

**RFB NO. 316048
(REBID)**



CONSTRUCTION DOCUMENTS PROJECT MANUAL

DANE COUNTY DEPARTMENT OF PUBLIC WORKS,
HIGHWAY AND TRANSPORTATION

PUBLIC WORKS ENGINEERING DIVISION
1919 ALLIANT ENERGY CENTER WAY
MADISON, WISCONSIN 53713

REQUEST FOR BIDS NO. 316048 (REBID)

NEW RESTROOM FACILITY HENRY VILAS ZOO

**702 SOUTH RANDALL AVENUE
MADISON, WISCONSIN**

Due Date / Time: **TUESDAY, DECEMBER 5TH, 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:

ERIC URTESE, AIA - PROJECT MANAGER
TELEPHONE NO.: 608/266-4798
FAX NO.: 608/267-1533
E-MAIL: urtes.eric@countyofdane.com

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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, DECEMBER 5, 2017

REQUEST FOR BIDS NO. 316048 (REBID)

NEW RESTROOM FACILITY

HENRY VILAS ZOO

702 SOUTH RANDALL AVENUE

MADISON, WISCONSIN

Dane County is inviting Bids for demolition of the existing restroom building and construction of a new restroom facility for the Henry Vilas Zoo on the same foundation. 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 Thursday, October 26, 2017** by downloading it from bids-pwht.countyofdane.com. Please call Eric Urtes, AIA - Project Manager, at 608/266-4798, 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 site tour will be held Wednesday, November 8th, 2017 at 9:30 a.m., at the existing restroom facility in the Henry Vilas Zoo. Bidders are strongly encouraged to attend this tour.

PUBLISH: OCTOBER 24TH & 31ST, 2017 - WISCONSIN STATE JOURNAL
OCTOBER 24TH & 31ST, 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 possess 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: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>
3	Will your firm meet all bonding requirements as required by applicable law or contract specifications?	Yes: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>
7	Will your firm fully abide by the equal opportunity and affirmative action requirements of all applicable laws, including County ordinances?	Yes: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/> 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: <input type="checkbox"/> No: <input type="checkbox"/> 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: <input type="checkbox"/> No: <input type="checkbox"/> If Yes, attach details.
11	In the past three (3) years, has your firm defaulted or failed to complete any contract?	Yes: <input type="checkbox"/> No: <input type="checkbox"/> 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: <input type="checkbox"/> No: <input type="checkbox"/> 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: <input type="checkbox"/> No: <input type="checkbox"/> If Yes, attach details.
14	Is your firm Executive Order 108 precertified with the State of Wisconsin?	Yes: <input type="checkbox"/> No: <input type="checkbox"/>
15	Is your firm an active Wisconsin Trade Trainer as determined by the Wisconsin Bureau of Apprenticeship Standards?	Yes: <input type="checkbox"/> No: <input type="checkbox"/>
16	Is your firm exempt from being pre-qualified with Dane County?	Yes: <input type="checkbox"/> No: <input type="checkbox"/> 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: <input type="checkbox"/> No: <input type="checkbox"/>
18	Contractor has been in business less than one year?	Yes: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>
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: <input type="checkbox"/> No: <input type="checkbox"/>

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,
HIGHWAY & 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

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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 for Wednesday, November 8th, 2017 at 9:30 a.m. at the existing restroom facility inside the Henry Vilas Zoo. Attendance by all bidders is optional, however bidders and subcontractors 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 Contract, 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. 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. 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.

17. UNIT PRICES

- A. Provide unit prices where 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. Not Applicable.

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

Page ___ of ___

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

Page ___ of ___

**DANE COUNTY
EMERGING SMALL BUSINESS REPORT - CONTACTS**

(Copy this Form as necessary to provide complete information)

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

	<u>ESB FIRM NAME CONTACTED</u>	<u>DATE</u>	<u>PERSON CONTACTED</u>	<u>DID ESB BID?</u>	<u>ACC- EPT BID?</u>	<u>REASON FOR REJECTION</u>
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

SUBSURFACE DRILLING AND SAMPLING INFORMATION

RFB NO. 316048 (REBID)

PROJECT: NEW RESTROOM FACILITY

HENRY VILAS ZOO

INVESTIGATION DATA

Subsurface investigations have been made and soil boring report by Construction Geotechnical Consultants, Inc. (21 pages) are included following this page. This information was obtained for use in preparing the design; however, Bidders shall draw their own conclusions therefrom. No responsibility for subsoil quality or conditions are assumed by Architect / Engineer or Owner.



Construction • Geotechnical
Consulting Engineering/Testing

January 4, 2017
C16588

Mr. Eric Urtes
Dane County Public Works
1919 Alliant Energy Center Way
Madison, WI 53713

Re: Geotechnical Exploration Report
Proposed Restroom Building Reconstruction
Henry Vilas Zoo
City of Madison, Dane County, Wisconsin

Dear Mr. Urtes:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the geotechnical exploration program for the proposed restroom building reconstruction at Henry Vilas Zoo. The purpose of this exploration program was to evaluate the subsurface conditions within the proposed building area and to provide geotechnical recommendations regarding foundation and floor slab design/construction. We are sending you an electronic paper copy of this report and can provide a paper copy upon request.

PROJECT & SITE DESCRIPTION

We understand the existing restroom building at Henry Vilas Zoo will be partially demolished (excluding foundations), and some new foundations and superstructure will be constructed. Currently there are two buildings, with a 20-ft wide open-air section connected at the roof level. New strip footings will be poured to connect the two buildings, with five new interior column pads, as well as some perimeter footings planned. The building will primarily be a masonry and steel structure. Based on provided project plans, finish floor elevation will be established at EL 853.35 ft, and bottom of footing grade is expected to be about 1.5 to 5 ft below slab grade. Although not provided, foundation and slab grades are expected to be fairly light. Based on the provided drawings, the existing foundations were proportioned using an allowable bearing pressure of 2,500 psf, with the allowable bearing pressure contingent upon the removal of unsuitable soft and organic soils below the foundations, as well as below floor slab.

SITE CONDITIONS

The existing building is located in the south-central part of Henry Vilas Zoo. Lightly-wooded land and asphalt paved area generally exists south of the building, with asphalt pavement on the other sides. A small pond (connected to Lake Wingra) exists south and west of the building. Site grades generally slope down gently from the northeast to the southwest.

Mr. Eric Urtes
Dane County Public Works
January 4, 2017
Page 2

SUBSURFACE CONDITIONS

Subsurface conditions on site were explored by drilling a total of two Standard Penetration Test (SPT) soil borings to planned depths of 20 ft below existing site grades. The borings were located in the field by CGC after a site meeting with Dane County. The borings were drilled on December 29, 2016 by Soil Essentials (under subcontract to CGC) using an ATV-mounted drill rig equipped with hollow-stem augers and an automatic SPT hammer. Specific details on the drilling and sampling procedures are included in Appendix A. The boring locations are shown in plan on the Soil Boring Location Exhibit attached in Appendix B. The ground surface elevations at the boring locations were estimated by CGC using a provided topographic map, and the elevations should therefore be considered approximate (+/- 1 ft).

The subsurface profile at the boring locations varied to some degree, but a generalized profile includes the following strata, in descending order:

- 4.75 to 5.5 in. of *asphalt pavement* over 8.5 to 9 in. of *base course*, over
- About 1.5 ft of *fill* in Boring 1 consisting of medium dense silty sand, followed by
- About 1.5 to 3 ft of very soft *organic clayey silty* (marl), underlain by
- 0.5 to 1 ft of very loose *sedimentary peat*, followed by
- Medium dense to dense *sand* with significant silt content, minor gravel content, as well as occasional silt seams to the maximum depth explored.

The soil conditions in two previous borings drilled in the north and south portions of the existing building were fairly similar to the recently-drilled borings, and the soil profiles generally consisted of lower quality fill and organic silt to about 6 ft below grade over loose to dense sand with scattered silt seams, with weathered sandstone bedrock encountered in the southern boring (B-1).

Moisture contents were measured on four samples of the shallow organic soils, and the moisture contents ranged from 78.3 to 174.1%. The organic content (as measured by loss-on-ignition) was also measured to be 6.0% and 33.5%, respectively, where soils with organic contents of more than 4% are considered to be organic, and soils with organic contents of more than 12% are considered to be sedimentary peat.

Groundwater was encountered in the borings at 2.9 to 6.2 ft below existing grade during or shortly after drilling. Groundwater was encountered in the previous borings about 6 ft below existing grade. Groundwater levels can be expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration, the level of nearby Lake Wingra and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B.



