

F. The manufacturer shall provide a limited ten year warranty against failure.

G. Each individual MOV and capacitor shall be fused so that the failure of any component does not affect the operation or protection of the entire unit.

H. Manufacturer of the TVSS device must provide certified test data from an independent test lab showing that their unit of each rating has successfully passed the IEEE standard 8 x 20 microsecond waveform at the surge current capacity called for in the specification.

I. Surge suppressor shall be Current Technology TG100-120/208-3GY-L3 or engineer approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Each unit shall be installed per Manufacturer's recommended installation and wiring practices, as show on the drawing supplied.

B. The UL 1449 Voltage Protective Rating (VPR) shall be permanently affixed to the SPD unit.

C. The UL 1449 Nominal Discharge Surge Current Rating shall be a minimum of 20kA

D. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protective device for safe operation.

E. The unit shall be listed as a Type 1 SPD, suitable for use in both Type 1 and Type 2 locations per UL1449 3rd Edition.

F. The SPD manufacturer's technician shall perform a system checkout and start-up in the field to assure proper installation, operation and to initiate the warranty of the system. The technician will be required to do the following:

1. Verify voltage clamping levels by using the DTS-2 test equipment.
2. Verify N-G connection where applicable.
3. Record information to product signature card for each product installed.

G. Surge Suppressors shall be installed as close as possible to the equipment being protected.

H. TVSS devices designed with replaceable modules shall be furnished with one full set of spare modules to maintain system integrity.

END OF SECTION

SECTION 26 51 13

LIGHTING

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 SUMMARY

A. Section Includes:

1. Interior lighting fixtures.
2. Exterior lighting fixtures.
3. Lamps.
4. Ballasts.
5. Emergency lighting units.

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1. C78 Series - Lamps.
2. C82.2-84 - Fluorescent Lamp Ballasts.
3. C82.4-85 - Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
4. ANSI C2-90 - National Safety Code.

B. Institute of Electrical and Electronics Engineers (IEEE):

1. C62.41-91 - IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

C. National Fire Protection Association (NFPA):

1. 70-93 - National Electric Code.

D. Underwriters Laboratory (UL):

1. 844-90 - UL Standard for Safety Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
2. 924-90 - UL Standard for Safety Emergency Lighting and Power Equipment.
3. 935-84 - UL Standard for Safety Florescent-Lamp Ballast.
4. 1092 (P) - UL Standard for Safety Proposed First Edition of the Standard for Process Control Equipment.
5. 1570-88 - UL Standard for Safety Florescent Lighting Fixtures.
6. 1571-91 - UL Standard for Safety Incandescent Lighting Fixtures.
7. 1572-91 - UL Standard for Safety High Intensity Discharge Lighting Fixtures.
8. 1573-85 - UL Standard for Safety Stage and Studio Lighting Units.
9. 1574-87 - UL Standard for Safety Track Lighting Systems.
10. UL 773-87 - UL Standard for Safety Plug-In, Locking Type Photo controls for Use with Area Lighting.

E. RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

F. LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

G. LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

H. TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

I. NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

1.04 DEFINITIONS

A. Emergency Lighting Unit: Fixture with integral emergency battery power supply and means for controlling and charging battery. Also known as emergency light set. Emergency units are available with integral lamps only.

B. Fixture: Complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery powered exit signs and emergency lighting units also include battery and means for controlling and recharging battery. Emergency lighting units are available with and without integral lamp heads and lamps.

C. Luminaire: Fixture.

D. Average Life: Time after which 50% will have failed and 50% will have survived under normal conditions.

1.05 SUBMITTALS

A. Product Data:

1. Describe fixtures, lamps, ballasts, poles, emergency lighting units, and accessories. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories and following information:

a. Outline drawings of fixtures indicating dimensions and principal features.

b. Electrical ratings and photometric data with specified lamps and certified results of independent laboratory tests.

c. Data on batteries and chargers of emergency lighting units.

B. Shop Drawings: Detail nonstandard fixtures and indicating dimensions, weights, methods of field assembly, components, features, and accessories.

C. Samples: Submit sample of fixture if different than specified.

D. Miscellaneous:

1. For substitutes only, product certifications signed by manufacturers of lighting fixtures certifying that their fixtures comply with specified requirements.

2. Warranty for rechargeable battery.

3. Coordination drawings for fixtures that require coordination with other equipment installed in same space.

E. Submit in accordance with Division 1.

1.06 QUALITY ASSURANCE

A. Items provided under this section shall be listed and labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electric Code, Article 100.

B. Regulatory Requirements:

1. National Electric Code: Components and installation shall comply with NFPA 70.

2. Comply with ANSI C2, "National Electrical Safety Code".

C. Coordinate fixtures mounting hardware and trim with ceiling tile.

1.07 WARRANTY

A. Requirements:

1. Special Project Warranty Period (Where called for herein.): 10 years, beginning on date of Substantial Completion. Full warranty shall apply for first year of period, and prorata warranty for last 9 years.

2. Protection of Metal from Corrosion: Warranty against perforation or erosion of finish due to weathering.

3. Color Retention: Warranty against fading, staining, chalking due to effects of weather and solar radiation.

PART 2 - PRODUCTS

2.01 FIXTURES, GENERAL

A. Comply with requirements specified in Articles below and lighting fixture schedule.

2.02 FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support components to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating and free from light leakage under operating conditions. Arrange to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectances as follows, except as otherwise indicated:

1. White surfaces: 85%.

2. Specular Surfaces: 83%.

3. Diffusing Specular Surfaces: 75%.

4. Laminated Silver Metallized Film: 90%.

E. Exterior Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed fixtures.

F. Exterior Exposed Hardware Material: Stainless steel.

G. Lenses, Diffusers, Covers, and Globes: 100% virgin acrylic plastic or water white, annealed crystal glass except as indicated.

1. Plastic: Highly resistant to yellowing and other changes due to aging, exposure to heat and UV radiation.

2. Lens Thickness: 0.125 inches, minimum.

H. Photoelectric Relay: UL 773.

1. Contact Relays: Single-throw, arranged to fail in the "on" position and factory set to turn light unit on at 1.5 to 3 footcandles and off at 4.5 to 10 footcandles with 15 seconds minimum time delay.
2. Relay Mounting: In fixture housing.

2.03 SUSPENDED FIXTURE SUPPORT COMPONENTS

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

B. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount single fixture. Finish same as fixture.

C. Rod Hangers: 3/16-inch diameter cadmium plated, threaded steel rod.

D. Hook Hanger: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

2.04 LED Luminaires

A. LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:

1. Minimum Light Output.
2. Zonal Lumen Requirements.
3. Minimum Luminaire Efficacy.
4. Minimum CRI.
5. L70 Lumen Maintenance.
6. Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

Additional requirements:

B. Color Temperature of 3000K-5000K for interior fixtures as listed in the Light Fixture Schedule on the plans. The color temperature of exterior LED fixtures should not exceed 4100K (nominal).

C. Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent fixture-to-fixture color for interior fixtures. Exterior fixtures shall use a maximum 5-step MacAdam Ellipse binning process.

D. Glare Control: Exterior fixtures shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior fixtures.

E. Luminaire shall be mercury-free, lead-free, and RoHS compliant.

F. Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.

G. Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.

H. Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.

I. Driver shall have a rated life of 50,000 hours, minimum.

J. Lumen output shall not depreciate more than 20% after 10,000 hours of use.

K. Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.

L. Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior fixtures, and a minimum of 70 for exterior fixtures.

M. LED fixture shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the fixture is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).

N. LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.

O. Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.

P. Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.

Q. Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.

R. All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.

S. Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.

T. All luminaires shall be provided with knockouts for conduit connections.

U. The LED lighting fixture shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).

V. Provide all of the following data on submittals:

1. Delivered lumens
2. Input watts
3. Efficacy
4. Color rendering index.

Emergency LED Fixture Compatibility with Inverters:

W. Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the fixture will function with a square-wave inverter.

Dimming:

X. LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.

Y. LED fixtures shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Light Fixture Schedule on the plans without visible flicker or “popcorn effect”. “Popcorn effect” is defined as the fixture being on a pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the fixture.

2.05 INCANDESCENT FIXTURES

A. Conform to UL 1571.

2.06 FIXTURES FOR HAZARDOUS LOCATIONS

A. Conform to UL 844 or provide units that have Factory Mutual Engineering and Research Corporation (FM) certification for indicated class and division of hazard.

2.07 EXIT SIGNS

A. Conform to UL 924.

1. Sign Colors: Conform to local code.

2.08 EMERGENCY LIGHTING UNITS

A. Conform to UL 924. Provide self-contained units with following features and additional characteristics as indicated.

1. Battery: Sealed, maintenance-free, lead-acid type with 10-year nominal life minimum, and special project warranty.

2. Charger: Minimum 2-rate, fully-automatic, solid-state type, with sealed transfer relay.

3. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80% of nominal or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery automatically recharges and floats on trickle charge when normal voltage is restored.

4. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit "on" for fixed interval after restoration of power from an outage. Provide adequate time delay to permit HID lamps to restrike and develop output.

5. Wire Guard: Where indicated, provide heavy chrome plated wire guard arranged to protect lamp heads or fixtures.

2.09 LAMPS

A. Conform to ANSI C78 series applicable to each type of lamp.

2.10 FINISH

A. Steel Parts: Manufacturer's standard finish applied over corrosion-resistant primer, free of streaks, runs, holidays, stains, blisters, and defects. Remove fixtures showing evidence of corrosion during project warranty period and replace with new fixtures.

B. Other Parts: Manufacturer's standard finish.

C. Verify and provide light fixture finishes as selected by ARCHITECT for all light fixture types. Include colored finish selection tables with product submittals. Upon request submit actual material finish swatches for A/E review.

2.11 EXTERIOR FIXTURE SUPPORT COMPONENTS

A. Pole-Mounted Fixtures: Conform to AASHTO LTS-1.

B. Wind-Load Strength: 100 miles per hour and 1.3 gust factor for total support assembly, including pole, base, and anchorage, where used, to carry fixtures, supports, and appurtenances at indicated heights above grade without deflection or whipping.

C. Arm, Bracket, and Tenon Mount Materials: Match the poles.

D. Mountings, Fastenings, and Appurtenances: Corrosion-resistant components compatible with poles and fixtures that will not cause galvanic action at contact points. Provide mountings that will correctly position luminaire to provide indicated light distribution.

E. Pole Shafts: Square straight.

2.12 POLE BASES

A. Anchor type with galvanized steel hold-down or anchor bolts, leveling nuts, and base covers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Setting and Securing: Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's printed instructions and approved submittals.

B. Support For Recessed and Semirecessed Fixtures: Units may be supported from suspended ceiling support system. Install ceiling system support rods or wires at minimum of four rods or wires per fixture located not more than 6 inches from fixture corners.

1. Fixtures Smaller Than Ceiling Grid: Install minimum of four rods or wires for each fixture and locate at corner of ceiling grid where fixture is located. Do not support fixtures by ceiling acoustical panels.

2. Fixtures of Sizes Less Than Ceiling Grid: Center in acoustical panel. Support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

3. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture corners.

C. Support for Suspended Fixtures: Brace pendants and rods that are 4 feet long or longer to limit swinging. Support stem mounted single-unit suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Lamping: Lamp units according to manufacturer's instructions.

3.02 CONCRETE FOUNDATIONS

A. Construct concrete foundations with 3,000-pound, 28-day concrete conforming to requirements of Division 3. Comply with details and manufacturer's recommendations for reinforcing, anchor bolts, nuts, and washers.

3.03 GROUNDING

A. Ground fixtures and metal poles according to Section 26 05 11.

1. Poles: Install 10-foot driven ground rod at each pole.

2. Nonmetallic Poles: Ground metallic components of lighting unit and foundations. Connect fixtures to grounding system with No. 6 AWG conductor.

3.04 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Give 7-day notice of dates and times for field tests.

C. Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source.

D. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation.

1. Duration of supply.

2. Low battery voltage shut-down.

3. Normal transfer to battery source and retransfer to normal.

4. Low supply voltage transfer.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

3.05 ADJUSTING AND CLEANING

A. Clean fixtures upon completion of installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

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SECTION 27 10 00

TELECOMMUNICATIONS DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 DESCRIPTION

A. Section Includes: Equipment, materials, labor, and services to provide telephone and data distribution system including, but not limited to:

1. Raceway, boxes, and cable tray
2. Telephone and data cabling terminations
3. Telecommunications outlets
4. Terminal blocks/cross-connect systems
5. Equipment racks and cabinets
6. System testing
7. Documentation and submissions

B. Provide all equipment, materials, labor, and services, not specifically mentioned or shown, which may be necessary to complete or perfect all parts of the installation. Ensure that they are in compliance with requirements stated or reasonably inferred by the contract documents.

C. Work not included:

1. The following work will be done by others:
   a. Off-site services.
   b. Providing data concentrators, hubs, servers, computers, and other active devices.

1.03 REFERENCES

A. Design, manufacture, test, and install telecommunications cabling networks per manufacturer's requirements and in accordance with NFPA-70 (National Electrical Code®), state codes, local codes, requirements of authorities having jurisdiction, and particularly the following standards:

1. ANSI/NECA/BICSI-568 -- Standard for Installing Commercial Building Telecommunications Cabling
2. ANSI/TIA/EIA Standards
   a. ANSI/TIA/EIA-568-B.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements
   b. ANSI/TIA/EIA-568-B.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components
   c. ANSI/TIA/EIA-568-B.3 -- Optical Fiber Cabling Components Standard
   d. ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces
   e. ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
   f. ANSI/TIA/EIA-607(A) -- Commercial Building Grounding and Bonding Requirements for Telecommunications

g. ANSI/TIA/EIA-526-7 -- Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

h. ANSI/TIA/EIA-526-14A -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant

i. ANSI/TIA/EIA-758(A) -- Customer-Owned Outside Plant Telecommunications Cabling Standard

B. Install cabling in accordance with the most recent edition of BICSI® publications:

1. BICSI -- Telecommunications Distribution Methods Manual
2. BICSI -- Cabling Installation Manual
3. BICSI -- LAN Design Manual
4. BICSI – Customer-Owned Outside Plant Design Manual

C. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part of the specifications as if herein repeated or hereto attached. If the contractor should note items in the drawings or the specifications, construction of which would be code violations, promptly call them to the attention of the owner's representative in writing. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications shall apply.

1.04 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

A. The owner will make application and pay for building permit.

B. As prerequisite to final acceptance, supply to the owner certificates of inspection from an inspection agency acceptable to the owner and approved by local municipality and utility company serving the project.

1.05 SYSTEM DESCRIPTION

A. A telecommunications cabling system generally consists of one telecommunications outlet in each workstation, wall telephones in common and mechanical areas, and the equipment room (ER) located on the second floor.

B. The typical work area consists of a single-gang plate with three standards compliant work area outlets.

1. All work area outlets consist of individual four-pair Category 6 cables, installed from the work area outlet to the ER.