Mr. Eric Urtes
 Dane County Public Works
 January 4, 2017
 Page 3

DISCUSSION AND RECOMMENDATIONS

Subject to the limitations discussed below and based on the subsurface exploration, it is our opinion that the site is generally suitable for the proposed construction and conventional spread footing foundations can be used to supplement the existing foundations, where required, for the new restroom building. *However, undercutting of unsuitable soils (fill, organic silty clay and peat) below footings and floor slab will likely be required.* Our recommendations for foundation and floor slab design/construction are presented in the following subsections. Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Foundation Design

In our opinion, new foundations for the proposed building can consist of conventional spread footings bearing on suitable natural soils or engineered granular backfill where undercutting of unsuitable soil is required. Around the perimeter of the building, undercutting of unsuitable soil is expected to extend about 4 to 6 ft below existing grade. If undercutting of unsuitable soils occurred within the entire building footprint during initial construction, undercutting may not be required, but supplemental hand auger borings or test holes should be excavated below footing grade to check for the presence of unsuitable soil. Existing abandoned utilities or obsolete structure elements should also be undercut below new foundations in order to create a fairly uniform bearing surface. Assuming that footings will bear on suitable natural soils or engineered granular backfill where undercutting of unsuitable soil occurs, the following parameters should be used for foundation design:

- Maximum net allowable bearing pressure: 2,500 psf
- Minimum foundation widths:
 - Continuous wall footings: 18 in.
 - Column pad footings: 30 in.
- Minimum footing depths:
 - Exterior/perimeter footings: 4 ft
 - Interior footings: no minimum requirement

The subgrade soils should be carefully checked for footing support suitability during footing excavation. Undercutting below footing grade will be required where unsuitable existing fill or organic soils, loose natural sands or native clays with pocket penetrometer readings (an estimate of the unconfined compressive strength of cohesive soils) of less than 1.25 tsf are encountered at or slightly below footing grade. Where undercutting is required, the base of the undercut excavation should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Since the bottom of the undercut will likely extend near or slightly below the water table, a minimum 6-in. thick layer of clear stone should be placed and compacted at the bottom of the excavation

Mr. Eric Urtes
Dane County Public Works
January 4, 2017
Page 4

to stabilize the soils. If the the clear stone layer exceeds 12 in., the stone should be enveloped in non-woven geotextile fabric (e.g., Mirafi 160N or equivalent). If the bottom of the excavation is dry or above the 6-in. clear stone layer (if dry), granular backfill compacted to at least 95% compaction (ASTM D1557) or well-compacted 3-in. dense graded base can be used to re-establish footing grade.

If footing or undercut excavations will extend below the groundwater table, measures should be taken to control and lower the groundwater at least 2 ft below the bottom of footing or undercut excavation grade in advance of final excavation to reduce the risk of subgrade disturbance. For groundwater draw downs of less than about 1 to 2 ft, groundwater can likely be controlled using submersible pumps in filtered sump pits outside the footing line. If groundwater draw downs exceed about 1 to 2 ft, wells points or deep wells are typically required to control groundwater. Dewatering means and methods are the responsibility of the contractor.

CGC should be present during footing excavations to check whether the subgrades are satisfactory for the design bearing pressure and to advise on corrective measures, where necessary. We recommend using a smooth-edged backhoe bucket for footing excavations. Additionally, granular soils exposed at footing grade (well above groundwater) should be thoroughly recompacted with a large vibratory plate compactor prior to formwork/concrete placement to densify soils loosened during the excavation process. Soils potentially susceptible to disturbance from compaction (e.g., silty or clayey soils or soils with elevated water content) should be hand trimmed, and soils at or below the water table should be stabilized with compacted clear stone, as discussed above. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

2. Floor Slab

To reduce the risk of floor slab settlement and cracking, we recommend that the existing fill and organic soils (organic clayey silt and peat) be undercut below new slabs (including new stoops). Note that much of the unsuitable existing soil will be removed when undercutting below new footings, and undercut depths are similarly expected to be on the order of 4 to 6 ft below existing grade. As discussed in the Foundation Design Section of this report, appropriate dewatering and subgrade stabilization techniques should be used to reduce the potential for subgrade disturbance. Fill/backfill below floor slab areas should be compacted to at least 95% compaction based on modified Proctor methods (ASTM D 1557).

Assuming the existing fill and organic soils are undercut below new slab areas, we anticipate that the floor slab subgrade outside the existing building will consist of newly-placed engineered granular fill. Assuming that the unsuitable soils were undercut/removed during original construction, compacted granular fill will also likely be present within the existing building footprint, but this assumption should be checked in the field. We recommend that a couple shallow hand auger borings, test pits or observation of new footings inside the existing building be completed to check for the presence of unsuitable soils that would require undercutting/replacement below slabs.

Mr. Eric Urtes
Dane County Public Works
January 4, 2017
Page 5

Prior to slab construction, the subgrades should be thoroughly proof-rolled/recompacted to densify soils that may become disturbed or loosened during construction activities. Areas that remain loose after recompaction should be undercut and replaced with compacted 3-in. dense graded base or granular fill.

The design subgrade modulus is based on a recompacted subgrade such that non-yielding conditions are developed. The final 4 to 6 in. of soil placed below the slab should consist of well-graded sand/gravel with no more than 5 percent by weight passing a No. 200 U.S. standard sieve to act as a capillary break. (Note that some structural engineers require a 4 to 6 in. layer of $\frac{3}{4}$ in. or 1- $\frac{1}{4}$ in. dense graded base below the slab to increase the subgrade modulus immediately below the slab.) Fill and base layer material below the floor slab should be placed and compacted to 95% compaction based on modified Proctor methods (ASTM D 1557). A subgrade modulus of 100 pci may be used for slab design if the slab is supported on well-graded sand/gravel over a firm subgrade. If 6 in. of dense graded base is included below the slab, the subgrade modulus can be increased to 150 pci. To further minimize the potential for moisture migration, a plastic vapor barrier can also be utilized below the slab. The slab should be structurally separate from the foundations and have construction joints and reinforcement for crack control.

3. Seismic Design Category

In our opinion, the average soil/rock properties in the upper 100 ft of the site (based on SPT blow counts (N-values) of more than 15 blows/ft, on average, in the granular soils underlying the site) may be characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code (see Table 1613.5.2).

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties that could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.
- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.
- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.



Mr. Eric Urtes
Dane County Public Works
January 4, 2017
Page 6

- When excavating next to existing footings caution should be exercised to prevent undermining of the existing foundations. If footings will be undermined, underpinning or other methods of support should be provided to properly support the footing to reduce the risk of unacceptable settlement.
- Based on observations made during the field exploration, groundwater may be encountered in building excavations at this site, and dewatering was previously discussed. Additional water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation and floor slab subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Foundation excavation/subgrade preparation;
- Fill/backfill placement and compaction; and
- Concrete placement.

* * * * *



Mr. Eric Urtes
Dane County Public Works
January 4, 2017
Page 7

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

David A. Staab, P.E., LEED AP
Consulting Professional

Michael N. Schultz, P.E.
Principal/Consulting Professional

- Encl: Appendix A - Field Exploration
Appendix B - Soil Boring Location Exhibit
Logs of Test Borings (2)
Log of Test Boring-General Notes
Unified Soil Classification System
Appendix C - Document Qualifications
Appendix D - Recommended Compacted Fill Specifications

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

A total of two Standard Penetration Test (SPT) soil borings were drilled to planned depths of 20 ft below existing site grades. The borings were located in the field by CGC after a site meeting with Dane County. The borings were drilled on December 29, 2016 by Soil Essentials (under subcontract to CGC) using an ATV-mounted drill rig equipped with hollow-stem augers and an automatic SPT hammer. The boring locations are shown in plan on the Soil Boring Location Exhibit attached in Appendix B. The ground surface elevations at the boring locations were estimated by CGC using a provided topographic map, and the elevations should therefore be considered approximate (+/- 1 ft).

In each boring, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

The boring is extended downward, between samples, by a hollow-stem auger.

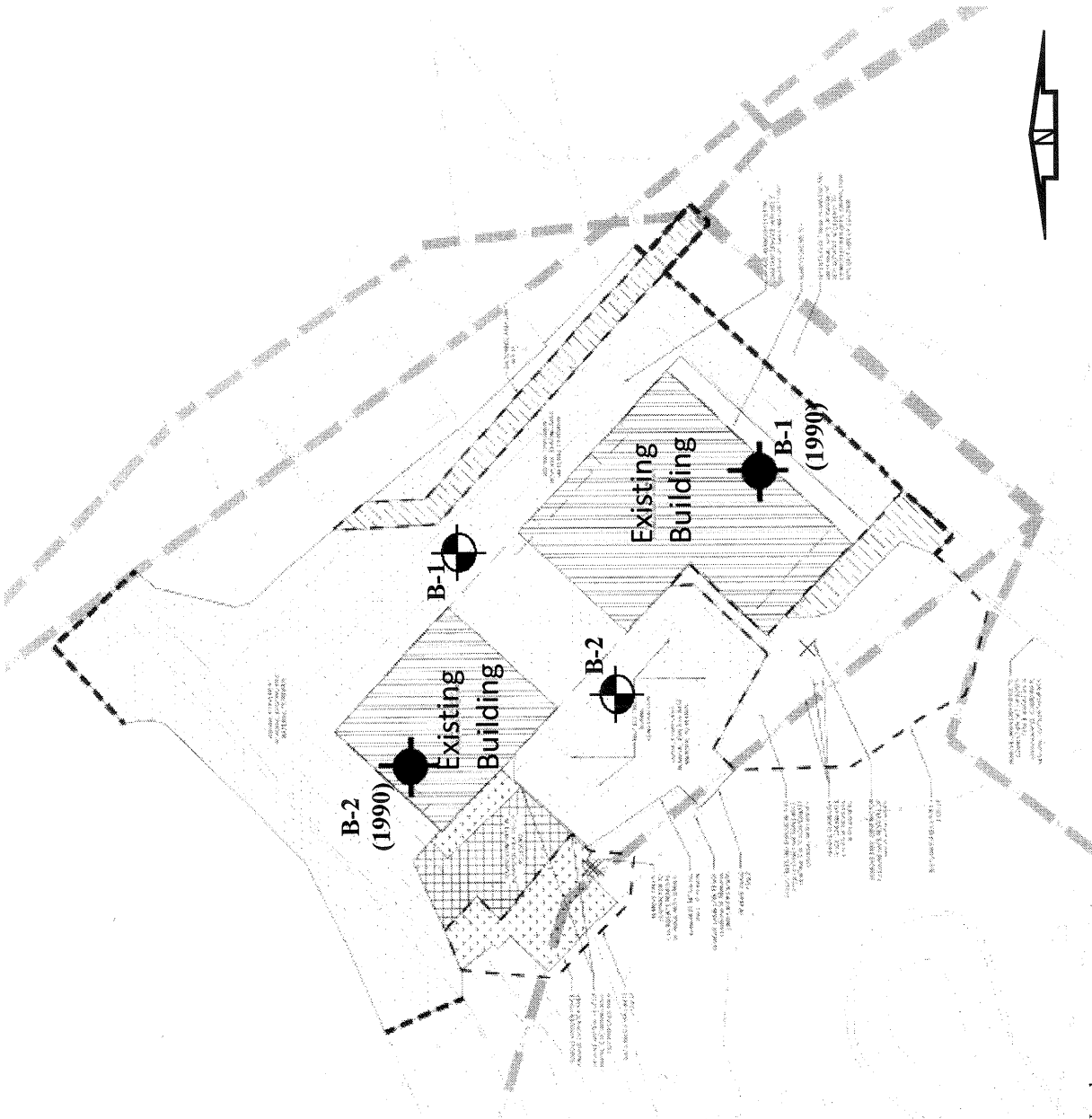
2. Standard Penetration Test and Split-Barrel Sampling of Soils
(ASTM Designation: D 1586)