1.06 SUBMITTALS

A. Submit to the engineer/designer shop drawings, product data (including cut sheets and catalog information), and samples required by the contract documents. Submit shop drawings, product data, and samples with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors. The engineer/designer will indicate approval of shop drawings, product data, and samples submitted to the engineer by stamping such submittals "APPROVED" with a stamp. Submitted shop drawings shall be initialed or signed by the contractor, showing the date and the contractor's legitimate firm name.

1. By submitting shop drawings, product data, and samples, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings, product data, and samples conform to the requirements of the work and of the contract documents. The engineer/designer remains responsible for the design concept expressed in the contract documents as defined herein.

2. The engineer's/designer's approval of shop drawings, product data, and samples submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed the engineer/designer in writing of such deviation at time of submittal, and the engineer/designer has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by the engineer in writing.

3. The engineer's/designer's approval of shop drawings, product data, and samples shall not relieve the contractor of responsibility for errors or omissions in such shop drawings, product data, and samples.

4. The engineer's/designer's review and approval, or other appropriate action upon shop drawings, product data, and samples, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. The engineer's/designer's review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the contractor as required by the contract documents. The review shall not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures. The engineer's/designer's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

B. Perform no portion of the work requiring submittal and review of shop drawings, product data, or samples, until the engineer/designer has approved the respective submittal. Such work shall be in accordance with approved submittals.

C. Submit shop drawings, product data, and samples as a complete set within thirty (30) days of award of contract.

1. For initial submission and for resubmission required for approval, submit four (4) copies of each item. The engineer/designer will only return two copies. Make reproductions as required for your use and distribution to subcontractors.

2. Illegible submittals will not be checked by the engineer.

D. General: Submit the following:

1. Bill of materials, noting long lead time items

2. Optical loss budget calculations for each optical fiber run

3. Project schedule including all major work components that materially affect any other work on the project

E. Shop drawings: Submit the following:

1. Backbone (riser) diagrams.

2. System block diagram, indicating interconnection between system components and subsystems.

3. Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor.

4. Fabrication drawings for custom-built equipment.

F. Product Data -- Provide catalog cut sheets and information for the following:

1. Wire, cable, and optical fiber

2. Outlets, jacks, faceplates, and connectors

3. All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings

4. Terminal blocks and patch panels

5. Enclosures, racks, and equipment housings

6. Over-voltage protectors

7. Splice housings

G. Project record drawings:

1. Submit project record drawings at conclusion of the project and include:

a. Approved shop drawings

b. Plan drawings indicating locations and identification of work area outlets, nodes, telecommunications rooms (TRs), and backbone (riser) cable runs

c. Telecommunications rooms (TRs) and equipment room (ER and/or MC) termination detail sheets.

d. Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.

e. Labeling and administration documentation.

f. Warranty documents for equipment.

g. Copper certification test result printouts and diskettes.

1.07 QUALITY ASSURANCE

A. The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.

B. Upon request by the engineer/designer, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.

C. Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.

D. Where equipment and materials have industry certification, labels, or standards (i.e., NEMA - National Electrical Manufacturers Association), this equipment shall be labeled as certified or complying with standards.

E. Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.

F. Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the owner and engineer/designer.

1.08 WARRANTY

A. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than fifteen (15) years from date of acceptance by the owner. The owner shall deem acceptance as beneficial use.

B. Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Submit these warranties on each item in list form with shop drawings. Detail specific parts within equipment that are subject to separate conditional warranty. Warranty proprietary equipment and systems involved in this contract during the guarantee period. Final payment shall not relieve you of these obligations.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with the owner for secure storage of equipment and materials. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

1.10 SEQUENCE AND SCHEDULING

A. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, owner acceptance, and demolition completion.

1.11 USE OF THE SITE

A. Use of the site shall be at the owner's direction in matters in which the owner deems it necessary to place restriction.

B. Access to building wherein the work is performed shall be as directed by the owner.

C. The owner will occupy the premises during the entire period of construction for conducting his or her normal business operations. Cooperate with the owner to minimize conflict and to facilitate the owner's operations.

D. Schedule necessary shutdowns of plant services with the owner, and obtain written permission from the owner. Refer to article - CONTINUITY OF SERVICES herein.

E. Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the owner.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Devices

1. Hubbell
2. Ortronics
3. Panduit

B. Cables

1. Berk-Tek
2. Belden
3. Mohawk
4. Commscope
5. Superior Essex
6. Optical Cable Corporation

C. Contractor shall be a certified installer

2.02 FABRICATION

A. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and functional aspects of equipment and its installation.

2.03 SUITABILITY

A. Provide products that are suitable for intended use, including, but not limited to environmental, regulatory, and electrical.

2.04 STATION CABLE

A. STATION CABLE

1. Solid copper, 24 AWG, 100 W balanced twisted-pair (UTP) Category 6 cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2 up to 250 MHz.

a. Listed Type CMP.

2.05 WORK AREA OUTLETS

A. VOICE/DATA WORK AREA OUTLETS (Copper only)

1. Single-gang mounting plate with four (4) openings containing the following devices:

a. Two voice/data outlets - 8-pin modular, Category 6, unkeyed, black, pinned to either T568 (A or B) standards.

b. Two dust covers

B. WALL VOICE OUTLETS

1. Single-gang stainless steel faceplate with six-conductor jack and wall telephone mounting lugs

C. DATA ONLY WORK AREA OUTLET

1. Single-gang faceplate with 8-pin modular, category 6, unkeyed, black data jack, pinned to either T568 (A or B) standards

2.06 PATCH PANELS

A. 19 in. rack mountable, 24-port 8-pin modular to insulation displacement connector (IDC) meeting Category 6 performance standards, and pinned to either T568 (A or B) standards. Typical examples of IDC connections are the 110, BIX, and Krone.

2.07 RACK MOUNTED OPTICAL FIBER TERMINATION PANEL

A. 19 in. rack mounted 72-port rack-mounted optical fiber termination panel with cable strain relief, grounding lugs, slack storage and three 12-port duplex SC or approved alternative connector panels with adapters and provisions for six (6) splice trays.

2.08 SPLICE TRAYS

A. Sized for singlemode and multimode fibers, nonmetallic with clear plastic cover, 12-fiber splice capacity, compatible with splice enclosure and splicing method.

2.09 OPTICAL FIBER CONNECTORS

A. Ceramic tipped field installed 568SC connectors, which meet or exceed the performance specifications in ANSI/TIA/EIA-568-B.3.

2.10 OPTICAL FIBER JUMPERS

A. Dual 50/125-µm (and/or singlemode) optical fiber jumper cable, 1 m long with 3.0 mm Duplex 568 SC optical fiber connectors on each end.

2.11 OPTICAL FIBER PIGTAILS

A. 50/125 µm (and/or singlemode) optical fiber pigtail 1 m long with 3.0 mm single 568 SC optical fiber connectors on one end

2.12 EQUIPMENT RACKS

A. Frames, Open, Four Post

1. Frames shall be manufactured from aluminum and/or steel extrusion and sheet.

2. Each frame will have two L-shaped top angles, two L-shaped base angles, a top and bottom

pan, and four C-shaped equipment-mounting channels (a front and rear pair). The rack will assemble with nut and bolt hardware. The base angles and bottom pan will be pre-punched for attachment to the floor. The top pan will be pre-punched for attaching ladder rack with J-bolts.

3. Equipment mounting channels will be 3" deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern to provide 45 rack-mount spaces for equipment. Each mounting space will be marked and numbered on the mounting channel.

4. When assembled with top and bottom pans and angles, equipment-mounting channels will be spaced to allow attachment of 19" EIA rack-mount equipment. Attachment points will be threaded with 12-24 roll-formed threads. The frame will include assembly and equipment-mounting hardware. Frames will include 100 each combination pan head, pilot point, mounting screws.

5. The assembled frame will measure 7' (84") high, 20.3" wide and 41" deep. There will be 29" between the front and rear mounting surfaces of the two pairs of mounting channels. The sides (webs) of the equipment-mounting channels will be punched to allow attachment of vertical cable managers along the sides of the frame or for frame-to-frame or frame-to-rack baying (frames must be able to bay with a 2-post relay rack).

6. The frame will be rated for 2,000 lb. of equipment.

7. Finish shall be either clear grained aluminum or epoxy-polyester hybrid powder coat in the color as specified below.

8. Design Make:
Chatsworth Products, Inc. (CPI),
QuadraRack™ 4-Post Frame

2.13 LISTED BUILDING ENTRANCE PROTECTORS

A. Building entrance terminal utilizing a two (2) foot fuse link between the outside cable plant splice and the protector module with IDC type input and output terminals, 100-pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Provide sufficient protector modules to completely populate all building entrance terminals.

2.14 SPLICE HOUSING

A. Encapsulated, re-enterable splice housing, sized as required with bonding straps, accessories, end caps and encapsulant as required

B. Splice modules (such as 710 series or MS2) for use within splice housing

2.15 SPARES

A. Furnish the following spare equipment and parts:

1. Five (5) percent of base bid quantity of each type of jack shall be provided

2. Five (5) percent of base bid quantity of each type of outlet

3. Two thousand (2000) ft of each type of station cable

PART 3 - EXECUTION

3.01 PRE-INSTALLATION SITE SURVEY

A. Prior to start of systems installation, meet at the project site with the owner's representative and representatives of trades performing related work to coordinate efforts. Review areas of potential interference and resolve conflicts before proceeding with the work. Facilitation with the General Contractor will be necessary to plan the crucial scheduled completions of the equipment room and telecommunications closets.

B. Examine areas and conditions under which the system is to be installed. Do not proceed with the work until satisfactory conditions have been achieved.

3.02 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

A. Be responsible for safekeeping of your own and your subcontractors' property, such as equipment and materials, on the job site. The owner assumes no responsibility for protection of above named property against fire, theft, and environmental conditions.

3.03 PROTECTION OF OWNER'S FACILITIES

A. Effectively protect the owner's facilities, equipment, and materials from dust, dirt, and damage during construction.

B. Remove protection at completion of the work.

3.04 INSTALLATION

A. Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed as part of the contract. Store in areas as directed by the owner's representative. Include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and other related work whether or not expressly defined herein.

B. Install materials and equipment in accordance with applicable standards, codes, requirements, and recommendations of national, state, and local authorities having jurisdiction, and National Electrical Code® (NEC) and with manufacturer's printed instructions.

C. Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and sidewall pressure when installing cables.

1. Where manufacturer does not provide bending radii information, minimum-bending radius shall be 15 times cable diameter. Arrange and mount equipment and materials in a manner acceptable to the engineer and the owner.

D. Penetrations through floor and fire-rated walls shall utilize intermediate metallic conduit (IMC) or galvanized rigid conduit (GRC) sleeves and shall be firestopped after installation and testing, utilizing a firestopping assembly approved for that application.

E. Install station cabling to the nearest telecommunications room (TR), unless otherwise noted.

F. Installation shall conform to the following basic guidelines:

1. Use of approved wire, cable, and wiring devices
2. Neat and uncluttered wire termination

G. Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches. Support cables installed above removable ceilings.

H. Install adequate support structures for 10 foot of service slack at each TR.

I. Install cables in one continuous piece. Splices shall not be allowed except as indicated on the drawings or noted below:

J. Provide overvoltage protection on both ends of cabling exposed to lightning or accidental contact with power conductors.

3.05 GROUNDING

A. Grounding shall conform to ANSI/TIA/EIA 607(A) - Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum.

B. Bond and ground equipment racks, housings, messenger cables, and raceways.

C. Connect cabinets, racks, and frames to single-point ground which is connected to building ground system via #6 AWG green insulated copper grounding conductor.

3.06 LABELING

A. Labeling shall conform to ANSI/TIA/EIA-606(A) standards. In addition, provide the following:

1. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
2. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
   a. Inside receptacle box at the work area.
   b. Behind the communication closet patch panel or punch block.
   c. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications closet location that is specific to the facilities terminated therein.
   d. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
   e. Mount termination blocks on color-coded backboards.
   f. Labels shall be machine-printed. Hand-lettered labels shall not be acceptable.
   g. Label cables, outlets, patch panels, and punch blocks with room number in which outlet is located, followed by a single letter suffix to indicate particular outlet within room, i.e., S2107A, S2107B. Indicate riser cables by an R then pair or cable number.
   h. Mark up floor plans showing outlet locations, type, and cable marking of cables. Turn these drawings over to the owner two (2) weeks prior to move in to allow the owner's personnel to connect and test owner-provided equipment in a timely fashion.
   i. Three (3) sets of as-built drawing shall be delivered to the owner within four (4) weeks of acceptance of project by the owner. A set of as-built drawings shall be provided to the owner in magnetic media form (3.5” floppy disks) and utilizing CAD software that is acceptable to the owner. The magnetic media shall be delivered to the owner within six (6) weeks of acceptance of project by owner.

3.07 TESTING

A. Testing shall conform to ANSI/TIA/EIA-568-B.1 standard. Testing shall be accomplished using level IIe or higher field testers.

B. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct grounded, and reversed pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

1. Perform testing of copper cables with tester meeting ANSI/TIA/EIA-568-B.1 requirements.
2. If copper backbone cable contains more than one (1) percent bad pairs, remove and replace entire cable.
3. If horizontal cable contains bad conductors or shield, remove and replace cable.

C. Initially test optical cable with a light source and power meter utilizing procedures as stated in ANSI/TIA/EIA-526-14A: OFSTP-14A Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss of Installed Singlemode Fiber Cable Plant. Measured results shall be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with optical time domain reflectometer to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the owner

1. Cables shall be tested at 850 and 1300 nm for multimode optical fiber cables. Cables shall be tested at 1310 and 1550 nm for singlemode optical fibers.
2. Testing procedures shall utilize “Method B” – One jumper reference.
3. Bi-directional testing of optical fibers is required.

D. Where any portion of system does not meet the specifications, correct deviation and repeat applicable testing at no additional cost to the owner.

E. Testing of the Transmission Performance of station cables Category 6 shall include the following:

1. Length
2. Attenuation
3. Pair to Pair NEXT Loss (new limits)
4. PSNEXT Loss
5. Pair to Pair ELFEXT Loss (Equal Level Far End Cross-talk)
6. PSEFEXT Loss
7. Propagation Delay
8. Delay Skew
9. Return Loss

F. Cables shall be tested to the maximum frequency defined by the standards covering that performance category. Transmission Performance Testing shall be performed using a test instrument designed for testing to the specified frequencies. Test records shall verify "PASS" on each cable and display the specified parameters - comparing test values with standards based "templates" integral to the unit.

G. Category 6 testing shall be per ANSI/TIA/EIA 568B.2 Permanent Link test configurations and ANSI/TIA/EIA 568B.2 Category 6.

H. The maximum length of station cable shall not exceed 90 meters which allows 10 meters for equipment and patch cables. Worst case performance at 20°C, based on a Horizontal Cable length of 90 meters and Equipment Cord length of 4 meters, shall be as follows:

I. Propagation Delay

1. The maximum propagation delay determined in accordance with the TIA/EIA –568B.1 for a Permanent Link configuration shall be less than 498-ns measured at 10MHz. (Note: In determining the permanent link propagation delay, the propagation delay contribution of connecting hardware is assumed to not exceed 2.5 ns from 1 MHz to 100MHz).

J. In order to establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an 8-position Category 5e Modular plug (8-pin) to facilitate testing. Net Propagation Velocity (NPV) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NPV data is available from the cable manufacturer for the exact cable type under test.

K. In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacement and changes as are necessary, and shall then repeat the test or tests which disclosed faulty or defective material, equipment or installation method, and shall make additional tests as the Engineer deems necessary at no additional expense to the project or user agency.

Category 6 Test Parameters:

Category 6 Cable
Permanent Link Test

Frequency	TIA/EIA 568B.2-1 Insertion Loss Attenuation	TIA/EIA 568B.2-1 NEXT Worst Pair to Pair	TIA/EIA 568B.2-1 PSNEXT Worst Case Loss	TIA/EIA 568B.2-1 ELFEXT Worst Pair to Pair Loss	TIA/EIA 568B.2-1 PSELFEXT Loss	TIA/EIA 568B.2-1 Return Loss
Mhz	Max. dB	dB	dB	DB	dB	dB
1.00	1.9	65.0	62.0	64.2	61.2	19.1
4.00	3.5	64.1	61.8	52.1	49.1	21.0
8.00	5.0	59.4	57.0	46.1	43.1	21.0
10.00	5.5	57.8	55.5	44.2	41.2	21.0
16.00	7.0	54.6	52.2	40.1	37.1	20.0
20.00	7.9	53.1	50.7	38.2	35.2	19.5
25.00	8.9	51.5	49.1	36.2	33.2	19.0
31.25	10.0	50.0	47.5	34.3	31.3	18.5
62.50	14.4	45.1	42.7	28.3	25.3	16.0
100.00	18.6	41.8	39.3	24.2	21.2	14.0
200.00	27.4	36.9	34.3	18.2	15.2	11.0
250.00	31.1	35.3	32.7	16.2	13.2	10.0

3.08 FIELD QUALITY CONTROL

A. Employ job superintendent or project manager during the course of the installation to provide coordination of work of this specification and of other trades, and provide technical information when requested by other trades. This person shall maintain current RCDD® (Registered Communications Distribution Designer) registration and shall be responsible for quality control during installation, equipment set-up, and testing.

B. At least 30 percent of installation personnel shall be BICSI Registered Telecommunications Installers. Of that number, at least 15 percent shall be registered at the Technician Level, at least 40 percent shall be registered at the Installer Level 2, and the balance shall be registered at the Installer Level 1.

C. Installation personnel shall meet manufacturer's training and education requirements for implementation of extended warranty program.

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SECTION 27 41 13
ARCHITECTURALLY INTEGRATED AUDIO-VIDEO EQUIPMENT

PART 1 – GENERAL

1.1 A/V CONSULTANT:

DSH AUDIO VISIONS LLC, MILWAUKEE, WI
DAVID HOSBACH, PRINCIPAL
dhosbach@dshaudiovisions.com
414.732.8448

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of contract apply to work of this section.

B. Architectural, structural, mechanical and other applicable documents are considered a part of the audio video (A/V) system documents insofar as they apply as if referred to in full.

1.3 SCOPE OF THE WORK

A. These Specifications, together with the related drawings and general conditions of the contract, comprise the requirements for the A/V system for the project.

B. The A/V System Subcontractor shall furnish, deliver, erect, and connect complete all the material and appliances described herein and in the drawings, and also all other incidental material and appliances, tools, transportation, etc., required to make the work complete, in accordance with the true intent of these plans and specifications, and as required to leave the audio video systems in first-class operating condition, excluding those items listed under WORK BY OTHERS.

C. The A/V System Subcontractor shall perform all assembly of equipment, wiring and interconnection and soldering of wires to jacks, devices, terminals or equipment, using technical employees only, who are experienced in the installation of A/V equipment and its interconnection.

D. The A/V System Subcontractor shall submit shop drawings to the Architect for approval prior to fabrication. He shall verify dimensions and conditions at the job site prior to installation, and shall perform installation in accordance with these Specifications, manufacturers' recommendations and all applicable code requirements.

1.4 INTENT OF THE SPECIFICATIONS

A. It is the intent of these Specifications to describe and provide for A/V equipment of high professional quality and reliability. Consequently, rigid performance standards by the A/V installation subcontractor and the equipment will be required. In all cases, the Architect shall determine the acceptability of the work based upon the observations and visits of the A/V Consultant.

1.5 SUBSTITUTIONS

A. Many items are listed in the Specifications by the manufacturer's type or model number, without a detailed performance specification, and may not include the phrase "or approved equal". Where this is the case, no substitutions will be accepted, without the written consent of the A/V Consultant. Where the phrase "or approved equal" appears, the item specified shall set a standard of quality and performance, based on the published specifications of the manufacturer and on the actual performance as known by the A/V Consultant. Substitutions will be approved in writing only, based upon these criteria.

1.6 INSTALLER QUALIFICATIONS

A. The A/V System Subcontractor shall be an A/V systems contractor, normally engaged in the business of audio and video system installation. He shall not be an electrical contractor. The A/V System Subcontractor shall show proof, as a part of his bid, that he has been in the sound system installation business for a period of not less than five years and has completed projects of a similar size and scope. The Architect reserves the right to reject any bids submitted by firms without sufficient experience in projects of this size.

B. The Subcontractor shall hold a current, valid franchise for the major lines of sound equipment furnished by him under these Specifications.

1.7 COOPERATION AND COORDINATION

A. The A/V System Subcontractor shall cooperate and coordinate as required with the other contractors who are responsible for work not included in this section. He shall provide any and all information as required or requested in order for this work to be completed to the satisfaction of the Architect, the A/V Consultant and the Owner, in the best interests of the Project. Such assistance or information shall be transmitted in writing to the requesting party in all cases.

1.8 GUARANTEE

A. The A/V System Subcontractor shall guarantee all parts and labor furnished by him under his contract for a period of twelve months from the date of final system acceptance by the Architect. During that time, he shall repair or replace any defective materials or labor without cost to the Owner, and with all reasonable speed. Where warranties on individual pieces of equipment exceed 12 months, the guarantee period shall be extended to the warranty period of the particular items.

B. The A/V Subcontractor shall furnish a complete and working A/V system, to the satisfaction of the Architect, the A/V Consultant and the Owner. He shall be of maximum assistance to the Owner during the guarantee period of the system, to the end that maximum Owner satisfaction is assured.

1.9 SHOP DRAWINGS AND SUBMITTALS:

A. The Sound System Subcontractor shall submit to the Architect, through proper channels and prior to the procurement of equipment or commencement of work the following for approval:

1. A complete equipment list, with model numbers, manufacturers' names, and quantities;

2. Manufacturers' cut sheets on all equipment items;

3. Rack layouts (not shown in these drawings);

4. Proposed construction details for any custom built items. These details shall show dimensions, materials, finishes and color selection;

5. System schematic where applicable, with wire numbers;

6. Certain other submittals as may be required under various equipment items prior to construction, fabrication, or finishing of that equipment item and are so noted.

B. Upon completion of the work, but prior to final system acceptance by the Architect, the Subcontractor shall deliver to the Architect three (3) sets of the following:

1. A complete and correct system schematic for all parts of the system which shall include wire numbers;

2. Any other record drawings showing parts of the system;

3. Service manuals for each and every equipment item furnished;

4. Manufacturer's operating instructions for each and every equipment item furnished.

1.10 WORK BY OTHERS

A. All conduit and electrical boxes;

B. 110V, 60 Hz ac power to all A/V device locations as shown on the A/V drawings;

C. Blocking/support for flat panel displays and other wall-mount equipment as required.

PART 2 – PRODUCTS

2.1 GENERAL

A. The following sections specifically list the acceptable equipment types and items for this project. Where quantities are not noted, they may be obtained from the drawings. In the event of a discrepancy between the specifications and the drawings, the greater quantity or better quality shall be furnished.

B. Refer to 'Substitutions' paragraph in Part 1 of this Specification.

C. During the installation, the A/V System Subcontractor shall make provisions for all equipment included in the base bid and any alternates, whether taken or not, so that items which are to be provided as alternates may be added to the system without rewiring or additional construction.

2.2 EQUIPMENT

A. First Floor Digital Announcement and Video Playback
   1. The first floor digital announcement and video playback system shall consist of electronics which will allow for the capability to show digital signage announcements from a computer and video playback from a Blu-Ray/DVD playback device.
   2. Source switching shall be accomplished via a simple 2x1 switcher component
   3. Digital signage/announcements shall be conceived on a computer (Furnished By Owner) and driven
   4. Video Playback shall be accomplished via a Blu-Ray/DVD playback device
   5. Interconnect shall be HDMI format
   6. Two flat panel displays will be utilized to ensure viewing from all parts of the public seating areas
   7. Power will be conditioned using SurgeX units mounted locally at the flat panel devices, and at the front end equipment rack
   8. The equipment shall be as specified in the table as follows:

FIRST FLOOR A/V SYSTEM INPUT/HEAD-END			
			OFE = OWNER-FURNISHED EQUIPMENT
Qty	**Mfr**	**Model**	**Description**
1		**OFE**	COMPUTER WITH HDMI CABLE FOR SIGNAGE CREATION & TRANSMIT
1	RAPCO	OR EQUAL	SINGLE-GANG STAINLESS PLATE WITH NEUTRIK NAHDMI-W-B HDMI CONNECTOR
1	BRIGHTSIGN	HD1023	DIGITAL SIGNAGE MEDIA DECODER/PLAYER
1	LOWELL	US-110	1-RU SHELF FOR BRIGHTSIGN MEDIA PLAYER
1	DENON PROFESSIONAL	DN-500BD	BLU-RAY/DVD PLAYBACK DEVICE
1	EXTRON	SW2 HD 4K	2-INPUT X 1-OUTPUT HDMI SWITCH
1	EXTRON	DA4 HD 4K	1-INPUT X 4-OUTPUT HDMI DISTRIBUTION AMPLIFIER
2	EXTRON	RSU126	1-RU RACK SHELF FOR EXTRON SW2 AND DA4
1	LOWELL	LDTR-1018	STEEL RACK CABINET - *CAN BE MOUNTED UNDER RECEPTION DESK OR PLACED ON OPTIONAL CASTER BASE*
1	LOWELL	LDTR-RAC10	REAR ACCESS COVER FOR RACK CABINET
1	SURGEX	SX-1115RT	POWER STRIP/POWER SWITCH WITH INDUSTRIAL-GRADE SURGE PROTECTION & POWER CONDITIONING
1	LOT		CABLE, CONNECTORS, HARDWARE

FLAT PANEL DISPLAY ASSEMBLY - AV-121 LOCATION (SEE SHEET AVS-2.1)			
Qty	**Mfr**	**Model**	**Description**
1	NEC	E655	COMMERCIAL-GRADE 65" DIAGONAL FLAT PANEL DISPLAY - FULL 1080P; ON/OFF TIMERS; BUILT-IN SPEAKERS; 3-YEAR WARRANTY
1	CHIEF	PNRUB	ARTICULATING FLAT PANEL WALL-MOUNT SYSTEM
1	SURGEX	SA-82	FLAT-PAK LOW-PROFILE INDUSTRIAL-GRADE SURGE PROTECTOR/POWER CONDITIONER
1	FSR	DR-PCB-H15M+	50-FOOT RIBBON CABLE WITH SIGNAL CONVERSION BUILT INTO HDMI CONNECTORS
1	RAPCO	OR EQUAL	SINGLE-GANG STAINLESS PLATE WITH NEUTRIK NAHDMI-W-B HDMI CONNECTOR
1	RAPCO	OR EQUAL	5-FOOT HDMI CABLE FOR CONNECTION FROM WALL PLATE TO FLAT PANEL

FLAT PANEL DISPLAY ASSEMBLY - AV-122 LOCATION (SEE SHEET AVS-2.1)			
Qty	**Mfr**	**Model**	**Description**
1	NEC	E505	COMMERCIAL-GRADE 50" DIAGONAL FLAT PANEL DISPLAY - FULL 1080P; ON/OFF TIMERS; BUILT-IN SPEAKERS; 3-YEAR WARRANTY
1	CHIEF	TS525TU	ARTICULATING FLAT PANEL WALL-MOUNT SYSTEM
1	SURGEX	SA-82	FLAT-PAK LOW-PROFILE INDUSTRIAL-GRADE SURGE PROTECTOR/POWER CONDITIONER
1	FSR	DR-PCB-H15M+	50-FOOT RIBBON CABLE WITH SIGNAL CONVERSION BUILT INTO HDMI CONNECTORS
1	RAPCO	OR EQUAL	SINGLE-GANG STAINLESS PLATE WITH NEUTRIK NAHDMI-W-B HDMI CONNECTOR
1	RAPCO	OR EQUAL	5-FOOT HDMI CABLE FOR CONNECTION FROM WALL PLATE TO FLAT PANEL

9. Substitutions shall be as approved by the A/V Consultant **7 days in advance of the bid due date**
10. A/V Contractor shall site-verify distances from equipment rack to flat panel devices for proper length determination of FSR ribbon cables

B. Second Floor Conference/Class Room Equipment
    1. Two possible configurations shall be accounted for in this room (see also sheet AVS-2.1)
        a. Large class configuration with large flat panel on one end of the room
        b. Small class configuration with small flat panel on opposite end of the room
    2. Each flat panel shall be independent of the other with HDMI input at each respective location
    3. Sound system for large room configuration may be considered by Owner in the future but is not included as part of this contract
    4. Equipment for this Conference/Class Room is as specified in the table as follows:

LARGE FLAT PANEL DISPLAY ASSEMBLY - AV-221 LOCATION (SEE SHEET AVS-2.1)			
Qty	**Mfr**	**Model**	**Description**
1	NEC	E805	COMMERCIAL-GRADE 80" DIAGONAL FLAT PANEL DISPLAY - FULL 1080P; ON/OFF TIMERS; BUILT-IN SPEAKERS; 3-YEAR WARRANTY
1	CHIEF	XSM1U	FLAT PANEL FIXED-POSITION WALL-MOUNT SYSTEM
1	SURGEX	SA-82	FLAT-PAK LOW-PROFILE INDUSTRIAL-GRADE SURGE PROTECTOR/POWER CONDITIONER
1	FSR	DR-PCB-H15M+	50-FOOT RIBBON CABLE WITH SIGNAL CONVERSION BUILT INTO HDMI CONNECTORS
1	RAPCO	OR EQUAL	SINGLE-GANG STAINLESS PLATE WITH NEUTRIK NAHDMI-W-B HDMI CONNECTOR
1	RAPCO	OR EQUAL	5-FOOT HDMI CABLE FOR CONNECTION FROM WALL PLATE TO FLAT PANEL
1	WIREMOLD	EVOLUTION EFB45S	FLOOR BOX WITH HDMI; A.C. POWER; MICROPHONE JACK (MIC JACK FOR FUTURE TERMINATION) - *PROVIDED BY A/V CONTRACTOR; INSTALLED BY E.C.*
1	RAPCO	OR EQUAL	30-FOOT HDMI CABLE FOR FLOOR BOX-TO-FLAT PANEL CONNECTION - *SITE VERIFY DISTANCE FOR PROPER CABLE FIT*

FLAT PANEL DISPLAY ASSEMBLY - SECOND FLOOR LOCATIONS AV-223 (SEE SHEET AVS-2.1)			
Qty	**Mfr**	**Model**	**Description**
1	NEC	E505	COMMERCIAL-GRADE 50" DIAGONAL FLAT PANEL DISPLAY - FULL 1080P; ON/OFF TIMERS; BUILT-IN SPEAKERS; 3-YEAR WARRANTY
1	CHIEF	LTM1U	FLAT PANEL VERTICAL TILTING WALL-MOUNT SYSTEM
1	SURGEX	SA-82	FLAT-PAK LOW-PROFILE INDUSTRIAL-GRADE SURGE PROTECTOR/POWER CONDITIONER
2	RAPCO	OR EQUAL	SINGLE-GANG STAINLESS PLATE WITH NEUTRIK NAHDMI-W-B HDMI CONNECTOR
1	RAPCO	OR EQUAL	5-FOOT HDMI CABLE FOR CONNECTION FROM WALL PLATE TO FLAT PANEL
1	RAPCO	OR EQUAL	10-FOOT HDMI CABLE FOR RUN FROM INPUT PLATE TO FLAT PANEL LOCATION - *SITE VERIFY DISTANCE BETWEEN CONNECTOR BOXES*

5. Substitutions shall be as approved by the A/V Consultant **7 days in advance of the bid due date**
6. A/V Contractor shall site-verify distances from equipment rack to flat panel devices for proper length determination of FSR ribbon cables
7. Owner may wish to consider flat panel assembly purchase for device locations AV-202/222 and AV-204/224 in the future, but they are not included in this contract

PART 3 - EXECUTION

3.0 FINAL TESTING AND EQUALIZATION

A. The completed installation is to be tested for compliance with the Specifications, and is to be inspected by the A/V Consultant: DSH Audio Visions LLC, Milwaukee, Wisconsin.