This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite (where required) to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soil samples were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

**SOIL BORING LOCATION EXHIBIT
LOGS OF TEST BORINGS (2)
LOG OF TEST BORING – GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM**



Scale: Reduced

Legend

- Denotes Recent Boring Location and Number
- Denotes Previous Boring Location and Number

Notes

1. Borings drilled by Soil Essentials on December 29, 2016.
2. Base map provided by Dane County.
3. Boring locations are approximate.

Job No.
CI6588

Date:
01/2017



SOIL BORING LOCATION EXHIBIT
Proposed Restroom Reconstruction
Henry Vilas Zoo
Madison, WI



LOG OF TEST BORING

Project Henry Vilas Zoo
Restroom Building Reconstruction
 Location Madison, WI

Boring No. **B1**
 Surface Elevation (ft) 852±
 Job No. **C16588**
 Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	DEPTH (ft)	Rec (in.)	Moist	N		qu (qa) (tsf)	W	LL	PL	LI
					5.5 in. Asphalt/9 in. Base Course					
1		18	M	12	FILL: Medium Dense, Dark Brown Silty Sand, Little Clay and Gravel					
2		5	M	2/18"	Very Soft, Gray Organic Clayey SILT, Little Sand, with Shells (OL-Marl)		78.7			7.4
					Very Loose, Dark Brown Sedimentary PEAT (PT)	(0.25)	174.1			33.5
3		16	W	14	Medium Dense to Dense, Brown to Tan Fine to Medium SAND, Some Silt, Trace Gravel, with Occasional Silt Seams (SM)					
4		14	W	27						
5		16	W	34						
6		18	W	36						
					End of Boring at 20 ft					
					Borehole backfilled with bentonite chips					
					Note: Frost to 1.5 ft					

WATER LEVEL OBSERVATIONS

While Drilling ∇ 6.0' Upon Completion of Drilling _____
 Time After Drilling _____ 15 min.
 Depth to Water _____ 6.2 ∇
 Depth to Cave in _____

GENERAL NOTES

Start 12/29/16 End 12/29/16
 Driller SE Chief DAP Rig Geoprobe
 Logger DAP Editor AJB 7822DT
 Drill Method 2.25" HSA; Autohammer

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.



LOG OF TEST BORING

Project Henry Vilas Zoo
Restroom Building Reconstruction
 Location Madison, WI

Boring No. B2
 Surface Elevation (ft) 851.5±
 Job No. C16588
 Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE					VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N		Depth (ft)	q _u (qa) (tsf)	W	LL	PL
					0	4.75 in. Asphalt/8.5" Base Course				
1	█	18	M	1/12"	1	Very Soft, Gray Organic Clayey SILT, Little Sand, with Shells (OL-Marl)				
					5	Very Loose, Dark Brown to Black Sedimentary PEAT (PT)				
2	█	12	M	16	5	Medium Dense to Dense, Brown to Tan Fine to Medium SAND, Some Silt, Trace Gravel, with Occasional Silt Seams (SM)				
3	█	10	W	14	10					
4	█	17	W	26	15					
5	█	18	W	30	20					
6	█	18	W	34	25					
End of Boring at 20 ft										
Borehole backfilled with bentonite chips										
Note: Frost to 1.5 ft										

WATER LEVEL OBSERVATIONS	GENERAL NOTES
While Drilling ∇ <u>6.0'</u> Upon Completion of Drilling _____ Time After Drilling _____ <u>15 min.</u> Depth to Water _____ <u>2.9'</u> ∇ Depth to Cave in _____	Start <u>12/29/16</u> End <u>12/29/16</u> Driller <u>SE</u> Chief <u>DAP</u> Rig <u>Geoprobe</u> Logger <u>DAP</u> Editor <u>AJB</u> <u>7822DT</u> Drill Method <u>2.25" HSA; Autohammer</u>
The stratification lines represent the approximate boundary between soil types and the transition may be gradual.	

LOG OF TEST BORING
General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders.....	Larger than 12"	Larger than 12"
Cobbles.....	3" to 12"	3" to 12"
Gravel: Coarse.....	¾" to 3"	¾" to 3"
Fine.....	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse.....	2.00 mm to 4.76 mm.....	#10 to #4
Medium.....	0.42 to mm to 2.00 mm.....	#40 to #10
Fine.....	0.074 mm to 0.42 mm	#200 to #40
Silt.....	0.005 mm to 0.074 mm	Smaller than #200
Clay.....	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

- Physical Characteristics
Color, moisture, grain shape, fineness, etc.
- Major Constituents
Clay, silt, sand, gravel
- Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
- Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose.....	0 - 4
Loose.....	4 - 10
Medium Dense.....	10 - 30
Dense.....	30 - 50
Very Dense.....	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace.....	0% - 5%
Little.....	5% - 12%
Some.....	12% - 35%
And.....	35% - 50%

Consistency

Term	q _u -tons/sq. ft
Very Soft.....	0.0 to 0.25
Soft.....	0.25 to 0.50
Medium.....	0.50 to 1.0
Stiff.....	1.0 to 2.0
Very Stiff.....	2.0 to 4.0
Hard.....	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic.....	Less than 4%
Organic Silt/Clay.....	4 - 12%
Sedimentary Peat.....	12% - 50%
Fibrous and Woody Peat...	More than 50%

Plasticity

Term	Plastic Index
None to Slight.....	0 - 4
Slight.....	5 - 7
Medium.....	8 - 22
High to Very High ..	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

- CS – Continuous Sampling
- RC – Rock Coring: Size AW, BW, NW, 2"W
- RQD – Rock Quality Designation
- RB – Rock Bit/Roller Bit
- FT – Fish Tail
- DC – Drove Casing
- C – Casing: Size 2 ½", NW, 4", HW
- CW – Clear Water
- DM – Drilling Mud
- HSA – Hollow Stem Auger
- FA – Flight Auger
- HA – Hand Auger
- COA – Clean-Out Auger
- SS - 2" Dia. Split-Barrel Sample
- 2ST – 2" Dia. Thin-Walled Tube Sample
- 3ST – 3" Dia. Thin-Walled Tube Sample
- PT – 3" Dia. Piston Tube Sample
- AS – Auger Sample
- WS – Wash Sample
- PTS – Peat Sample
- PS – Pitcher Sample
- NR – No Recovery
- S – Sounding
- PMT – Borehole Pressuremeter Test
- VS – Vane Shear Test
- WPT – Water Pressure Test

Laboratory Tests

- q_a – Penetrometer Reading, tons/sq ft
- q_u – Unconfined Strength, tons/sq ft
- W – Moisture Content, %
- LL – Liquid Limit, %
- PL – Plastic Limit, %
- SL – Shrinkage Limit, %
- LI – Loss on Ignition
- D – Dry Unit Weight, lbs/cu ft
- pH – Measure of Soil Alkalinity or Acidity
- FS – Free Swell, %

Water Level Measurement

- ▽ - Water Level at Time Shown
- NW – No Water Encountered
- WD – While Drilling
- BCR – Before Casing Removal
- ACR – After Casing Removal
- CW – Cave and Wet
- CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS

(more than 50% of material is larger than No. 200 sieve size)

Clean Gravels (Less than 5% fines)



GW

Well-graded gravels, gravel-sand mixtures, little or no fines



GP

Poorly-graded gravels, gravel-sand mixtures, little or no fines

Gravels with fines (More than 12% fines)



GM

Silty gravels, gravel-sand-silt mixtures



GC

Clayey gravels, gravel-sand-clay mixtures

GRAVELS
More than 50% of coarse fraction larger than No. 4 sieve size

Clean Sands (Less than 5% fines)



SW

Well-graded sands, gravelly sands, little or no fines



SP

Poorly graded sands, gravelly sands, little or no fines

Sands with fines (More than 12% fines)



SM

Silty sands, sand-silt mixtures



SC

Clayey sands, sand-clay mixtures

SANDS
50% or more of coarse fraction smaller than No. 4 sieve size

FINE-GRAINED SOILS

(50% or more of material is smaller than No. 200 sieve size.)