B. Any testing and setup work shall be performed after the installation work has been completed, but prior to ANY use of the system. During the testing work, the A/V System Subcontractor shall have on the job one (1) competent technician who is familiar with the project, and who will be prepared to stay as long as his services are needed.

C. During the final setup work, the A/V System Subcontractor shall arrange to have present a representative of the Owner to receive instruction and information regarding the operation and maintenance of the system. The A/V System Subcontractor shall coordinate, as necessary, to insure a quiet room during this testing period.

D. Prior to the testing, the A/V System Subcontractor shall insure that the system is free of short circuits, ground loops, parasitic oscillations, excessive system noise beyond published specifications of the equipment, hum, RF interference, or instability of any form.

3.2 TRAINING

A. The A/V System Subcontractor shall provide complete technical training in the proper use of the A/V system to a representative of the Owner, at a time mutually convenient, but before final acceptance of the system.

SECTION 27 52 23

HELP CALL SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 GENERAL PROVISIONS

A. In general, the work includes: Install a help call system as shown on plans.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Cornell

B. Jeron

C. Tektone

2.02 EQUIPMENT

A. Help Call Master shall be a Cornell A4020-TG flush wall mounted enclosure. LED as required shall be mounted on an anodized aluminum face plate. A hi-low tone switch, LED power indicator, and lamp test switch shall be provided.

B. The control module shall be a Cornell NC-102D for up to three call status capabilities. The module shall provide a steady voltage for operation of signal lamps during normal calls, a flashing voltage during emergency calls and a pulsing voltage for priority calls. Audible tones shall be sounded at all duty stations and at the annunciator panel whenever a call is placed. Priority calls take precedence over emergency calls and emergency calls take precedence over normal calls. The module shall derive its operating voltage from the Cornell P-5243 Power Supply.

C. Power supply shall be a Cornell P-5243.

D. Corridor dome lamps shall be Cornell L101.

E. Toilet stations shall be Cornell E-104-1WP with nylon pull-for-help cords.

PART 3 - EXECUTION

3.01 SYSTEM OPERATION

A. An emergency call is placed when the emergency station is pulled and causes the following: A flashing visual indication will appear at the calling station, room corridor lamp and, associated room indicator at the master. The emergency call takes priority over bedside calls and can be cancelled only at the point of origination.

3.02 CONTROLS AND ADJUSTMENT

A. The master has a hi-low switch to give a choice of two preset levels of volume. The master annunciator also has a lamp check switch. The NC-102 control module has adjustments for master volume of the tone level that is supplied to the master. There is an adjustment for frequency of the tone signal also. There are individual controls for the rate of pulsing (flashing) of the emergency calls.

B. Corridor lamps use bulbs that are replaceable from the front and are accessible by pulsing the dome perpendicular from the plate.

C. The power supply has no user adjustment on the outside of the cabinet. NOTE: Removal of the cabinet cover to make adjustments for qualified personnel only.

END OF SECTION

SECTION DIVISION 28 13 00

ACCESS CONTROL AND INTRUSION DETECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

B. A complete access control system shall be provided per specifications found under Division 28 (Access Control) and Division 25 (Integrated Automation).

C. The Division 28 Access Control System Peripheral Device (ACS-PD) Contractor shall provide all peripheral devices (PD) including but not limited to; electronic locking hardware (EL), door status sensors (DSS), proximity card readers (PCR), request to exit devices (REX), emergency door releases (EDR), fire alarm system interface (FASI), surge suppressors (SS), power supplies (PS), back up batteries (Batt), sub system interfaces (SSI) including but not limited to fire alarm systems, cable, cable support and labor for; mounting all enclosures/devices (including Division 25 enclosures), installation of all cabling, termination of all devices (including Division 25 devices) and 120VAC power installation as needed.

D. The Division 25 contractor shall provide all access control modules, access control module enclosures, access control system management software, access credentials, system programming and training under subcontract to the Division 28 contractor.

E. Both Division 28 and Division 25 contractors shall be responsible and present for a complete point to point checkout and commissioning of the system.

F. All labor, material and equipment not specifically referred to herein or on the plans, that are required to meet the functional intent of this specification, shall be provided without additional cost to the Owner.

G. Installation of all devices and components shall be in compliance with and conform to NFPA 70, NFPA 101 and NFPA 731.

1.02 SYSTEM DESCRIPTION

A. The Access Control System (ACS) shall be comprised of; master access control modules (ACM) with network connectivity; two door expansion units (ACEM) connected to master control modules via an RS-485 and power trunk; card readers, door status devices, request to exit devices, emergency door releases and electronic locking hardware that in turn are connected to either master access control modules or expansion modules; panic buttons, power supplies and back up batteries which support the electronic locking hardware as required.

B. The ACS-PD Contractor shall include all Ethernet network wiring required to create a control LAN/WAN that shall connect all ACMs, operator workstations, servers, routers, switches and other network devices as indicated on the riser diagram. The ACS-PD Contractor shall not connect to a customer provided LAN/WAN.

1.03 CONTRACTOR QUALIFICATIONS

A. General:

1. The ACS-PD Contractor shall have a successful history in the design and installation of access control systems based wide area network connectivity and shall provide evidence of this history as a condition of acceptance of bid.
2. The ACS-PD Contractor shall have an office that is staffed with trained engineers and technicians fully capable of providing instruction and routine emergency maintenance service on all peripheral system components within 24 hours of notification.
3. Contractor Service:
   a. ACS-PD Contractor shall have a local service facility within a 90-mile radius of the job site, staffed with qualified service personnel, fully capable of providing instructions and routine or emergency maintenance service.
   b. Experience (Submit the following information as part of the proposal package):
      i. Submit a list of no less than five similar projects that have access control systems devices installed by the ACS-PD Contractor. Include proper references and contact numbers.
   c. Submit an organizational diagram indicating the key technical staff proposed for the project including Project Manager, Application Engineer, etc.

1.04 SPECIFICATION NOMENCLATURE

A. Acronyms used in this specification are as follows:

1.	ACS	Access Control System
2.	ACM	Access Control Module
3.	ACEM	Access Control Expansion Module
4.	ACS-PD	Access Control System-Peripheral Device
5.	AWG	American Wire Gauge
6.	BAS	Building Automation System
7.	DSS	Door Status Sensor
8.	EDR	Emergency Door Release
9.	EL	Electronic Locking Hardware
10.	FASI	Fire Alarm System Interface
11.	IACS	Integrated Access Control System
12.	IOM	Input/Output Module
13.	LAN	Local Area Network
14.	PCR	Proximity Card Reader
15.	PD	Peripheral Device
16.	PR	Proximity Card Reader
17.	PS	Power Supply
18.	REX	Request to Exit Device
19.	SSI	Sub System Interface
20.	WAN	Wide Area Network

1.05 DIVISION OF WORK

A. The ACS-PD Contractor shall be responsible for all input/output wiring, power wiring (120VAC), interlock/safety wiring and Ethernet LAN/WAN wiring, where applicable to all peripheral devices and Division 25 enclosures.

B. The ACS-PD Contractor shall be responsible for the installation and mounting of all ACS peripheral devices, cabling, cabling support and Division 25 enclosures.

C. The Division 25 System Integrator shall be responsible for providing the ACMs and ACEMs to which all peripheral devices shall be connected, servers, software, programming of the ACMs/ACEMs, global supervisory control applications and system integration.

1.06 RELATED WORK SPECIFIED ELSEWHERE

A. Section 25 00 00:

1. Providing Access Control Modules
2. Providing Access Control Expansion Modules
3. Providing Access Control Software
4. Providing I/O Expansion Modules
5. Global supervisory control sequences
6. Integration of owner's existing control system (if applicable)

1.07 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and peripheral device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

1.08 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to insure that the Work will be carried out in an orderly fashion. It shall be this Contractor's responsibility to check the Contract Documents for possible conflicts between his Work and that of other crafts in equipment location, structural and architectural features and compatibility between systems, equipment and components.

1.09 SUBMITTAL

A. Eight copies of shop drawings of the entire control system shall be submitted and shall consist of a complete list of equipment and materials, including manufacturers catalog data sheets and installation instructions. Shop drawings shall also contain complete wiring and schematic diagrams, calculations, and any other details required to demonstrate that the system has been coordinated and will properly function as a system.

B. The ACS-PD Contractor shall provide catalog data sheets and wiring diagrams to the Section 25 System Integrator for proper coordination of work.

C. Upon completion of the work, provide a complete set of 'as-built' drawings on compact disk. Drawings shall be provided as AutoCAD™ or Visio™ compatible files. Eight copies of the 'as-built' drawings shall be provided in addition to the documents on magnetic floppy disk media or compact disk.

PART 2 - MATERIALS

2.01 GENERAL

A. The Access Control System Peripheral Devices (ACS-PD) shall include but not limited to; electronic locking hardware (EL), door status sensors (DSS), panic buttons (PB), proximity card readers (PCR), request to exit devices (REX), emergency door releases (EDR), fire alarm system interface (FASI), surge suppressors (SS), power supplies (PS), back up batteries (Batt), cable, cable support and labor for; mounting all enclosures/devices (including Division 25 enclosures), installation of all cabling, termination of all devices (including Division 25 devices) and 120VAC power installation as needed.

2.02 Proximity Card Readers (PCR)

A. All card readers shall be HID Corporation 125kHz proximity type - (no substitutes).
   1. One gang - ThinLine II style (1G) shall be 53695CG100.
   2. Mullion style - MiniProx (M) shall be 5365EGT00 or 5365EGP00.
   3. Small platform – ProxPoint Plus (SP)

B. The mounting height of all proximity card readers shall fall within ADA guidelines.

2.03 Door Status Sensor (DSS)

A. Door status sensors shall be either integral to the electronic locking hardware (latch bolt monitoring – LBM) or through stand-alone devices (magnetic contacts).

B. All stand-alone door status sensors shall be of the magnetic reed type and obtained from GE Security or approved equal.
   1. 1" Diameter Steel Door Recessed Sensor (DPDT): 1076D
   2. 1" Diameter Steel Door Recessed Sensor (N/O): 1078W
   3. ¾" Diameter Steel Door Recessed Sensor (N/O): 1078C
   4. Press fit rare earth magnet: 1840-N
   5. Roller Plunger (hinge side of door only – N/O): 3008

      Use only where a recessed sensor will not function properly. Prior approval must be obtained before installation.
   6. Commercial Steel Door Surface mounted Sensor (N/O): 1045

      Use only where a recessed sensor will not function properly. Prior approval must be obtained before installation.

C. Sensors of the recessed type shall adhere to the following installation standards:
   1. When installed at the top of the door the sensor shall not be installed no closer than 2" and no further than 10" from the latch side of the door.
   2. When installed on the latch side surface of the door the sensor shall not be installed closer than 2" of either the bottom or top of the door.
   3. When a recessed sensor is utilized at the top of an aluminum door where the door has a recessed channel an 1840-N or similar magnet shall be used. The construction of field expedient assemblies to utilize a standard press fit magnet will not be allowed.

D. Sensors of the plunger type shall adhere to the following installation standards:
   1. A plunger sensor shall only be used when a recessed sensor cannot be utilized on the latch side or top of a door.
   2. Plunger sensors shall only be used on the hinge side of a door.
   3. A plunger sensor shall be installed no closer than 2" from the bottom or top of the door.
   4. A plunger sensor shall have sufficient spacers applied to cause the switch to operate when the door has moved no further than 5" from the closed position.

E. Sensor of the surface mount type shall adhere to the following installation standards:
   1. A surface mounted switch shall be installed no closer than 1" and no further than 3" from the latch side of the door.
   2. Armored cable shall be installed to protect the integrity of the cable where accessible by human or mechanical contact.

F. All door status sensors shall have an end of line supervision device installed at the device within 12" of the sensor. The end of line supervision device shall be provided to the ACS-PD Contractor by the Division 25 Contractor.

2.04 Request to Exit Device (REX)

A. Request to exit devices, when applicable, may be indicated on the drawings as either motion (REX-M), wireless (REX-WL), button (REX-B) or integral to the electrified lockset (REX-INT).

1. Passive Infrared Motion (REX-M): Bosch DS150i/DS151i or approved equal.

2. Wireless (REX-W): Linear DXR-71 or DXR-702 (Receivers), DXT-41, DXT-42 or DXT-21 (Transmitters) or approved equal.

3. Button (REX-B): Momentary push button, SPDT, 4amps @ 28VDC or equal. Unit shall include a mountable enclosure to support wiring terminations.

4. Integral to Lockset (REX-INT): specific to electronic locking hardware.

B. All RTE devices shall be electronically wired as normally open circuits (NO) to allow for T-Tapping or parallel circuit connections for multiple REX devices on a single door.

2.05 Emergency Door Release (EDR)

A. Emergency door release devices, if applicable, shall be of either the manual pull station (EDR-MP) or pneumatic time delay (EDR-P) type.

1. Manual Pull Station (EDR-MP): Security Door Controls 492 or approved equal.

2. Pneumatic Time Delay (EDR-P): Alarm Controls Corporation TS-14 or approved equal.

2.06 Electronic Locking Hardware (EL)

A. Electronic locking hardware shall operate on 24 VDC unless otherwise noted.

B. Electronic strikes, electrified locksets or electrified crash bars are the preferred technologies for electronic locking hardware. Magnet locks are not the preferred method and will require written approval prior to installation.

C. Electronic locking hardware shall meet ANSI/BHMA Grade 1 standards.

D. Magnetic locking hardware, when approved, shall support a holding force of between 1,650 and 2,700 pounds.

E. Electronic locking hardware applied to fire rated door assemblies shall be listed for the intended use. Electronic locking hardware for use with fire rated door assemblies shall be UL 10C, NFPA-252 and ASTM-E 2074 listed.

2.07 Surge Suppressor (SS)

A. Surge suppression shall be provided between each electrified locking hardware device and the access control system controlling relay/power source. One suppressor shall be installed at the electronic locking hardware and one at the power source controlling relay.

1. Capacitor/Transzorb (DC power): Honeywell NC-S4, Diteck DTK-ESS or approved equal.

B. Where system devices are susceptible to power surges or stray voltages additional surge suppression shall be provided. Examples include but are not limited to card readers located at parking gates or stand-alone sheds.

1. Card Reader Surge Suppressor: Diteck DTK-4LVLP-CR or approved equal.

2. Door Status Sensor: Diteck DTK-2MHLP series or approved equal.

3. Request to Exit Device: Diteck DTK-2MHLP series or approved equal.

2.08 Panic Button (PB)

A. Provide Alarm Controls Corporation Model TS-18 mounted under desks as directed.

B. When activated, system to send text or email to designated cell phone equipped to receive this message.

2.09 Power Supply (PS)

A. Power supplies for electronic locking hardware shall be either wall mount or rack mount units depending on the application and available mounting source. Wall wart transformers shall not be allowed for either direct power to field devices or to a power supply distribution panel. Direct, hardwired 120VAC to open frame or like transformer mounted in an enclosure is the preferred method. Line cord connections to a duplex or like outlet for rack mount power supplies shall be deemed acceptable.

B. Power supplies shall provide back-up battery power sufficient to operate the system components for a minimum of 4 hours. The use of a UPS for rack mount power supplies is preferred over a separate rack mounted battery enclosure.

2.10 Backup Batteries (Batt)

A. Backup battery power shall be provided for all system components such that the entire system will function normally for a period of no less than 4 hours from the loss of AC power.

2.11 Access Cards

A. Provide (100) access cards.

2.12 Cabling

A. All cabling shall be rated for the intended use and follows local, State of Wisconsin and National Electrical Code standards.

B. All cabling shall be supported in a manner which meets local, State of Wisconsin and National Electrical Code Standards.

C. Component cabling for the following devices shall meet the following the gauge, type and conductor count minimums:

1. Card Reader – 6 conductor 20AWG stranded shielded
2. Request to Exit Device – 4 conductor 20AWG stranded
3. Door Status Device – 2 conductor 22AWG stranded
4. Electronic Locking Hardware – 2 conductor 18AWG stranded
5. Emergency Door Release – 2 conductor 18AWG stranded
6. RS-485 Data between ACM and ACEM – twisted pair 24AWG shielded - no more than 12.5pF
7. Power between ACM and ACEM – 4 conductor 18AWG stranded shielded

D. It is the responsibility of the ACS-PD Contractor to calculate the electrical load for each circuit and size the cabling conductors appropriately to facilitate a fully functioning system.

E. All cables are to be PLENUM and may be installed free-air.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work described in this section shall be installed, wired and circuit tested by factory certified technicians qualified for this work. The installing office shall have a minimum of five years of installation experience with the manufacturer and shall provide documentation in submittal package

verifying longevity of the installing company's relationship with the manufacturer. Supervision and checkout of the system shall be by the employees of the local contracting field office (branch or representative).
Install system and materials in accordance with manufacturer's instructions and as detailed on the project drawing set.

C. Drawings of access control system components are diagrammatic only and any apparatus not shown, such as relays, accessories, etc., but required to make the system operative to the complete satisfaction of the Engineer and Owner shall be furnished and installed without additional cost.

D. Line and low voltage electrical connections to system devices specified or shown on the control diagrams shall be furnished and installed by the ACS-PD Contractor in accordance with these specifications.

E. All electrical control wiring and power wiring to the control panels shall be the responsibility of the ACS-PD Contractor.

F. All wiring shall be in accordance with the Project Electrical Specifications (Division 26), the National Electrical Code and any applicable local or state codes. All access control system wiring shall be installed in the conduit types specified in the Project Electrical Specifications (Division 26) unless otherwise allowed by the National Electrical Code or applicable local codes. Where plenum rated cable wiring is required, it shall be run parallel to or at right angles to the structure, properly supported and installed in a neat and workmanlike manner.

G. Any devices, such as door status contacts and electronic locking hardware, which are applied to fire rated door assemblies shall be installed in a manner which maintains the fire rating of the assembly. All penetrations to the fire door assembly must conform with the manufacturer's specifications and local building code. The installing contractor shall provide documentation indicating the fire rating of the assembly has been maintained and is in conformance with local building code.

3.02 WIRING

A. GENERAL REQUIREMENTS

1. Install low voltage power and access system component wiring in conduit in the following locations regardless of local building code allowances.
    a. Mechanical rooms.
    b. Electrical rooms.
    c. Vertical risers (exception: fire rated continuous closet like a telephone closet).
    d. Open Areas where the wiring will be exposed to view or tampering.
2. Conceal conduit within finished shafts, ceilings and wall as required. Install exposed conduit parallel with or at right angles to the building walls
3. Tag all equipment, panels, cables, conduits, junction boxes, etc., as called out in the "Identification" section of this specification and as shown on the drawings. Where identification is not provided on the drawings the ACS-PD Contractor shall provide, at a minimum, identification tags on all cabling at both ends of the cable and shall provide documentation of the cable tag numbering with description of the cable use in a spread sheet format.
4. Perform installation of all devices in the manner specified by each manufacturer. Aside from product submittal requirements, provide manufacturer's installation instructions for verification when requested.
5. Where Class 2 wires are in concealed and accessible locations including ceiling return air plenums, approved cables not in raceway may be used provided that:
    a. Circuits meet NEC Class 2 (current-limited) requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit.)
    b. All cables shall be UL listed for application, i.e., cables used in ceiling plenums shall be UL listed specifically for that purpose.

6. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage may not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

7. Where Class 2 wiring is run exposed, wiring to be run parallel along a surface or perpendicular to it, and NEATLY tied at 3m intervals.

8. All wire-to-device connections shall be made at a terminal block, terminal strip or with a crimped connector where the device has a wiring harness. All wire-to-wire connections shall be at a terminal block or with a crimped connector. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

9. All unused conductors shall be capped by use of a crimp connector or wire nut.

10. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. ETHERNET Network Requirements

1. Wired network communication shall be via channels consisting of Category 5E or Category 6 network cable.

2. Communication conduits or cabling shall not be installed closer than 2m from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible.

3. Ethernet network wiring shall be installed as shown on riser diagram.

4. There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring.

5. Recommended CAT 5E and CAT 6 Ethernet wiring guidelines shall be followed and in no case shall the distance between any Ethernet switch, NAC or other Ethernet LAN device exceed 100 meters.

6. Ethernet wiring shall be installed and rated for communications to 1 GB.

C. CONDUIT AND FITTINGS

1. Conduit for Control Wiring, Control Cable and Transmission Cable: Electrical metallic tubing (EMT) with compression fittings, cold rolled steel, zinc coated or zinc-coated rigid steel with threaded connections.

2. Outlet Boxes (Dry Location): Galvanized drawn steel suited to each application, in general, four inches square or octagon with suitable raised cover.

3. Outlet Boxes (Exposed to Weather): Threaded hub cast aluminum or iron boxes with gasket device plate.

4. Pull and Junction Boxes: Size according to number, size, and position of entering raceway as required by National Electrical Codes. Enclosure type shall be suited to location.

5. Plug or cap all unused conduit openings and stub-ups. Do not use caulking compound.

6. Route all conduit to clear beams, plates, footings and structure members. Do not route conduit through column footings or grade beams.

7. Set conduits as follows:

   a. Expanding silicone firestop material where conduit is run between floors and through walls of fireproof shaft.

   b. Oakum and lead, sealed watertight penetration through outside foundation walls.

8. Cap open ends of conduits until conductors are installed.

9. Where conduit is attached to vibrating or rotating equipment, flexible metal conduit with a minimum length of 18 inches and maximum length of 36 inches shall be installed and anchored in such a manner that vibration and equipment noise will not be transmitted to the rigid conduit.

10. Where exposed to the elements or in damp or wet locations, waterproof flexible conduit shall be installed. Installation shall be as specified for flexible metal conduit.

11. Provide floor, wall, and ceiling plates for all conduits passing through walls, floors or ceilings. Use prime coated cast iron, split-ring type plates, except with polished chrome-plated finish in exposed finished spaces.

D. IDENTIFICATION

1. Wire Tags

a. All multi-conductor cables, including those for all I/O devices, in all pull boxes and terminal strip cabinets shall be uniquely tagged at both ends. Keep a catalog of wire identification in electronic spread sheet form for submittal to the owner at the project's completion.

b. Provide wire Tags as per Division 26.

2. Conduit Tags

a. Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.

3.03 WARRANTY

A. Equipment, materials and workmanship incorporated into the work shall be warranted for a period of one year from the time of system acceptance.

B. Within this period, upon notice by the Owner, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by the ACS-PD Contractor at no expense to the Owner.

3.04 START-UP AND TESTING

A. It is the responsibility of the ACS-PD contractor to ensure the proper installation and performance of the peripheral devices as specified in this section and to coordinate the start-up and testing of the access control system with the Division 25 System Integrator to ensure the networks and attached devices are functioning properly. Once all devices are installed, programmed, configured and powered, the ACS-PD contractor shall notify the Division 25 System Integrator to schedule a start-up plan. During the start-up, all devices supplied by the ACS-PD contractor shall be checked for proper communication and function, network connectivity as may be required and network traffic to ensure proper performance. The ACS-PD contractor shall correct any devices or performance found to be defective.

B. The system tests, conducted jointly by the ACS-PD contractor and the Division 25 System Integrator, shall provide the following:

1. Complete end-to-end test and verification for each connected input and output. This includes verification of all point data in graphic displays as may be required and if applicable.

2. Complete functional test of sequences of operation including global control sequences.

3.05 ACCEPTANCE TESTING

A. The ACS-PD Contractor shall verify that all peripheral devices are ready for operation. This inspection shall verify that the following items have been properly installed.

1. Network connections.

2. Power connections.

3. Proper power supply voltage and types.

4. Electrical installation conforms to local code authorities.

5. Point to point check of all digital I/O for continuity and correct execution of the functional operation.

B. Submit an Inspection Log, which enumerates the above in a check list form for all devices. Indicate corrective action for non-conforming or defective products and/or product installations.

C. The ACS-PD Contractor shall perform all necessary testing, de-bugging and perform all required operational checks to insure that the system is functioning in full accordance with these specifications. The ACS-PD and Division 25 contractor are to coordinate the checkout of the system such that each Division has a representative present during the entire system checkout.

D. The ACS-PD Contractor shall perform tests to verify proper performance of components and sequences of operation. Repeat tests until proper performance results are obtained. This testing shall include a point-by-point log to validate 100% of the input and output points of the IACS operation. The Division 25 System Integrator shall have a representative present during system checkout by the ACS-PD Contractor.

E. Upon completion of the performance tests described above, repeat these tests, point by point as described in the validation log above in presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

F. System Acceptance: Satisfactory completion is when the ACS-PD contractor has successfully performed all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner’s Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

G. In conjunction with the work of other trades, thoroughly test all equipment and systems in a dynamic mode simulating all operating sequences including safety unlocks and emergency fire mode where required.

3.06 WARRANTY ACCESS

A. The Owner shall grant the ACS-PD Contractor reasonable access to the ACS during the warranty period.

3.07 TRAINING

A. Training on the ACS shall be the responsibility of the Division 25 contractor.

3.08 PROGREAMMED DOOR AUTO UNLOCK ON TIME SCHEDULE:

A. The IACS shall automatically initiate an unlocked condition for the assigned doors based on a time schedule to be determined by the customer.

END OF SECTION 28 13 00

SECTION 28 23 00

VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.02 GENERAL REQUIREMENTS

A. Provide a complete operating video surveillance system as shown on the drawings and as herein specified.

1.03 MISCELLANEOUS

A. Contractor shall make all necessary connections/terminations and punch downs for all devices.

1.04 SUBMITTALS

A. Submit product data:

1. Cameras
2. Power Supply (POE Injector)
3. Camera Station Recorder

B. Submit the following information:

1. Maintenance agreements
2. Qualifications
3. Proposed installation schedule
4. Wiring diagram with wiring requirements indicated

1.05 GENERAL

A. All products provided by Contractor shall be new and unused, and shall be of manufacturer's current and standard production.

B. Where two or more equipment items of the same kind are provided, all shall be identical and provided by the same manufacturer.

C. Drawings and specifications indicate major system components and may not show every component, connector, module or accessory that may be required to support the operation specified. Contractor shall provide all components needed for complete and satisfactory operation.

1.06 SYSTEM FEATURES

A. System shall be hardwired, with all wiring run concealed, free-air.

B. The system shall collect HD image from cameras on the system and provide them at desktop PC’s via the facility local area network via a software application. The system shall also store the camera output for playback and analysis.

C. The system shall be capable of activation by motion or audio detection if so selected.

1.07 PRODUCT AVAILABILITY

A. Contractor, prior to submitting a proposal, shall determine product availability and delivery time, and shall include such considerations into his proposed Hard Schedule.

1.08 QUALIFICATIONS

A. Contractor: Company specializing in installing products as specified in this section with a minimum of five (5) years documented experience. Any system proposed shall be in operation in a non-test environment. Provide a list of installations of similar size with bid documents.

B. Contractor shall prove their ability to install and maintain similar systems.

C. Contractor shall show evidence that they can provide the necessary maintenance support for the proposed system. This should include:

1. Identification of adequate staffing to meet stated response time to minimize system down time.
2. List recent customer references that have had similar systems installed in a similar environment.
3. Specify which office(s) shall be responsible for maintaining the system.
4. Identify the number of technicians in the supporting office who have been factory trained on installation and maintenance.

D. The contractor/installer of the selected system is solely responsible for all equipment, software, etc., and third-party contractors used in any and all capacities, as they relate to meeting all codes, OSHA requirements, compatibility, etc. The installer shall assume all responsibilities in meeting these requirements, laws, compatibility needs, etc.

E. Certain products specified may only be available through factory-authorized dealers and distributors. Contractor shall verify his ability to procure the products specified prior to submitting a proposal.