ML

Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity



CL

Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays



OL

Organic silts and organic silty clays of low plasticity



MH

Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts



CH

Inorganic clays of high plasticity, fat clays



OH

Organic clays of medium to high plasticity, organic silts



PT

Peat and other highly organic soils

SILTS AND CLAYS
Liquid limit less than 50%

SILTS AND CLAYS
Liquid limit 50% or greater

HIGHLY ORGANIC SOILS

LABORATORY CLASSIFICATION CRITERIA

GW $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3

GP Not meeting all gradation requirements for GW

GM Atterberg limits below "A" line or P.I. less than 4
 GC Atterberg limits above "A" line or P.I. greater than 7
 Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

SW $C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3

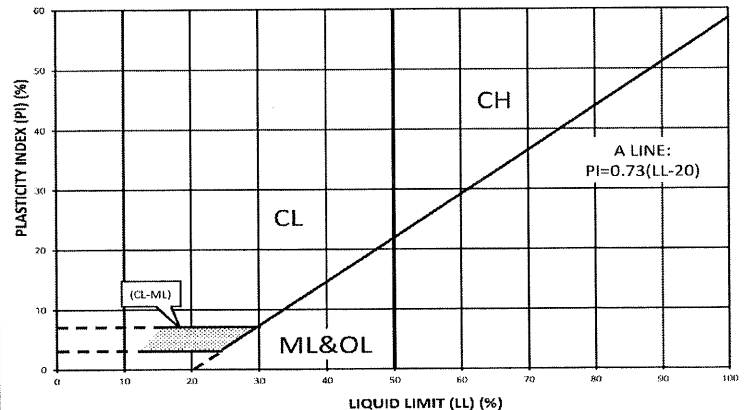
SP Not meeting all gradation requirements for GW

SM Atterberg limits below "A" line or P.I. less than 4
 SC Atterberg limits above "A" line with P.I. greater than 7
 Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent GW, GP, SW, SP
 More than 12 percent GM, GC, SM, SC
 5 to 12 percent Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C

DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

READ THE FULL REPORT

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most

effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the confirmation-dependent recommendations included in your report. *Those confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's confirmation-dependent recommendations if we do not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical engineering report. Confront that risk by having CGC participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONSTRUCTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time to perform additional study.* Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and constructors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic

expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

ENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention.* *Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in the Geotechnical Business Council (GBC) of Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of GBC, for more information.

Modified and reprinted with permission from:

Geotechnical Business Council
of the Geoprofessional Business Association
8811 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

**Table 1
Gradation of Special Fill Materials**

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55			
No. 40			5-20	8-28	10-35	75 (2)		
No. 100						15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:

1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction*.
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

**Table 2
Compaction Guidelines**

Area	Percent Compaction (1)	
	Clay/Silt	Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 2 ft below subgrade	92	95
- Greater than 2 ft below subgrade	90	90
Landscaping	85	90

Notes:

1. Based on Modified Proctor Dry Density (ASTM D 1557)

Name of Bidding Firm: _____

BID FORM

BID NO. 316048 (REBID)

**PROJECT: NEW RESTROOM FACILITY
HENRY VILAS ZOO**

**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 demolition of the existing restroom building and construction of a new restroom facility for the Henry Vilas Zoo on the same foundation. Only firms with capabilities, experience & expertise with similar projects should obtain this Request for Bids document & submit Bids. 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 plantings including installation, maintenance and design in coordination with the Owner, design team and City of Madison staff. Owner will provide the awarded general contractor with landscape contractor qualification requirements and project requirements.

Twenty Thousand ----- and _____ 00 /100 Dollars
Written Price

\$20,000.00
Numeric Price

ALTERNATE BID 1 - LUMP SUM:

Add price for providing AC split system. Provide all equipment, piping, and installation associated with ductless split heat pump system. Refer to specifications and drawings.

_____ and _____/100 Dollars
Written Price

\$ _____
Numeric Price (circle: Add or Deduct)

ALTERNATE BID 2 – LUMP SUM:

Provide deduct price for future Concession 100 fit out by Owner:

1. Omit Aluminum Sliding Service Window, specification section 08 58 00, in its entirety. Provide masonry opening as indicated for future installation of aluminum sliding service window with stainless steel sill and solid surface trim. In lieu of aluminum window, install masonry wall infill within the opening to match adjacent wall construction.
2. Plumbing fixtures, P101, provide rough in for the following future installation only. Omit S-1, S-2, MB-1 in Concessions 100. Omit backflow device and connection to Owner’s Equipment. Contractor to provide a 12”x12” concrete box out around the sanitary waste rough-in for MB-1 and cap waste above floor.
3. Omit EF-2, exhaust fan, duct, damper and hood. Provide rough in including roof curb for future installation of concessions exhaust.

_____ and _____/100 Dollars
Written Price

\$ _____
Numeric Price (circle: Add or Deduct)

UNIT PRICING - INFORMATIONAL BID ONLY:

Provide prices to furnish plumbing fixtures, faucets, and flush valves. Indicate cost included in the base bid for these products only, if they were provided by Owner. Informational bid does not include all piping, fixture supports, stops, supplies and labor to install fixtures complete. This is used by the County for budgetary purposes.

\$ _____
Numeric Price

UNIT PRICING: REMOVAL OF SOIL

Add pricing for the removal of unsuitable soil and engineered fill material where soil testing agency has determined existing conditions are insufficient for the purposes of the project.

Unsuitable Soil Removal & Replacement with Engineered Fill: @\$_____/cubic yard

UNIT PRICING: PROVIDE GEOTEXTILE MAT

Add pricing for providing non-woven geotextile material as specified by soil testing agency in the attached Geotechnical Report.

Geotextile Mat for Subgrade Stabilization: @\$_____/square yard

The undersigned agrees to add the alternate(s) portion of the Work as described, for the following addition(s) to or subtraction(s) from the Base Bid, as stipulated below.

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

Addendum No(s). _____ through _____

Dated _____

Dane County Henry Vilas Zoo must have this project completed by May 25, 2018. Assuming this Work can be started by January 2, 2018, 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 /Attach sheets with summary of previous work (See ITB Section 4)

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 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. 316048

Authority: 2017 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

WITNESSETH:

WHEREAS, COUNTY, whose address is c/o Assistant Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR provide services in order to construct the New Restroom Facility at the Henry Vilas Zoo, including Alternate Bids 1 & 2 ("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 _____

_____	(Contractor as Principal)	_____	(Seal)
(Witness)		_____	(Title)
		_____	(Surety)
_____		_____	(Seal)
(Witness)		_____	(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.

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

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name _____
and Title: _____

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

Signature: _____

Name _____
and Title: _____

(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:

Sample

(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: _____

Name and Title: _____

Address _____

Signature: _____

Name and Title: _____

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)

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 18

CONTRACTOR AS PRINCIPAL

Company: *(Corporate Seal)*

SURETY

Company: *(Corporate Seal)*

Signature: _____

Name _____
and Title: _____

Signature: _____

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:)

§ 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

Company: _____

(Corporate Seal)

SURETY

Company: _____

(Corporate Seal)

Signature: _____

Name and Title: _____

Address _____

Signature: _____

Name and Title: _____

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.

EQUAL BENEFITS COMPLIANCE PAYMENT CERTIFICATION FORM

PURPOSE

25.13 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 25.13 "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 25.13 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

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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.

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 (5th) 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 warranties 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 not 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 Statute 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 than \$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 project Dane County Public Works Project Manager for approval.


AIA Document G702™ – 1992

Application and Certificate for Payment

TO OWNER:	PROJECT:	APPLICATION NO:	Distribution to:
FROM CONTRACTOR:	VIA ARCHITECT:	PERIOD TO:	OWNER <input type="checkbox"/>
		CONTRACT FOR:	ARCHITECT <input type="checkbox"/>
		CONTRACT DATE:	CONTRACTOR <input type="checkbox"/>
		PROJECT NOS:	FIELD <input type="checkbox"/>
			OTHER <input type="checkbox"/>

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)

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: _____

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

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.
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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 ITEM NO.	B DESCRIPTION OF WORK	C SCHEDULED VALUE	D WORK COMPLETED		F MATERIALS PRESENTLY STORED <i>(Not in D or E)</i>	G TOTAL COMPLETED AND STORED TO DATE <i>(D+E-F)</i>	H BALANCE TO FINISH <i>(C-G)</i>	I RETAINAGE <i>(if variable rate)</i>
			FROM PREVIOUS APPLICATION <i>(D-E)</i>	THIS PERIOD				
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.

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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.

3. INSURANCE

A. **Contractor Carried Insurance.** In order to protect itself and the County, Contractor shall not commence work under this Contract until obtaining all required insurance and the County has approved such insurance. Contractor shall not allow any subcontractor to commence work on subcontract until insurance required of subcontractor has been so obtained and approved.

1. **Pollution Insurance Policy**

Contractor shall procure and maintain during life of this Contract, Pollution Insurance Policy in amount of at least \$1,000,000 per occurrence, \$5,000,000 aggregate.

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. Site Access
 25. Occupancy During Construction and Conduct of Work
 26. Protection
 27. Progress Cleaning
 28. Products
 29. Transportation, Handling, Storage and Protection
 30. Product Options
 31. Substitutions
 32. Starting Systems
 33. Demonstration and Instructions
 34. Contract Closeout Procedures
 35. Final Cleaning
 36. Adjusting
 37. Operation and Maintenance Data
 38. Spare Parts and Maintenance Materials
 39. 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 services in order to first demolish the existing and then construct a New Restroom Facility at the Henry Vilas Zoo atop an existing foundation.
- B. Work by Owner: Testing and Balancing for HVAC, Specification Section 23 05 93, will be contracted separately by Owner. Refer to General Conditions Article 16 for scope of testing of materials by Owner.
- 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 others and work by Owner.