PART 2 - PRODUCTS

2.01 CABLING

A. Provide CAT6 cabling meeting requirements of Section 27 10 00. Cabling to be PLENUM and may be installed free-air.

2.02 POWER SUPPLIES

A. Provide POE injector complying with IEEE 802.3af. Size for (32) cameras.

2.03 INDOOR CAMERAS

A. Provide AXIS P3367-V indoor network camera, 5MP, multi-view with audio and I/O ports.

1. Image Sensor: progressive scan RGB, CMOS 1/3.2”.
2. Lens: 3-9mm, 84 degree to 30 degree horizontal angle of view, F1.2.
3. Minimum Illumination: Color 0.2 lux, B/W 0.04 lux, F1.2.
4. Shutter Time: 1/28000 seconds to 2 seconds.
5. Camera Angle Adjustment: Pan 360˚, Tilt 160˚, Rotation 340˚.
6. Video Compression: H.264 Baseline and Main Profile (MPEG-4 Part 10/AVC) Motion JPEG.
7. Resolution: 2592 x 1944 (5MP) to 160 x 90.
8. Frame Rate H.264/Motion JPEG: 5MP Capture mode: 12fps in all resolutions.
9. Video Streaming: Multiple, individually configurable streams in H.264 and Motion JPEG

10. Controllable frame rate and bandwith, VBR/CBR H.264
Multi-view Streaming: AXIS P3367-V: When streaming 4 view areas and 1 overview in VGA resolution, the frame rate is 12 fps per stream (5 MP capture mode) or 20 fps per stream (3 MP capture mode).
12. Pan/Tilt/Zoom: Digital PTZ, preset positions, guard tour.
13. Image Settings: Compression, color, brightness, sharpness, contrast, white balance, exposure control, exposure zones, backlight compensation, WDR – dynamic contrast, fine tuning of low light behavior. Rotation: 0˚, 90˚, 180˚, 270˚, including Corridor Format. AXIS P3384-V: WDR – dynamic capture: Up to 120dB (0.5-5000,000 lux) depending on scene.
14. Audio Streaming: Two-way.
15. Audio Compression: AAC LC 8/16 kHz, G.711 PCM 8 kHz, G.726 ADPCM 8 kHz Configurable bit rate.
16. Audio input/output: External microphone input or line input, line output, built-in microphone (can be disabled).
17. Security: Password protection, IP address filtering, digest authentication, user access log, IEEE 802.1 network access control, HTTPS encryption.
18. Supported Protocols: IPv4/v6, HTTP, HTTPS, SSL/TLS, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP™, SNMPv1/v2c/v3(MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS.
19. Application Programming Interface: Open API for software integration, including the ONVIF specification available at www.onvif.org, as well as VAPIX® and AXIS Camera Application Platform from Axis Communications, specifications available at www.axis.com. Support for AXIS Video Hosting System (AVHS) with One-Click Camera connection.
20. Intelligent Video: Video motion detection, active tampering alarm. Support for AXIS Camera Application Platform enabling installation of additional applications. All models except AXIS P3353/P3354: Audio detection.
21. Event Triggers: Intelligent video, edge storage events.
22. Event Actions: File upload: FTP, HTTP, network share and email, Notification: email, HTTP and TCP, Video recording to edge storage, Pre and post-alarm video buffering, PTZ preset, guard tour, External output activation, audio recording to edge storage, play audio clip.
23. Data Streaming: Event data.
24. Built-in Installation Aids: Remote zoom, remote focus, pixel counter.
25. Provide wall, pendant or drop ceiling mounting accessories for each camera appropriate for location.

2.04 OUTDOOR CAMERAS

A. Provide AXIS P5415-E outdoor cameras

1. Image sensor 1/2.9” progressive scan RGB CMOS
2. Lens f=4.7–84.6 mm, F1.6–2.8, autofocus Horizontal angle of view: 59°–4°
3. Day and night Automatically removable infrared-cut filter
4. Minimum illumination: Color: 0.5 lux at 30 IRE F1.6; B/W: 0.04 lux at 30 IRE F1.6
5. Shutter time 2 s to 1/28000 s
6. Pan/Tilt/Zoom Pan: Pan: ± 135°, 0.2°–400°/s, Tilt: 0°– 90°,

   Zoom: 18x optical zoom and 12x digital zoom, total 216x zoom

   100 preset positions, Limited guard tour, Control queue, Focus window, On-screen directional indicator
7. Video compression H.264 Main and Baseline Profiles (MPEG-4 Part 10/AVC) Motion JPEG
8. Resolutions AXIS P5415-E: 1920x1080 (HDTV 1080p) to 240x135
9. Frame rate H.264: Up to 25/30 fps (50/60 Hz) in all resolutions

   Motion JPEG: Up to 25/30 fps (50/60 Hz) in all resolutions

10. Video streaming Multiple, individually configurable streams in H.264 and Motion JPEG
    Controllable frame rate and bandwidth
    VBR/CBR H.264
11. Image settings Compression, Color, Brightness, Sharpness, Contrast, White balance, Exposure control, Exposure zones, Backlight compensation, Fine tuning of behavior at low light, Text and image overlay, 20 individual 3D privacy masks
12. Audio streaming Two-way
13. Audio compression AAC-LC 8/16 kHz, G.711 PCM 8 kHz, G.726 ADPCM 8 kHz Configurable bit rate
14. Audio input/output External microphone or line input, and line output
15. Security Password protection, IP address filtering, HTTPSb encryption, IEEE 802.1Xb network access control, Digest authentication, User access log
16. Supported protocols IPv4/v6, HTTP, HTTPSb, SSL/TLSb, QoS Layer 3 DiffServ, FTP, CIFS/SMB, SMTP, Bonjour, UPnP, SNMPv1/v2c/v3 (MIB-II), DNS, DynDNS, NTP, RTSP, RTP, TCP, UDP, IGMP, RTCP, ICMP, DHCP, ARP, SOCKS
17. Application Programming Interface
    Open API for software integration, including VAPIX® and AXIS Camera Application Platform; specifications at *www.axis.com*
    AXIS Video Hosting System (AVHS) with One-Click Camera Connection ONVIF Profile S, specifications at *www.onvif.org*
18. Intelligent video Video motion detection, Audio detection, Advanced Gatekeeper, AXIS Camera Application Platform enabling installation of additional applications
19. Event triggers Video motion detection, Audio detection, External input, PTZ preset, Temperature, Memory card full
20. Event actions File upload: FTP, HTTP, network share and email
    Notification: email, HTTP and TCP
    External output, PTZ preset, Guard tour, Play audio clip, Video and audio recording to edge storage, Day/night mode, Pre- and post-alarm video buffering
21. Data streaming Event data
22. Built-in installation aids Pixel counter
23. Casing IP66- and NEMA 4X-rated, IK07 impact-resistance, metal casing (aluminum), clear dome (PC), sunshield (ASA)
24. Memory 256 MB RAM, 128 MB Flash
25. Power Power over Ethernet Plus (PoE+) IEEE 802.3at Type 2 Class 4, max. 30 W
    24 V DC max. 16 W
26. Connectors RJ45 for 10BASE-T/100BASE-TX PoE
    Terminal blocks for DC input, 4 configurable alarm inputs/outputs, mic in/line in, line out
27. Edge storage SD/SDHC/SDXC slot supporting memory card up to 64 GB (card not included)
    Support for recording to dedicated network-attached storage (NAS)
28. Operating conditions -20 °C to 50 °C (-4 °F to 122 °F), Humidity 10–100% RH (condensing)
29. Approvals EN 50121-4, IEC 62236-4: 2008, EN 50581, EN 55022 Class B, EN 61000-6-1, EN 61000-6-2, EN 55024, FCC Part 15 Subpart B Class B, ICES-003 Class B, VCCI Class B, C-tick AS/NZS CISPR 22 Class B, KCC KN22 Class B, KN24, IEC/EN/UL 60950-1, IEC/EN/UL 60950-22, IEC 60068-2-1, IEC 60068-2-2, IEC 60068-2-6, IEC 60068-2-14, IEC 60068-2-27, IEC 60068-2-30, IEC 60068-2-78, IEC 60529 IP66, NEMA 250 Type 4X, IEC 62262 Class IK07, ISO 4892-2
30. Weight 3.5 kg (7.7 lb.)
31. Included accessories Installation Guide, AVHS Authentication key, Installation and Management Software CD, Windows decoder 1-user license

2.05 CAMERA STATION RECORDER

A. Provide an AXIS Camera Station S1032 Recorder

1. Number of channels 32 Channels included, can be upgraded up to 48 channels (sold separately)
2. Processor Intel® Xeon® E5-2407 v2, 2.40GHz, 10M Cache, 6.4GT/s QPI, No Turbo, 4C, 80W, DDR3-1333MHz
3. Memory 2 x 4 GB (4096 MB) Memory type: RDIMM, 1333 MHz, Low Volt, Single Rank, x8 Data Width
4. Storage 9 TB, 7200rpm HDD with 64 MB cache and SATA 6Gb/s interface, RAID 5, Hot Plug
5. Graphic card Matrox 200 eR
6. Optical Disk Drive OEM DVD RW
7. Operating System Microsoft Windows Professional Embedded 7
8. Network Card On-Board Broadcom 5720 Dual Port Gigabit NIC
9. Compatible Products Axis network cameras and encoders including HD, standard resolution, high resolution, Pan Tilt Zoom and thermal cameras with firmware 4.30 or later
10. Power Dual, Hot-plug, Redundant Power Supply, 350 W
11. Connectors 4 x USB 2.0, 2 x VGA, Serial port (DB9), 2 x Ethernet (RJ45), 2 x Power inlet
12. Operating conditions 10 °C to 35 °C (50 °F to 95 °F)
13. Dimensions 43 x 483 x 607 mm (1.69 x 19.0 x 23.9 in)
14. Weight 13.6 kg (30.0 lb)
15. Approvals EN/IEC/UL 60950-1, CSA C22.2 No. 60950-1, EN 62311, EN 55022, CISPR 22, EN 55024, CISPR 24, EN/IEC 61000-3-2, EN/IEC 61000-3-3, EN 50581, IEC60664-1
16. Hardware warranty 3-years included
17. Included accessories Installation guide, Keyboard (International/US), Computer mouse, Power cable
18. Software Axis Camera Station 4.x
19. Languages All major languages
20. Audio One-way audio streaming, AAC, G.711, G.726 compression
21. Video compression H.264 (MPEG-4 Part 10/AVC), Motion JPEG
22. Resolution Supports all camera resolutions up to 5 megapixels
23. Video streams Optimized for H.264 streams with 1080p at 15 fps
24. Recording rate Optimized for 24 MByte per second
25. Map function Yes
26. PTZ Control Yes
27. Smart Search for recordings Yes
28. Playback Up to 64x or frame by frame, Up to 25 cameras synchronized playback
29. Export Manual and scheduled export, Single images in JPEG format, Video in ASF format, Digital signature on exported recordings, Standalone player
30. Event triggers Events triggered by video motion detection, Active Tampering Alarm, AXIS Cross Line Detection, External I/O, Action button, System triggers and device event triggers
31. Scheduled recording Schedule per camera for continuous recording or customization of weekday and weekend recordings
32. Alarm manager Yes
33. Microsoft Active Directory support Yes, multiple user access levels with password protection using local or Windows domain users (Active directory)

2.06 WARRANTY

A. Contractor warrants that all work furnished (material and labor) under this contract will be of good quality, free from faults and defects, and in conformance with the Project Drawings and Specifications.

B. Contractor shall provide a parts and labor guarantee on all work. Unless otherwise specified herein, Contractor's guarantee shall be for a period of two years from date of acceptance, except where any specific guarantees from a supplier or equipment manufacturer extends for a longer time.

C. Contractor's guarantee shall cover all costs associated with troubleshooting, repair and replacement of defective work, including costs of labor, transportation, lodging, materials and equipment.

D. Guarantee shall not cover any damage to material or equipment caused by accident, misuse, unauthorized modification or repair by Client, or acts of God.

E. Contractor shall promptly respond to Client's requests for service during the guarantee period. Contractor shall provide repair service as soon as reasonably possible upon request from Client, but in no case shall service response exceed 8 hours from time of request.

PART 3 - EXECUTION

3.01 SYSTEM STARTUP

A. Power shall only be applied to the system after re-checking for proper grounding of the system and measuring all loops for lack of shorts, grounds, and open circuits.

B. System supplier shall be responsible for coordinating all programming of the system with the Owner.

3.02 OWNER'S INSTRUCTIONS

A. Contractor shall closely schedule and coordinate his activities with the Owner’s Project Representative.

B. Coordinate with the owner all operating, and monitoring functions which shall be included within the programming.

3.03 COMMISSIONING

A. After all work is completed and prior to requesting acceptance test, Contractor shall conduct a final inspection and pre-test all equipment and system features. Contractor shall correct any deficiencies discovered as the result of the inspection and pre-test of all contractor installed equipment and materials.

B. Contractor shall submit a request for the acceptance test in writing to the Owner’s Project Representative no less than fourteen days prior to the requested test date. The request for acceptance test shall be accompanied by a certification from Contractor that all work is complete and has been pre-tested, and that all corrections have been made.

C. During acceptance test, Contractor shall demonstrate all equipment and system features to the Owner’s Project Representative. Contractor shall remove covers, open wiring connections, operate equipment, and perform other reasonable work as requested by the Owner’s Project Representative.

D. Any portions of the work found to be deficient or not in compliance with the Project Drawing and Specifications will be rejected. The Project Representative will prepare a list of any such deficiencies observed during the acceptance test. Contractor shall promptly correct all deficiencies. Upon correction of deficiencies, Contractor shall submit a request in writing to the Project Representative for another acceptance test.

3.04 PREPARATION

A. Contractor shall order all required parts and equipment upon notification of award of the work.

B. Contractor shall verify power where required.

3.05 INSTALLATION

A. Each camera shall be securely mounted.

B. Contractor shall carefully follow the instructions in the manufacturers' Installation Manual to insure all steps have been taken to provide a reliable, easy to operate system.

C. Perform all work as indicated in the drawings and specifications.

D. Contractor shall also execute adequate testing of the system to insure proper operation.

3.06 WORKMANSHIP

A. Perform work with persons experienced and qualified to produce workmanship specified.

B. Comply with highest industry standards, except when specified requirements indicate more rigid standards or more precise workmanship.

C. Maintain quality control over suppliers and Subcontractors.

D. Quality of workmanship is considered important. The Project Representative will have the authority to reject work that does not conform to the Drawings and Specifications.

3.07 EQUIPMENT PRE-TEST

A. All equipment shall be bench tested prior to delivery to job site and prior to installation. Bench test per manufacturer’s installation instructions.

3.08 GROUNDING

A. Provide grounding of equipment as required by equipment manufacturer.

3.09 SPARE PARTS

A. Not included in the scope of this contract.

END OF SECTION 28 23 00

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SECTION 28 31 00

FIRE ALARM SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide an intelligent, addressable, noncoded, continuous sounding, UL listed, electrically supervised system, complete, tested, and ready for operation.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies
   1. National Fire Protection Association (NFPA):
      a. NFPA No. 70 - National Electric Code (NEC).
      b. NFPA No. 101 - Life Safety Code.
   2. Wisconsin Administrative Code.
   3. Underwriters Laboratories, Inc.
   4. Local codes and ordinances.
   5. ADA

B. Reference Standards:
   1. National Fire Protection Association (NFPA):
      a. NFPA No. 72
   2. National Electrical Manufacturer's Association (NEMA).