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 Architect / Engineer for initial approval. Architect / Engineer will forward approved copies to Owner who will also approve & process for payment.

1.5 CHANGE PROCEDURES

- A. Change Order Forms: Dane County Contract Change Order, Form 014-32-20 (latest issue).

- B. 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. Alternates quoted on Bid Form shall be reviewed and accepted or rejected at Owner's option.
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates:
 - 1. Alternate Bid 1: Provide split AC system.
 - a. List lump sum pricing for the equipment, piping, and installation associated with a ductless split heat pump system.
 - 2. Alternate Bid 2: Deduct future Concession 100 fit out from scope.
 - a. Omit Aluminum Sliding Service Window, specification section 08 58 00, in its entirety. Provide masonry opening as indicated for future installation of aluminum sliding service window with stainless steel sill and solid surface trim. In lieu of aluminum window, install masonry wall infill within the opening to match adjacent wall construction.
 - b. Plumbing fixtures, P101, provide rough in for the following future installation only. Omit S-1, S-2, MB-1 in Concessions 100. Omit backflow device and connection to Owner's Equipment. Contractor to provide a 12"x12" concrete box out around the sanitary waste rough-in for MB-1 and cap waste above floor.
 - c. Omit EF-2, exhaust fan, duct, damper and hood. Provide rough in including roof curb for future installation of concessions exhaust.

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. Owner will schedule a pre-construction conference after Award of Contract for all affected parties.
- C. Contractor shall submit Construction Schedule at pre-construction meeting.
- D. Pre-installation Meetings will be held for all major components including review of in place mock ups including all components of exterior wall assembly including: wall openings, corners, conditions at columns, wall base, roof edge, window installation, flashing, windows, etc. Provide all exterior insulations, air and vapor barriers including junction with foundation wall intersection. Mock-up shall demonstrate surface preparation, joint treatment, and sealing of gaps, terminations, and penetrations of air barrier. Refer to individual spec sections for additional mock up requirements. Approval of mock-ups does not constitute approval of deviations from the Contract Documents contained in the mock-ups unless Architect specifically approves such deviations in writing. Notify A/E 7 days in advance of dates and time when mock-up will be prepared.

1.10 PROGRESS MEETINGS

- A. Preside at meetings, record minutes, and distribute copies within two (2) business days to those affected by decisions made.
- B. Owner shall schedule and administer meetings throughout progress of the Work at minimum of one (1) per week.

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.
- B. The awarded contractor must submit shop drawings for all long lead time items submitted within seven (7) business days of the Notice to Proceed.

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 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
- B. Before the building, or portion thereof, can be considered enclosed, the Contractor shall have advanced the construction of the building to conform with the following requirements.
- C. The exterior walls should be erected to full thickness and height shall extend to the top of the horizontal level which encloses the space intended to receive heat. If erection of full thick walls is not feasible, erection of back-up wall only will be accepted if approved weatherproofing of back up materials is provided to avoid damage to back-up materials. The entire overhead enclosure shall be made weatherproof.
- D. Provide approved translucent material for temporary enclosure of window openings if they have not been glazed. Plain or reinforced polyethylene film or other suitable translucent material will be acceptable, provided it is installed in or on a well-fitting rigid wood frame and kept in good repair. This means of temporary enclosure shall be used for other minor openings in walls.
- E. Construct temporary walls as required to protect contents and to separate interior enclosed sections from the interior open section of the building during construction. Temporary wall enclosure shall consist of plywood panels, at least 3/8" thick, fastened to wood framework, consisting of 2x4 studs spaced 24" o.c., securely spiked to wood plates, to and bottom. Temporary walls must provide protection from dirt, dust, and drafts. Make suitable provisions for passage of air to permit proper drying out of the building.

- F. Provide exterior doors with hinges, self-closing device and locks. At the end of day's work, securely close temporary enclosures. Padlock exterior doors. Architect and Public Works Project Manager to approve method of securing exterior doors.
 - G. Temporary enclosure shall provide for an orderly expansion of areas of work which are advantageous to the progress of the work and approved by the Public Works Project Manager.
- 1.21 Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations. This includes dehumidification or temporary ventilation. Equipment installed as a part of this project is not allowed to be used for building conditioning prior to Substantial Completion as determined by the Public Works Project Manager
- 1.22 .PROTECTION OF INSTALLED WORK
- A. Protect installed work and provide special protection where specified in individual Specification sections.
 - B. All heating and protective covering, required to protect the work from injury due to freezing and moisture during the construction period and prior to enclosure of the building, shall be classed as COLD WEATHER PROTECTION. Such protection shall be provided and paid for by the Contractor
 - C. Provide and pay for heating devices and heat as need to maintain specified conditions for construction operations. Heat required to protect materials from injury due to freezing during the construction period prior to enclosure, shall be provided by means of portable heating units intended for this purpose. All heating units must be approved types. Proper ventilation must be provided. The use of temporary units whose product of combustion will damage fresh concrete, mortar or other building materials, will not be allowed. Use of coke or oil salamanders is prohibited. Heating units and the area surrounding the units shall be kept in a clean and safe condition.
 - D. Equipment installed as a part of this project is not allowed to be used for building conditioning prior to Substantial Completion as determined by the Public Works Project Manager.
- 1.23 PARKING
- A. Arrange for temporary parking areas to accommodate construction personnel. Parking shall be available at the Work site. There is parking available for three hour increments in the parking lot around the zoo in addition to free street parking.
- 1.24 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.

1.25 SITE ACCESS

- A. The zoo can be accessed by contractors between 8 am and 5 pm. If your work requires activities outside this time frame you will need to make prior arrangements with the zoo staff.

1.26 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.
- B. Contractor shall provide and maintain sanitary temporary toilets, located where directed by Public Works Project Manager, in sufficient number required for the force employed.

The toilets shall comply with International Building Code Chapter 29 on Plumbing Systems. Toilets shall be self-contained chemical type.

- C. Temporary Water Service: connect to existing water source.
- D. Temporary Electricity: Provide and pay for power service required from utility source as needed for construction operation.

Provide distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1. Provide two 20 ampere weatherproof duplex outlets on a single phase circuit for power tools for every 1000 sq. ft. of active work area.
2. Provide 20 ampere, single phase branch circuits for lighting.

- E. Temporary Lighting for Construction Purposes: Provide and maintain HID lighting for construction operations to a minimum level of 0.25 watt/sq. ft.

Provide and maintain 0.1 watt/sq. ft. lighting to exterior staging and storage areas after dark for security purposes.

Provide and maintain 0.25 watt/sq. ft. HID lighting to interior work areas after dark for security purposes.

Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

Maintain lighting and provide routine repairs.

Permanent building lighting may be utilized during construction with written permission of Division 26. Such usage shall not shorten guarantee period.

- F. Removal of Utilities, Facilities and Controls: Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.

Remove underground installations to minimum depth of **2 feet**.

Clean and repair damage caused by installation or use of temporary work.

- G. Traffic Regulation: Post signage and provide traffic, cones, drums, flares, lights and trained flag persons as approved by authority having jurisdiction.

Consult with Dane County Public Works Project Manager and authority having jurisdiction to establish public thoroughfares to be used for haul routes and site access. Remove equipment at substantial completion and restore site.

- H. Water Control: Grade site to drain. Maintain excavations free of water. Provide, operate and maintain pumping equipment. Protect the site from puddling or running water.
- I. Dust Control: Execute Work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere.
- J. Pollution Control: Provide methods, means and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with pollution and environmental control requirements of authorities having jurisdiction.
- K. Pest and Rodent Control: Provide methods, means and facilities to prevent pests, insects and rodents from entering facility or damaging the Work.

1.27 PROTECTION

- A. Contractor shall protect from injury all trees, shrubs, hedges, 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.
- C. Contractor shall provide and maintain guard lights at all barricades, railings, obstructions in streets, roads or sidewalks and at all trenches adjacent to public walks or roads.

1.28 PROGRESS CLEANING

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

1.29 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.

1.30 TRANSPORTATION, HANDLING, STORAGE AND PROTECTION

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

1.31 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. Should bidder choose to bid materials other than those specified, bidder shall submit said materials specifications to Public Works Project Manager for approval at least seven (7) business days prior to Bid Due Date.
- 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 may be considered. Owner reserves right to approve or reject substitutions based on Specification requirements and intended use.

1.32 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.

1.33 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.

1.34 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.

1.35 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.
- C. Submit a list of any items that are not complete for Architect review prior to scheduling substantial and final completion site visits.

1.36 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.

1.37 ADJUSTING

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

1.38 OPERATION AND MAINTENANCE MANUAL

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

1.39 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.

1.40 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.

- 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

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 be recycled or reused as well as recommendations for waste sorting methods.

B. Contractor shall complete WMP and include cost of recycling / reuse in Bid. WMP will be submitted to Public Works Project Manager within 15 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 www4.uwm.edu/shwec/wrmd/search.cfm.

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	Name: _____
Wood	_____ cu. yds. _____ tons	_____ Recycled	_____ Reused	Name: _____
Wood Pallets	_____ units	_____ Recycled	_____ Reused	Name: _____
PVC Plastic	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Asphalt & Concrete	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Bricks & Masonry	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Vinyl Siding	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Cardboard	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Metals	_____ cu. yds. _____ tons	_____ Recycled	_____ Reused	Name: _____
Unpainted Gypsum / Drywall	_____ cu. yds. _____ tons	_____ Recycled	_____ Reused	Name: _____
Shingles	_____ cu. yds. _____ tons	_____ Recycled	_____ Reused	Name: _____
Fluorescent Lamps	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Foam Insulation	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Carpet Padding	_____ cu. ft. _____ lbs.	_____ Recycled	_____ Reused	Name: _____
Barrels & Drums	_____ units	_____ Recycled	_____ Reused	Name: _____

WASTE MANAGEMENT PLAN FORM

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

SECTION 02 41 13
DEMOLITION

PART 1 - GENERAL

SCOPE

The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for the demolition of site work and such features as required in these specifications and on the drawings. Included are the following topics:

INDEX

PART 1 GENERAL

- Scope
- Related Work
- Submittals
- Record Drawings
- Safety
- Permits
- Disconnection of Services
- Provisions for Future Work
- Removal/Salvaging of Items
- Owner Salvaged or Removed Materials

PART 2 - MATERIALS

- Equipment

PART 3 - EXECUTION

- Protection of Existing Work and Facilities
- Demolition
- Building Demolition
- Demolition below Grade
- Demolition Backfill
- Drain Tile
- Transportation and Disposal of Demolition Waste

RELATED WORK

Related Documents: Applicable provisions of Division 1 shall govern all work under this section.

SUBMITTALS

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

Submit record drawings.

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

Identification of work to remain and to be protected. Identification of materials to be salvaged.

RECORD DRAWINGS

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.

SAFETY

All construction fencing and tree protection to be installed and reviewed with Owner's Representative prior to beginning work.

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

3
4 Contact Diggers Hotline at 1-800-242-8511 in accordance with statutory requirements. Request that non-
5 member utilities and private utilities be located by the appropriate parties.

6
7 Take all necessary precautions while dismantling piping containing gas, gasoline, oil or other explosive or
8 toxic fluids or gases. Purge lines and contain materials in accordance with all applicable regulations. Store
9 such piping outdoors until fumes are removed.

10
11 Maintain a clean and orderly site. Remove debris at end of each workday.

12
13 Burning of debris is not permitted.

14
15 If hazardous materials are not anticipated, but encountered, terminate operations and contact the Owner
16 Construction Representative immediately. Follow all applicable local, state and federal regulations
17 pertaining to hazardous materials.

18
19 Contractor is solely responsible for worksite safety.

20
21 Perform all work in accordance with applicable OSHA, state and local safety standards.

22 23 PERMITS

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

26
27 If necessary, file and maintain Notification of Demolition and/or Renovation and Application for Permit
28 Exemption (WDNR Form 4500-113) in accordance with the Wisconsin Administrative Code Chapter
29 NR447.

30 31 DISCONNECTION OF SERVICES

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

34
35 Disconnect all services in manner which insures continued operation in facilities not scheduled for
36 demolition.

37
38 Disconnect all services in manner which allows for future connection to that service.

39
40 Disconnect services to equipment at unions, flanges, valves, or fittings wherever possible.

41 42 PROVISIONS FOR FUTURE WORK

43 Refer to drawings.

44 45 REMOVAL/SALVAGING OF ITEMS

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

47
48 Secure salvaged items to allow for future movement; provide pallets, skids and other devices as necessary.
49 Secure all loose parts.

50
51 Provide crates, padding, tarps and other measures necessary to protect salvaged items during storage. Store
52 items in secure location, safe from vandalism, weather, dust and other adverse elements.

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

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

6
7 OWNER SALVAGED OR REMOVED MATERIALS

8 None.

9
10 PART 2 - MATERIALS

11
12 EQUIPMENT

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

15
16
17 PART 3- EXECUTION

18
19 PROTECTION OF EXISTING WORK AND FACILITIES

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

22
23 Confine work to the minimum area reasonably necessary to undertake the work as determined by the
24 Owner Construction Representative. In no case shall construction activities extend beyond state property
25 lines or construction easements.

26
27 Furnish and install shoring, fencing or other barriers as shown on the plans or as otherwise necessary to
28 protect existing features. Obtain approval from Owner's Construction Representative of identification of
29 elements to be protected prior to proceeding with deconstruction.

30
31 Verify the locations of, and protect, buildings, structures, utilities, paved surfaces, fences, signs,
32 streetlights, utilities, landscaping and all other such facilities that are intended to remain or be salvaged as
33 noted on drawings.

34
35 Make such explorations and probes as necessary to ascertain any required protection measures that shall be
36 used before proceeding with demolition.

37
38 Provide and maintain adequate catch platforms, warning lights, barricades, guards, weather protection, dust
39 protection, fences, planking, bracing, shoring, piling, signs, and other items required for proper protection.
40 Provide protection for workers, public, adjacent construction and occupants of existing building(s).

41
42 Report damage of any facilities or items scheduled for salvaging to the Owner Construction
43 Representative.

44
45 Repair, replace or reconstruct any damaged facilities that are not scheduled for demolition.

46
47 Explosives shall not be used for demolition.

48
49 Keep streets, walks and all other adjacent paved areas clean and swept clear of dirt, mud and debris
50 deposited as a result of this operation.

51
52 Protect surrounding area from dust. Control rodents, and other vermin associated with demolition
53 operations. Provide temporary enclosure for interior rooms during demolition, including the Tunnel.

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

3
4 Cease operations if public safety or remaining structures are endangered. Perform temporary corrective
5 measures until operations can be continued properly.

6
7 If necessary, provide additional materials to protect existing building components that are to remain.
8 Where necessary to prevent collapse of any construction, install temporary shores, struts or bracing. Do
9 not commence demolition work until all temporary construction is complete.

10
11 Take precautions to guard against movement, settlement or collapse of any surrounding construction
12 designated to remain and be liable for any such movement, settlement or collapse.

13 14 DEMOLITION

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

17
18 Demolish and remove all portions of buildings and structures scheduled for demolition as shown on the
19 plans.

20
21 Abandon gas, electric and communication utilities in accordance with local utility company requirements,
22 or applicable substantive requirements if considered private.

23
24 Carry out vehicle loading as necessary within the project boundaries or as defined or indicated on the
25 drawings, but not in locations that block vehicular traffic on the streets or pedestrian traffic on adjacent
26 public walks.

27
28 Dismantle each structure in an orderly manner to provide complete stability of the structure at all times.
29 Provide bracing and shoring where necessary to avoid premature collapse of structure or damage to
30 portions of the building to remain.

31
32 Conduct demolition operations and the removal of rubbish and debris in such a way that a minimum of
33 nuisance dust is caused. Constantly sprinkle rubbish and debris with water if necessary to keep nuisance
34 dust to a minimum.

35
36 Where necessary to prevent collapse of any construction, install temporary shores, underpinning, struts or
37 bracing. Do not commence demolition work until all temporary construction is complete.

38
39 During the execution of the work, provide, operate, and maintain all pumping equipment, suction and
40 discharge lines in a number of capacity as required to keep all cellars and pits free of water from any
41 source whatsoever at all times.

42
43 Masonry and concrete shall be demolished in small sections. Use braces and shores as necessary to
44 support the structure of the building or structure and protect it from damage. Where limits of demolition
45 are exposed in the finished work, cutting shall be made with saws, providing an absolutely straight line,
46 plumb, true and square.

47 48 BUILDING DEMOLITION

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

51
52 Proceed with demolition in a systematic manner, from top of structure to ground. Complete demolition
53 work above each floor or tier before disturbing supporting members on lower levels.

1 Patch or repair any damaged surfaces or structural members at the limits of removal.
2
3 Remove structural framing members and lower to ground by hoists, derricks or other suitable means.
4 Refer to drawings for below grade structure to remain.
5
6 Remove existing flooring in accordance with plans. Remove all sealant, fasteners and damaged or rotten
7 blocking from existing construction to remain where demolition occurs. If hazardous materials are not
8 anticipated, but encountered, terminate operations and contact the Owner Construction Representative
9 immediately
10
11 Locate demolition equipment and remove structure so as to not impose excessive loads to supporting walls,
12 floors or framing.
13
14 Break up and remove concrete slabs-on-grade, unless otherwise shown to remain.
15
16 Remove all structures, retaining walls, stairs, paved surfaces, vegetation, and any other items; noted on the
17 drawings to be removed or demolished.
18
19 **DEMOLITION BELOW GRADE**
20 Existing footings and foundations to remain. Demolish only portions of foundation walls and other below
21 grade features in accordance with the plans to allow for new work.
22
23 **DEMOLITION BACKFILL**
24 Backfill and compact below grade areas and voids resulting from demolition of structures and other
25 abandonment and demolition.
26
27 Backfilling shall not begin until demolition and abandonment has been approved and documented by the
28 Owner Construction Representative.
29
30 Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen
31 materials, trash and debris.
32
33 Backfill type, lift thickness and compaction requirements shall be in accordance with Section 31 23 00 –
34 Foundation Excavating and Backfilling.
35
36 **DRAIN TILE**
37 Carefully protect and/or replace drain tiles encountered during demolition which are necessary to maintain
38 site drainage conditions. Immediately repair or replace any drain tiles not scheduled for demolition, but
39 damaged. Report damage to the Owner Construction Representative.
40 Repairs to drain tile or replacement drain tile shall be comparable or better than the existing drain tile
41 system.
42
43 Test drain lines with water to assure free flow before covering. Remove all obstructions which may be
44 found, retest until satisfactory.
45
46 **TRANSPORTATION AND DISPOSAL OF DEMOLITION WASTE**
47 Transport and dispose all demolition waste in accordance with local, state, and federal guidelines.
48
49 Whenever possible, or otherwise required by the Contract Documents, recycle demolition waste.
50
51 Demolition waste shall be disposed of at a landfill or dumpsite designed and approved to accept the given
52 waste.
53

1 Maintain records documenting recycling and disposal of demolition waste. Record description of material,
2 date removed, quantity removed, method of transport and recycling/disposal destination.