C. System equipment to be of one manufacturer and supported by factory trained, established service organization of equipment manufacturer who shall stock parts for equipment supplied.

D. Equipment must be manufactured by firm actively manufacturing fire alarm systems for minimum of 10 years.

E. Manufacturer's Services:
   1. Manufacturer's representative factory trained service engineer for equipment specified herein shall be present at job site to supervise final adjustment of system after installation complete, equipment startup, and training of OWNER'S personnel for system operation.
   2. Manufacturer shall direct services to system and equipment operation, maintenance, troubleshooting, and equipment and system related areas.

1.03 SUBMITTALS

A. Shop Drawings to include:
   1. Data sheets and equipment description.
   2. Bill of materials listing components.
   3. Component wiring diagrams.
   4. System wiring and interconnection diagrams showing all devices – not a typical diagram.

B. Operation and Maintenance (O & M) Data: Submit in accordance with Division 1. Provide electronic record drawings in Autocad Version 2004 or newer on CD.

C. Field quality control test results.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Receive equipment at jobsite, verify applicable components and quantity delivered per invoice.

B. Handle equipment to prevent internal components damage, breakage, denting, and scoring enclosure and finish.

C. Do not install damaged equipment.

D. Store equipment in clean, dry space and protect from dirt, fumes, water, construction debris, and physical damage.

E. After installation, protect from damage by Work of other trades.

PART 2 - PRODUCTS

2.01 GENERAL

A. Use of manufacturer's name and model or catalog number is for purpose of establishing standard of quality, general configuration, and operating characteristics desired only.

2.02 ACCEPTABLE MANUFACTURERS

A. Notifier Company

B. Or approved equivalent by:

1. Simplex Time Recorder Company
2. Siemens Cerberus Pyrotronics
3. EST Edwards

2.03 SYSTEM OPERATION

A. Alarm devices to sound continuously upon actuation of alarm initiating devices and indicate on LCD screen on face of control panel and on remote LCD annunciator.

B. Actuation of alarm initiating devices shall automatically cause following operations.

1. Sound audio and audio/visual devices automatically (Synchronized, temporal building wide).
2. Activate all strobes automatically (Synchronized building wide).
3. Indicate on control panel device initiating alarm and/or trouble condition on 80 character display.
4. Indicate reporting device on remote annunciator.
5. Transmit signal to central station (via leased telephone lines).
6. Stop air supply and return fans.
7. Disengage magnetic door holder units.
8. Close smoke dampers.
9. Display alarm, supervisory or trouble condition on 80 character display.
10. Perform programmed interlocks.

C. Provide Dedicated 120 volt, 60 hertz, input power.

D. Activation of elevator lobby, machine room or top of hoistway smoke detectors shall initiate Phase One recall.

E. Activation of elevator shaft, pit or machine room heat detectors shall initiate main power shut down to the elevator.

2.04 FIRE ALARM CONTROL PANEL

A. Fire alarm control panel shall be Notifier model NFW2-100, with solid state modular design capable of future expansion.

B. Includes features:

1. 198 intelligent device capability (total of addressable detectors and modules)
2. Up to (8) ANN_BUS annunciators
3. UL 864 listed, 9th edition.
4. Auto-program mode
5. Four on-board NAC circuits
6. Selectable strobe synchronization for System Sensor, Wheelock or Gentex devices
7. Remote acknowledge, silence, reset and drill via addressable monitor modules
8. Integral backlit 80 character LCD display
9. Realtime clock/calendar with auto daylight savings time
10. 1000 event history file
11. Detector sensitivity test capability (NFPA 72 compliant)
12. Maintenance alert
13. One person audible or silent walk-test with walk-test log and print out
14. Point trouble identification
15. Waterflow (non-silenceable) selection by point
16. System alarm verification selection per alarm point
17. On-board DACT
18. Positive Alarm Sequence and Pre-signal per point
19. 2.5A total power available for NAC's
20. Two programmable relays and one fixed trouble output relay
21. Sixteen key alpha-numeric keypad
22. Battery standby, 12 volt, Gel-Cell type (two required) with sufficient power capacity to power the fire alarm for not less than twenty-four hours plus five minutes of alarm upon a normal AC power failure.

2.05 SMOKE DETECTION

A. Smoke detectors shall be Photoelectric type NP-100.

B. Duct smoke detector shall be Photoelectric type ND-100.

1. Sampling tube as required for duct width dimensions.

2.06 ISOLATION MODULES

A. Isolation module shall be model N100-ISO.

2.07 HEAT DETECTION

A. Heat detector shall be model NH-100.

B. Heat detector for unconditioned spaces (attic) shall be model 5602 and monitored by NMM-100 monitor module:

2.08 MODULES:

A. Monitor module shall be model NMM-100.

B. Control module shall be NC-100.

2.09 PULL STATIONS

A. Pull station shall be a model NOT-NBG12LX.

2.10 SIGNALS

A. Horn/strobe unit shall be model GEC3-24WR (Wall) / GCC24-CW (Ceiling):

1. 100dB at 10 feet sound pressure. (anechoic)
2. Temporal audio output (synchronized).
3. 15cd, 30cd, 75cd, or 110cd strobe as required (synchronized) (See plans for candela requirements).
4. Mounts on 4” square or 4” square with 1- or 2-gang ring.

B. Strobe unit shall be model GES-24-WR (Wall) / GCS24-CW (Ceiling):

1. 15cd, 30cd, 75cd, or 110cd strobe as required (synchronized) (See plans for candela requirements).
2. Mounts on 4” square box or 4” square with 1- or 2-gang ring.

C. Horn units shall be GEH-24R:

1. 100dB at 10 feet sound pressure.
2. Temporal audio output (synchronized).
3. Mounts on 4” square with 1- or 2-gang ring

D. Mini-Horn shall be GX93-R (red):

1. Temporal audio output (synchronized)
2. Mounts on 4” square with 1- or 2-gang ring.
3. Provide one per bedroom to assure 70 dB at pillow.

2.11 REMOTE ANNUNCIATOR

A. Remote annunciator shall be N-ANN-80:

1. 80 character display.
2. Function switches which can be displayed.
3. Back box furnished with annunciator and locking flush trim.

2.12 NOTIFICATION APPLIANCE CIRCUIT PANEL

A. Notification Appliance Circuit Panel (NAC) shall be ASPS-2406 or FCPS24-S8:

1. Four (4) signal circuits (synchronized temporal & synchronized strobe).
2. 6.0 amp filtered 24V DC power supply.
3. Supervised power supply.
4. Battery stand-by, 12V, 12 AH Gel-Cell Batteries (2 required per panel).

2.13 CENTRAL STATION ALARM TIE

A. Provide as part of main fire alarm control panel.

1. Necessary apparatus to transmit signal intelligence from local system to central station over voice grade telephone line.
2. Key operated cut-off switch.
3. Trouble lamp and silencing switch.

2.14 FLOW, PRESSURE AND TAMPER SWITCHES

A. Wire and install in accordance with requirements of other specification sections and wire as specified in this section. Provide necessary monitor modules and circuits. Wire and install outdoor sprinkler alarm bell. Flow, pressure, tamper switches and sprinkler alarm bell furnished by others.

2.15 SLAVE FAN RELAY

A. Slave fan relay shall be Notifier model C-215D, SPDT contacts, 5 amperes, 120 vac.

1. Relay Coil: 24 vdc.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which fire alarm system to be installed and notify ENGINEER in writing of conditions detrimental to proper and timely completion of Work.

3.02 INSTALLATION

A. Installation of the Fire Alarm/Life Safety System shall be in strict compliance with manufacturer's recommendations. Consult the manufacturer's Control Panel and Peripheral Equipment installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the Riser/Connection diagram for all specific System Installation Termination Wiring Data. Provide (3) copies to CM prior to beginning work.

B. Power Requirements:

1. The Fire Alarm Control Panel (FACP) and/or Notification Appliance Circuit (NAC) panels shall be connected to a separate 20 ampere, 120 volt dedicated branch circuit labeled as FIRE ALARM.
2. The Control Panel Cabinet shall be grounded securely using a copper grounding conductor.
3. Conduit shall enter into the Fire Alarm Control panel backbox only at those areas of the back box which have factory conduit knockouts.
4. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring: an audible and visual trouble signal will be activated until system and its associated field wiring are restored to normal condition.

C. Cables must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.

D. SLC loops shall be loaded to no more than 75% of their capacity.

E. Install wiring in accordance with Section 26 05 00 and shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer. See Article 3.06 FREE AIR CABLING for further requirements.

1. SLC loop shall be 2 #16 shielded FPLR or FPLP cable as required.
2. Signal circuit wiring shall be 2 conductor #14 or 2 conductor #12 FPLR or FPLP cable as required. 2#14 or 2#12 THHN is acceptable if signal circuits are enclosed in listed raceway. Synchronization modules shall be utilized to provide audio and visual synchronization over 2 conductors. Consult loading chart for proper wire gauge and wire length to insure against excessive DC voltage drop. A minimum of 20.5V DC must be available at the last signal of a NAC under full alarm condition.
3. Provide 2 #14 from control panel or door holder power supply to door holders.

F. Provide all fire alarm system wiring drops to devices within raceways and junction boxes. Where existing conditions prohibit fishing existing walls, so as to avoid excessive cutting and restoration metallic wiremold finished to match existing wall surface shall be permitted where allowed by OWNER/ENGINEER, routing subject to OWNER/ENGINEER approval. Install conduit in accordance with Section 26 05 00 and as shown on Drawings.

G. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.

H. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas if approved by Owner/Engineer before installation. All system junction boxes shall be as manufactured by system supplier or painted red and stenciled with fire alarm system designation.

I. All fire detection and alarm system devices shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas if approved by Owner/Engineer before installation.

J. All conductor identification shall be labeled in accordance with 16001 at all accessible locations including at control panel, junction boxes and at devices for future tracing and maintenance.

K. Provide concealed 3/4" conduit and wire to telephone terminal board from main fire alarm control panel.

L. Coordinate connections with supplier of central station network system.

M. Provide concealed ¾” conduit and wire to security panel for monitoring of trouble, supervisory and system alarm.

N. Provide elevator recall and elevator shunt trip using addressable control modules. Utilizing detector auxiliary contacts is not acceptable. Provide Elevator shunt trip power supervision for integrity per NFPA 72.

3.03 ADJUSTMENT AND CLEANING

A. Clean system equipment and enclosure of dirt and debris.

3.04 FIELD QUALITY CONTROL

A. Provide the service of a NICET certified, Level II minimum, factory-trained technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and test for the system.

B. System shall test free from grounds, opens, and short circuits.

C. Upon completion of installation of fire alarm equipment, CONTRACTOR shall provide ENGINEER with signed written statement substantially in form as follows.

D. "The undersigned having been engaged as the CONTRACTOR on the Dane County Day Resource Center confirms the fire alarm equipment was installed in accordance with wiring diagrams, instructions, and directions provided to us by the manufacturer."

3.05 WARRANTY

A. All work performed and all material and equipment furnished under this contract shall be from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

3.06 FREE AIR WIRING

A. All wiring shall be run “free-air”, in conduit or in surface raceway. "Free-air" wiring is allowed where it can be completely concealed. If wiring cannot be concealed, it shall be installed in wiremold in finished areas and in conduit in unfinished areas.

B. Where installed “free-air”, comply with the following:

1. Cable shall run at right angles and be kept clear of other trades work.
2. Cables shall be supported according to code utilizing bridle rings anchored to ceiling concrete, piping supports or structural steel beams. Rings shall be designed to maintain cables bend to larger than the minimum bend radius (typically 4 x cable diameter).
3. Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If cable "sag" at mid-span exceeds 12-inches, another support shall be used.
4. Cable shall never be laid directly on the ceiling grid.
5. Cables shall not be attached to or supported by, existing cabling, plumbing or steam piping, ductwork, ceiling supports or electrical or communications conduit.
6. A coil of 2 feet in each cable shall be placed in the ceiling at each “free-air” wired fire alarm device. These "service loops" shall be secured at the last cable support before the cable reaches the device and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.
7. Devices wired with conduit shall be provided with an 8-inch wire tail at each device box and 36-inch wire tails at the FACP and FAAP.
8. To reduce or eliminate EMI, the following minimum separation distances from ≤480V Power lines shall be adhered to:
    a. Twelve (12) inches from power lines of <5-kVa.
    b. Eighteen (18) inches from high voltage lighting (including fluorescent).
    c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
    d. Thirty-nine (39) inches from transformers and motors.
9. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellem grips shall be used to spread the strain over a longer length of cable.
10. Manufacturers minimum bend radius specifications shall be observed in all instances. Care should be taken in the use of cable ties to secure and anchor the station cabling. Ties should not be over tightened as to compress the cable jacket. No sharp burrs should remain where excess length of the cable tie has been cut.
11. All vertical cable extensions to fire alarm devices located below the finished ceiling shall be in conduit.

C. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment is to include, but not limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices, which may move or wear in a manner to pose a hazard to the cable, shall not be used.

D. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to insure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a "break-away" or other approved method.

3.07 DEPARTMENT OF COMMERCE SUBMITTALS

A. This Contractor is responsible for making required Department of Commerce submittals.

B. Pay Department of Commerce fees for reviewing submittal.

C. Make submittal after engineering review has been obtained for shop drawings.

D. Incorporate any Department of Commerce comments into shop drawings and as-builts.

E. This Contractor is responsible to pay all local fire department fees.

END OF SECTION

SECTION 32 31 16

WELDED WIRE FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section as though repeated herein.

1.2 SUMMARY

A. Section Includes:
1. Metallic-coated-steel, welded-wire fences.
2. Horizontal-slide gates.
3. Gate operators, including controls.

B. Related Requirements:
1. Section 03 30 00 "Cast-in-Place Concrete" for concrete bases for gate operators, drives, and controls.
2. Electrical for rough in.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For gates. Include plans, elevations, sections, details, and attachments to other work.

C. Retain subparagraph below if equipment includes wiring.

D. Include diagrams for power, signal, and control wiring.

E. Submit within 35 days of contract award date and prior to delivery of any fencing products.

F. Samples: Provide Samples 12 inches square for wire mesh.

1.5 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For gate operators to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.8 CERTIFICATIONS

A. American Welding Society AWS D1.2 Structural Welding Code.

B. All welds on the gate frame shall conform to Welding Procedure Specification and Procedure

C. Qualification Record to insure conformance to the AWS D1.2 Structural Welding Code. All individual welders shall be certified to AWS D1.2 welding code.

D. Gate manufacturer shall provide independent certification as to the use of a documented Welding Procedure Specification and Procedure Qualification Record to insure conformance to the AWS D1.2 welding code. Upon request, Individual Certificates of Welder Qualification documenting successful completion of the requirements of the AWS D1.2 code shall also be provided.