3
4 Remove materials without disruption to Owner or facility operations.

5
6 CLEANING

7
8 All adjacent areas shall be broom cleaned and ready to receive new construction.

9
10 The Contractor shall restore all disturbed areas in accordance with the drawings and specifications. If
11 plans and specifications do not address restoration of specific areas, these areas will be restored to pre-
12 construction conditions as approved by the Owner Construction Representative.

13
14
15
16

END OF SECTION 02 41 13

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

- 1 A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and
2 smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
3
- 4 B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material.
5 Provide lumber dressed on at least two edges and one side for tight fit.
6
- 7 2.02 STEEL REINFORCEMENT
- 8 A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
9 B. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel
10 wire into flat sheets.
11
- 12 C. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
13
- 14 D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening
15 reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel
16 wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice."
17 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use
18 CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
19
- 20 2.03 CONCRETE MATERIALS
- 21 A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and
22 source, throughout Project:
23 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
24 a. Fly Ash: ASTM C 618, Class C.
25 b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
26 2. Normal-Weight Aggregates: ASTM C 33 Free of materials with deleterious reactivity to
27 alkali in cement.
28
- 29 B. Water: ASTM C 94/C 94M and potable.
30
- 31 C. Air-Entraining Admixture: ASTM C 260.
32
- 33 D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with
34 other admixtures and that will not contribute water-soluble chloride ions exceeding those
35 permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium
36 chloride.
37 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
38 2. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
39
- 40 2.04 VAPOR RETARDERS
- 41 A. Plastic Vapor Retarder: ASTM E 1745, Class C, or polyethylene sheet, ASTM D 4397, not less
42 than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive joint
43 tape.
44
- 45 2.05 CURING MATERIALS
- 46 A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application
47 to fresh concrete.
48
- 49 B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing
50 approximately 9 oz./sq. yd. when dry.

- 1
2 C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene
3 sheet.
4
5 D. Water: Potable.
6
7 E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B,
8 dissipating.
9
10 F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B,
11 nondissipating, certified by curing compound manufacturer to not interfere with bonding of
12 floor covering.
13
14 G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315,
15 Type 1, Class A.
16
17 2.06 RELATED MATERIALS
18 A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber
19 or ASTM D 1752, cork or self-expanding cork.
20
21 2.07 CONCRETE MIXTURES
22 A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of
23 laboratory trial mixture or field test data, or both, according to ACI 301.
24

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)
Foundation Walls	3500	3	1	4-1/2	--	--	(A)
Interior Slab on Grade	4000	3	1	--	--	520	(B) (E)
Exterior Slab on Grade	4500	3	1	6	0.45	520	(B) (E)
Grout for Cores of Masonry Wall Construction	3000	7-10	3/8	--	.55		(D)

- 25
26 Comments:
27 A) Maximum replacement of cementitious materials by weight flyash 25%, slag 50%, Limit total
28 replacement of cementitious materials to 50%
29 B) Maximum replacement of cementitious materials by weight flyash 15%, slag 30%, Limit total
30 replacement of cementitious materials to 30%,
31 C) Provide 4-1/2% Air Entrainment At Exposed Conditions

- 1 D) Slump may be increased when chemical admixtures are used, provided that the admixture treated
2 concrete has the same or lower water-cement ratio and does not exhibit segregation potential or
3 excessive bleeding.
4 E) Concrete supplier and finisher shall coordinate approximate set times of proposed mix design un-
5 der various weather conditions and adjust mix design as necessary to assure set time is acceptable
6 to complete placing and finishing of slab in a timely manner.
7

8 2.08 FABRICATING REINFORCEMENT

- 9 A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."
10

11 2.09 CONCRETE MIXING

- 12 A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to
13 ASTM C 94/C 94M and ASTM C 1116, and furnish batch ticket information.
14 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from
15 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and
16 delivery time to 60 minutes.
17

18 PART 3 - EXECUTION

19
20 3.01 FORMWORK

- 21 A. Design, erect, shore, brace, and maintain formwork according to ACI 301 to support vertical,
22 lateral, static, and dynamic loads, and construction loads that might be applied, until structure
23 can support such loads.
24
25 B. Construct formwork so concrete members and structures are of size, shape, alignment,
26 elevation, and position indicated, within tolerance limits of ACI 117.
27
28 C. Chamfer exterior corners and edges of permanently exposed concrete.
29

30 3.02 EMBEDDED ITEMS

- 31 A. Place and secure anchorage devices and other embedded items required for adjoining work that
32 is attached to or supported by cast-in-place concrete. Use setting drawings, templates,
33 diagrams, instructions, and directions furnished with items to be embedded.
34

35 3.03 VAPOR RETARDERS

- 36 A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643
37 and manufacturer's written instructions.
38 1. Lap joints 6 inches and seal with manufacturer's recommended tap.
39

40 3.04 STEEL REINFORCEMENT

- 41 A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
42 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before
43 placing concrete.
44
45 B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that
46 would reduce bond to concrete.
47
48 C. Accurately position, support, and secure reinforcement against displacement. Locate and
49 support reinforcement with bar supports to maintain minimum concrete cover. Do not tack
50 weld crossing reinforcing bars.

- 1 1. Weld reinforcing bars according to AWS D1.4, where indicated.
2
3 D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
4
5 E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to
6 minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset
7 laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with
8 wire.
9
10 3.05 JOINTS
11 A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
12
13 B. Construction Joints: Install so strength and appearance of concrete are not impaired, at
14 locations indicated or as approved by Architect.
15
16 C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning
17 concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-
18 fourth of concrete thickness as follows:
19 1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof
20 abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when
21 cutting action will not tear, abrade, or otherwise damage surface and before concrete
22 develops random contraction cracks.
23
24 D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab
25 junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and
26 other locations, as indicated.
27
28 3.06 CONCRETE PLACEMENT
29 A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded
30 items is complete and that required inspections have been performed.
31
32 B. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new
33 concrete will be placed on concrete that has hardened enough to cause seams or planes of
34 weakness. If a section cannot be placed continuously, provide construction joints as indicated.
35 Deposit concrete to avoid segregation.
36 1. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
37
38 C. Cold-Weather Placement: Comply with ACI 306.1.
39
40 D. Hot-Weather Placement: Comply with ACI 301.
41
42 3.07 FINISHING FORMED SURFACES
43 A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes
44 and defects repaired and patched. Remove fins and other projections that exceed specified
45 limits on formed-surface irregularities.
46 1. Apply to concrete surfaces not exposed to public view .
47
48 B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in
49 an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and

1 defects. Remove fins and other projections that exceed specified limits on formed-surface
2 irregularities.
3

4 3.08 FINISHING FLOORS AND SLABS

5 A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and
6 finishing operations for concrete surfaces. Do not wet concrete surfaces.
7

8 B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-
9 floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4
10 inch in 1 direction.

11 1. Apply scratch finish to surfaces indicated and to receive concrete floor toppings to
12 receive mortar setting beds for bonded cementitious floor finishes
13

14 C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small
15 or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots.
16 Repeat float passes and restraightening until surface is left with a uniform, smooth, granular
17 texture.
18

19 D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by
20 hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of
21 trowel marks and uniform in texture and appearance. Grind smooth any surface defects that
22 would telegraph through applied coatings or floor coverings.

23 1. Finish and measure surface so gap at any point between concrete surface and an
24 unlevelled, freestanding, 10-foot- long straightedge resting on 2 high spots and placed
25 anywhere on the surface does not exceed 1/4 inch
26

27 E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and
28 elsewhere as indicated.
29

30 3.09 CONCRETE PROTECTING AND CURING

31 A. General: Protect freshly placed concrete from premature drying and excessive cold or hot
32 temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-
33 weather protection during curing.
34

35 B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or
36 windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing
37 operations. Apply according to manufacturer's written instructions after placing, screeding, and
38 bull floating or darbying concrete, but before float finishing.
39

40 C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

41 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days.

42 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining
43 cover for curing concrete, placed in widest practicable width, with sides and ends lapped
44 at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than
45 seven days. Immediately repair any holes or tears during curing period using cover
46 material and waterproof tape.

47 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller
48 according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall
49 within three hours after initial application. Maintain continuity of coating and repair
50 damage during curing period.

- a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.010 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.

3.011 FIELD QUALITY CONTROL

- A. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. but less than 25 cu. yd. plus one set for each additional 50 cu. yd. or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
 6. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi
 8. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive

1 strength at 28 days, concrete mixture proportions and materials, compressive breaking
2 strength, and type of break for both 7- and 28-day tests.

3 9. Additional Tests: Testing and inspecting agency shall make additional tests of concrete
4 when test results indicate that slump, air entrainment, compressive strengths, or other
5 requirements have not been met, as directed by Architect. Testing and inspecting agency
6 may conduct tests to determine adequacy of concrete by cored cylinders complying with
7 ASTM C 42/C 42M or by other methods as directed by Architect.