PART 2- PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 METALLIC-COATED-STEEL, WELDED-WIRE FENCES

A. Metallic-Coated-Steel, Welded-Wire Fences:
1. Master Halco Design Master; Deacero, 'Classic'.
2. Or approved equal.

B. Fence Fabric: Metallic-coated-steel wire.
1. Spacing of Vertical Wires: 2 ¼".
2. Vertical Wire Size: 6 gauge.
3. Spacing of Horizontal Wires: 6".
4. Horizontal Wire Size: 6 gauge.

C. Posts:
1. Line Posts: Square tubes 2-1/4 by 2-1/4 inches 16 gauge nominal-thickness, metallic-coated steel sheet.
2. Guide Posts for Class 1 Horizontal-Slide Gates: 4" O.D. steel tubing with 3/16-inch min. wall thickness, hot-dip galvanized; installed adjacent to gate post to permit gate to slide in space between.
3. Post Caps: Ultraviolet-protected plastic, sized to post dimensions, friction fit.
4. Fasteners: Manufacturer's standard tamperproof, corrosion-resistant, color-coated fasteners matching fence components with resilient polymer washers or clips.
5. First option in "Finish" Paragraph below allows several different coating systems for maximum competition. See Evaluations.
6. Finish: Organic coating complying with requirements in ASTM F 2408 Powder coating.

2.3 HORIZONTAL-SLIDE GATES

A. Manufacturer: SurTrac Aluminum Cantilever Slide Gate by Master Halco, Inc., Irving, TX , Phone (888) 643-3623 or Approved Equal.

B. Gate Configuration: As indicated on Working Drawings.

C. Gate Frame Height: 92 inches.

D. Single Gate Opening Width: approximately 18', field verify and coordinate with adjacent fence materials.

E. Infill: Comply with requirements for adjacent fence. Fabric shall be attached between each internal upright with hook bolts spaced no more than 15 inches (380 mm) on center as recommended by the manufacturer.

F. Trussing: Each bay shall be cross-trussed by means of 1/4" cable with adjustable turnbuckles. Trusses will maintain the structural integrity of the gate while allowing for expansion and contraction of aluminum in varying weather conditions.

G. Top track/rail: Enclosed combination one-piece track and rail, aluminum extrusion with weight of:
1. -Openings up to 30'; 4.62 lbs./ft. Top track/rail to be a single formed profile with integrated center stabilizing web without welding. All wall thicknesses to be 0.25".
2. Coordinate installation of top track/rail with adjacent fencing material.

H. Truck assembly: Swivel type, zinc die coated steel, with 6 sealed lubricant ball bearing rollers, 2 inches (50 mm) in diameter by 9/16" (14 mm) in width, and 2 side rolling wheels to ensure truck alignment in track. Mount trucks on post brackets using 7/8" (22 mm) diameter ball bolts with 5/8" shank. Truck assembly shall withstand same reaction load as track 2,000 # (907.2 kg.).

I. Gate hangers, brackets, guide assemblies, receivers, and latches: Malleable iron or steel, galvanized after fabrication.

J. Bottom guide wheel assemblies: Each assembly shall consist of two, 3" (75 mm) diameter wheels, straddling bottom horizontal gate rail, allowing adjustment to maintain gate frame plumb and in proper alignment. Attach one assembly to each support post.

K. End Plug: After gate has been installed, both ends of the combination track/frame member shall be closed off with a shock absorbing plastic block that shall also serve as a stop bracket. Products from qualified manufacturers having a minimum of 5 years experience manufacturing internal roller cantilever slide gate will be acceptable by the architect as equal, if approved in writing, ten days prior to bidding, and if they meet all of the following specifications for design, size, gauge of metal parts and fabrication.

L. Obtain gates, including accessories, fittings, and fastenings from a single source.

M. Gate frames: Fabricate cantilever slide gates in accordance with ASTM F-1184, Type II, Class 2, using aluminum members conforming to ASTM B 221, alloy and temper 6061-T6. Vertical members shall be 2 inch (50mm) square aluminum, weighing 1.13 lb./ft., 2 inch x 4 inch aluminum bottom frame member weighing 1.73 lb./ft., and a one-piece aluminum track/frame member weighing a minimum of 4.621 lb./ft. for Single Track and 7.95 lb./ft. for Dual Track.
1. The 2 inch square frame member of said track/frame shall have a wall thickness of not less than .250
2. inches on all four sides. Aluminum alloy used shall be 6061-T6 only. Internal uprights shall be 2-inch square aluminum spaced equally at no more than 6 feet on center subdividing the gate frame into panels.
3. Weld all members together forming a rigid one-piece frame integral with top track. Provide 2 truck assemblies for each gate leaf, except as indicated for gates larger than 30'.

2.4 GATE OPERATORS

A. Gate Operators Manufacturer: Master Halco, Access Control, Orange, CA Phone (800) 229-5615 Fax (714) 385-0104 or approved equal.

B. Obtain operators and gates, including accessories, fittings, and fastenings, from a single source.

C. For gates up to 20'- MODEL: MHAC 076047, H.P. ½, VOLTS- 110VAC, PHASE- Single

D. Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures; coordinate electrical requirements with building electrical system.

E. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.

F. Provide operator with UL approval.

G. Provide electronic components with built-in troubleshooting diagnostic feature.

H. Provide unit designed and wired for both right-hand/left-hand opening, permitting universal installation.

I. Comply with NFPA 70.

J. UL Standard: Manufacturer and label gate operators to comply with UL 325.
   1. Emergency Access Requirements: Comply with requirements of authorities having jurisdiction for automatic gate operators on gates that must provide emergency access.
   2. Motorized gate to have an additional knox box holding an operating signal button when power is on; when power is off a chain opening device.

K. Interface with radio controlled devices and loop detectors.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
   1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi, 3-inch slump, and 1-inch maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C 387/C 387M mixed with potable water according to manufacturer's written instructions.

C. Concrete Equipment Bases/Pads: dimensioned and reinforced according to gate operator component manufacturer's written instructions.

D. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M and specifically recommended by manufacturer for exterior applications.

2.6 GROUNDING MATERIALS

A. Grounding Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

B. Material above Finished Grade: Copper.

C. Material on or below Finished Grade: Copper.

D. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

E. Grounding Connectors and Grounding Rods: Comply with UL 467.

F. Connectors for Below-Grade Use: Exothermic-welded type.

G. Grounding Rods: Copper-clad steel.

H. Size: 5/8 by 96 inches.

2.7 METALLIC-COATED-STEEL FINISHES

A. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a zinc-phosphate conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

B. Powder Coating: Immediately after cleaning and pretreating, apply two-coat finish consisting of zinc-rich epoxy prime coat and TGIC polyester topcoat, with a minimum dry film thickness of 2 mils for topcoat. Comply with coating manufacturer's written instructions to achieve a minimum total dry film thickness of 4 mils.

C. Color and Gloss: Selected by architect from manufacturer's standard designations.

D. High-Performance Coating: Apply epoxy primer, polyurethane intermediate coat, and polyurethane topcoat to prepared surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

E. Match approved Samples for color, texture, and coverage. Remove and refinish, or recoat work that does not comply with specified requirements.

PART 3- EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Install fences by setting posts as indicated and fastening rails and infill panels to posts.

C. Revise "Post Excavation" and "Post Setting" paragraphs below as needed if conditions include unstable or rocky soils.

D. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 48”.

E. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil. Post footing shall be 48" deep or as approved by manufacturer.

F. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.

G. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

H. Exposed Concrete: Extend 2 inches above grade. Finish and slope top surface to drain water away from post.

I. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

J. Extend posts at least 5 inches into sleeve.

K. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

L. Space posts uniformly at 8 feet.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

B. Post footing shall be 48" deep or as approved by manufacturer.

C. Install gates plumb and level, 1/4 inch in 10 feet.

3.5 GATE OPERATOR INSTALLATION

A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.

B. Excavation for Concrete Bases: Hand-excavate holes for bases in firm, undisturbed soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated.

C. Concrete Bases: Cast-in-place or precast concrete, dimensioned and reinforced according to gate operator component manufacturer's written instructions. Anchor or install electric operator using ½"x4-1/2" Hilti Quick bolt concrete stud type anchors

D. Vehicle Loop Detector System: Bury and seal wire loop according to manufacturer's written instructions. Connect to equipment operated by detector.

E. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.6 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

B. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.

C. Gates and Other Fence Openings: Ground fence on each side of opening.

D. Bond metal gates to gate posts.

E. Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

F. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

G. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

H. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

I. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

J. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

K. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.

L. Make connections with clean, bare metal at points of contact.
   1. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   2. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

M. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

C. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

D. Report: Prepare test reports of grounding resistance at each test location, certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Gate movement shall not be initiated by gravity when an automated gate operator is disengaged / disconnected per ASTM F-2220 (Section 4.9).

C. There shall be a maximum gap of 2 ¼" (57 mm) between the horizontal plane of the moving gate panel and any fixed obstacle (support posts, "fall-over" posts, hardware, pilaster, etc.) Except that said obstacle be more than 16" from the moving horizontal plane of the gate panel per ASTM F-2200 (Section 6.1.4.).

D. Gate Receiver Guides shall be recessed behind the leading edge of the receiver post or any other fixed object per ASTM F- 2200 (Section 6.1.6).

E. No device designed to provide activation for the automated gate operator is to be installed within 6' of the horizontal plane of the gate panel per UL-325.

F. All Operated Cantilever slide gates are required to have Gate Warning Placards fully visible to the approach on both sides of the gate per UL-325.

G. Attached hardware by means which will prevent unauthorized removal.

H. All operated gate installations to conform to all applicable federal, state, and local codes as well as: ASTM F-567, ASTM F- 1184, ASTM F-2200, and Underwriters Laboratory UL-325 safety standards.

I. Automatic Gate Operators: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

J. Hydraulic Operators: Purge operating system, adjust pressure and fluid levels, and check for leaks.

K. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

L. Test and adjust controls, alarms, and safeties. Replace damaged and malfunctioning controls and equipment.

M. Lubricate hardware, gate operators, and other moving parts.

3.9 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trees.
2. Shrubs.
3. Ground cover.
4. Plants.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Product certificates.

C. Planting Schedule: Indicating anticipated planting dates for exterior plants.

D. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of exterior plants during a calendar year.

1.4 QUALITY ASSURANCE

A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.

1. Report suitability of topsoil for plant growth. State-recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil.

C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of

exterior plants during delivery. Do not drop exterior plants during delivery and handling.

B. Handle planting stock by root ball.

C. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants and trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.6 WARRANTY

A. Special Warranty: Installer's standard form in which Installer agrees to repair or replace plantings that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, abuse by Owner, or incidents that are beyond Contractor's control.

b. Structural failures including plantings falling or blowing over.

2. Warranty Periods from Date of Substantial Completion:

a. Trees and Shrubs: One year.

b. Ground Cover and Plants: One year.

1.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below.

1. Maintenance Period for Trees and Shrubs: Two months from date of planting completion.

2. Maintenance Period for Ground Covers and Plants: Two months from date of planting completion.

PART 2 - PRODUCTS

2.1 TREE AND SHRUB MATERIAL

A. General: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

B. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

C. Provide balled and burlapped trees.

D. Shrub sizes indicated on Drawings are sizes after pruning.

2.2 GROUND COVER PLANTS

A. Ground Cover: Provide ground cover of species indicated, established and well rooted in pots or similar containers, and complying with ANSI Z60.1.

2.3 PLANTS

A. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

B. Perennials: Provide healthy, field-grown plants from a commercial nursery, of species and variety shown or listed, complying with requirements in ANSI Z60.1.

C. Vines: Provide vines of species indicated complying with requirements in ANSI Z60.1 as follows:

2.4 TOPSOIL

A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Topsoil Source: Reuse surface soil stockpiled on-site. Verify suitability of stockpiled surface soil to produce topsoil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient.

2. Topsoil Source: Import topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.5 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.

B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Aluminum Sulfate: Commercial grade, unadulterated.

E. Perlite: Horticultural perlite, soil amendment grade.

F. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

G. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.6 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m.

B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

C. Peat: Finely divided or granular texture, with a pH range of 6 to 7.5, containing partially decomposed moss peat, native peat, or reed-sedge peat and having a water-absorbing capacity of 1100 to 2000 percent.

D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.7 FERTILIZER

A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of 4 percent nitrogen and 20

percent phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight. Use phosphorous only if required by the soil analysis report.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight. Use phosphorous only if required by the soil analysis report.

2.8 MULCHES

A. Organic Mulch: Shredded hardwood, Ground or shredded bark, Pine straw, Wood and bark chips, Pine needles, and Peanut, pecan, and cocoa-bean shells.

B. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 2 to 5 decisiemens/m.

C. Mineral Mulch: Rounded riverbed gravel or smooth-faced stone and Crushed stone or gravel.

1. Size Range: 1 to 3 inches maximum, 1 inch minimum, unless indicated otherwise.

2. Color: Uniform tan-beige color range acceptable to Architect.

2.9 WEED-CONTROL BARRIERS

A. Nonwoven Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum.

2.10 PLANTING SOIL MIX

A. Planting Soil Mix: Add soil amendments and fertilizers as required by the soil analysis report.

2.11 EDGING

A. Aluminum: 1/8 inch thick by 4 inches high.

1. PermaLoc Cleanline; Black Duraflex.

PART 3 - EXECUTION

3.1 PLANTING BED ESTABLISHMENT

A. Loosen subgrade of planting beds to a minimum depth of 4 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply fertilizer directly to subgrade before loosening.

2. Thoroughly blend planting soil mix off-site before spreading; or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.

3. Spread planting soil mix to a depth of 4 inches100 mm but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

B. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.2 TREES AND SHRUBS

A. Excavation of Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation.

1. Excavate approximately three times as wide as ball diameter.

2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.

B. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1.

C. Stock with Root Balls: Set trees and shrubs plumb and in center of pit or trench with top of root ball 2 inches 50 mm above adjacent finish grades.

1. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

2. Container Grown: Carefully remove root ball from container without damaging root ball or plant.

3. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix.

D. Organic Mulching: Apply 3-inch75-mm average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches75 mm of trunks or stems.

3.3 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character.

3.4 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants as indicated.

B. Dig holes large enough to allow spreading of roots and backfill with planting soil.

C. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

D. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

E. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.5 PLANTING BED MULCHING

A. Install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches. Tape or pin seams as recommended by manufacturer.

B. Mulch backfilled surfaces of planting beds and other areas indicated.

1. Organic Mulch and Mineral Mulch: Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

3.6 PLANT MAINTENANCE

A. Tree and Shrub Maintenance: Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, and resetting to proper grades or vertical position, as required

to establish healthy, viable plantings. Spray or treat as required to keep trees and shrubs free of insects and disease.

B. Ground Cover and Plant Maintenance: Maintain and establish plantings by watering, weeding, fertilizing, mulching, and other operations as required to establish healthy, viable plantings.

C. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

END OF SECTION 329300