8 10. Additional testing and inspecting, at Contractor's expense, will be performed to determine
9 compliance of replaced or additional work with specified requirements.

10 11. Correct deficiencies in the Work that test reports and inspections indicate dos not comply
11 with the Contract Documents.

12
13
END OF SECTION 03 30 00

1 SECTION 04 05 19

2
3 MASONRY ACCESSORIES

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Applicable provisions of Division 1 shall govern all work under this section.

10
11 1.02 WORK INCLUDED

- 12
13 A. Single Wythe Wall Reinforcing
14
15 B. Ties and Anchors
16
17 C. Lintel Reinforcing

18
19 1.03 RELATED WORK

- 20
21 A. Section 04 10 00, Mortar and Masonry Grout
22
23 B. Section 04 20 00, Unit Masonry
24
25 C. Section 04 72 00, Stone Masonry
26
27 D. Section 05 50 00, Metal Fabrications (lintel & shelf angles)

28
29 1.04 SUBMITTALS

- 30
31 A. Submit in accord with the General Conditions of the Contract.
32 1. Manufacturer's Literature
33 a. Manufacturer's product literature for each accessory specified.

34
35 1.05 SUSTAINABLE DESIGN REQUIREMENTS

- 36
37 A. Recycled content: Provide products manufactured from recycled content as specified.
38 1. Steel: Minimum 50% post-consumer recycled content.

39
40 PART 2 - PRODUCTS

41
42 2.01 ACCESSORIES, GENERAL

- 43
44 A. Materials: Including, but not limited to the following, ties and anchors specified in this article
45 that are made from materials that comply with the following unless otherwise indicated.
46 1. Provide hot-dipped galvanized accessories unless noted otherwise, ASTM A153 Class 2
47 (1.50 ounces per square foot)
48 a. Prime following welded fabrication.

49
50 2.02 REINFORCEMENT

- 51
52 A. Reinforcing Steel:
53 1. Reinforcing Bars:

- 1 a. Uncoated deformed steel, ASTM A615, Grade 60.

2
3 2.03 JOINT REINFORCEMENT

- 4
5 A. Masonry Joint Reinforcement, General: ASTM A 951/A 951M.
6 1. Prefabricated welded-wire units with deformed continuous side rods and plain cross
7 rods, straight lengths of not less than 10'-0".
8 2. Steel Wire Size: 9 gauge side and cross rods.
9 3. Width: Approximately 2 inches less than nominal width of walls and partitions.
10 4. Mortar coverage: Minimum 5/8-inch on joint faces exposed to exterior and 1/2-inch
11 elsewhere.
12 5. Provide hot-dipped galvanized reinforcing, ASTM A153, Class B2, unless noted
13 otherwise.
14 6. Furnish prefabricated corners and tees.
15
16 B. Single Wythe Wall Reinforcing
17 1. Ladder type joint reinforcement, cross rods spaced not more than 16 inches on center.
18 a. Heckman Building Products
19 b. Dur-O-Wal, Ladur.
20 c. Hohmann & Barnard, No. 220.
21 d. Or approved equal.

22
23 2.04 TIES AND ANCHORS

- 24
25 A. Materials: Provide ties and anchors specified in this article that are made from materials that
26 comply with the following unless otherwise indicated.
27 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M; with
28 ASTM A 153/A 153M, Class B-2 coating.
29 2. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
30
31 B. Wire Ties, General: Unless otherwise indicated, size wire ties to extend at least halfway
32 through veneer but with at least 5/8-inch cover on outside face. Outer ends of wires are bent 90
33 degrees and extend 2 inches parallel to face of veneer.
34
35 C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
36 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long
37 may be used for masonry constructed from solid units.
38 2. Where wythes [do not align] [are of different materials], use adjustable ties with pintle-
39 and-eye connections having a maximum adjustment of 1-1/4 inches
40 3. Wire: Fabricate from 1/4-inch-diameter, hot-dip galvanized steel.
41
42 D. Veneer Anchors:
43 1. Heckman 187 corrugated veneer anchor, hot dipped galvanized after fabrication.
44 2. Or approved equal.

45
46 2.05 MISCELLANEOUS ANCHORS

- 47
48 A. Anchor Bolts:
49 1. Steel bolts with hex nuts and flat washers, ASTM A307, Grade A.
50 a. Hot-dip galvanized, Class C.
51 b. In sizes and configurations indicated.
52

- 1 B. Post-installed Anchors: Chemical or torque-controlled expansion anchors with capability to
2 sustain, without failure, a load equal to 6 times the load imposed when installed in concrete, per
3 ASTM E488 testing by qualified testing agency.
- 4 1. Material: Stainless-steel components complying with ASTM F593 and ASTM F594,
5 Alloy Group 1 or 2.
 - 6 a. Bolts and nuts ASTM F738 and ASTM F 836.
 - 7 b. Anchors: ASTM A666 or ASTM A 276 304 or 316.
 - 8
 - 9 2. Acceptable manufactures subject to compliance with requirements:
 - 10 a. Dur-O-Wall, Inc.
 - 11 b. Heckman Building Products, Inc.
 - 12 c. Hohmann & Barnard
 - 13 d. Masonry Reinforcing Corporation of America
 - 14 e. National Wire Products Industries
- 15
- 16 C. Shelf Angle Anchors: Unit type masonry inserts in concrete: cast iron or malleable iron inserts
17 of type and size indicated.
- 18
- 19 2.06 FLASHING
- 20
- 21 A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal
22 Manual" and Division 07 Section "Sheet Metal Flashing and Trim" and as follows:
 - 23 1. Metallic Wall Flashing: Pre-finished Galvanized: ASTM A653, G-90; 20 gauge
24 galvanized steel.
 - 25
 - 26 B. Fabricate wall flashing to conform to actual dimensions of wall and as follows:
 - 27 1. Exposed portion of flashing, when installed, shall break surface of wall uniformly.
 - 28 2. Concealed portion of flashing shall have a minimum 4" vertical back dam; bend between
29 back dam and horizontal shall be slightly greater than 90 degrees.
 - 30 a. End dams shall be a minimum of 2" in height.
 - 31
 - 32 3. Exposed portion of flashing shall have a 1/2" hemmed drip outer edge, bent down 30
33 degrees.
 - 34 4. Provide prefabricated continuous pieces fabricated specifically for each corner; pieces
35 shall be a minimum of 18" in length, in both directions from the corner.
 - 36 5. Notch and lap joints 3" between sections.
- 37
- 38 2.07 MISCELLANEOUS
- 39
- 40 A. Termination Bars: 304 stainless steel.
 - 41
 - 42 B. Compression Seal: Flexible semi-closed urethane
 - 43 1. Brock White No. 4290 Shok Pak
 - 44 2. Or approved equal.
 - 45 3. Installed 1/2" thicker than joint thickness.
 - 46
 - 47 C. Bond Breaker Strips:
 - 48 1. Asphalt-saturated organic roofing felt, ASTM D226, Type I, (No. 15 asphalt felt).
 - 49
 - 50 D. Isolation Sheet: 4 mil polyethylene; use to separate incompatible metals from direct contact.
 - 51
 - 52 E. Pipe Sleeves: Schedule 40, ASTM A53, 14 inches long.
 - 53 1. Provide and install as indicated on Drawings.

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- F. Pressure Treated Wood Blocking: Provide PT wood blocking, as indicated on Drawings and in accord with Section 06 10 00.

- G. Masonry Cleaners
 - 1. Do not use cleaning agents other than water without approval of A/E and unit manufacturer.
 - 2. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gallon of water.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Work of Other Trades: Prior to commencing work, carefully inspect, with installer present, and verify that work is complete to point where this installation may properly commence.

3.02 INSTALLATION OF ACCESSORIES IN MASONRY

- A. See Section 04 20 00 for installation of accessories.
- B. Concrete masonry walls shall be reinforced at every other bed joint with joint reinforcement.
- C. Install wall flashing as follows:
 - 1. Slope flashing to drain with masonry grout under horizontal portion of flashing.
 - 2. Apply a continuous bead of sealant within the laps between sections.
- D. Cleaning Reinforcing: Before placing, remove loose rust, ice, and other soiled materials from reinforcing.

END OF SECTION

SECTION 04 10 00

MORTAR AND MASONRY GROUT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

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.
- C. Stone Masonry: Section 04 43 00.

1.04 SUBMITTALS

- A. Submit in accord with the General Conditions of the Contract.
 - 1. Refer to Section 04 20 00 - Unit Masonry for pre-installation conference requirements.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Regional Materials: Provide materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the project site.
 - 1. Aggregate: Minimum 100%.
 - 2. Water: Minimum 100%.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

- A. Portland Cement: ASTM C150, Type 1, except Type III may be used for cold-weather construction.
 - 1. Provide natural color or white cement as required to produce mortar color indicated.
- B. Hydrated Lime: ASTM C207, Type S.
- C. Aggregate for Mortar: ASTM C144, natural or manufactured sand.
 - 1. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
 - 2. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.
- D. Water: Potable.
- E. Admixtures:

- 1. Antifreeze Compounds: Not allowed.
 - 2. Chloride mixtures: Not allowed.
 - 3. Air entrainment: Not allowed.
 - 4. Do not add set-retarding or set-accelerating, bond modifying, or corrosion-inhibiting admixtures to mortar or grout without written approval of A/E.
- F. Masons Cement: Not allowed.
- G. 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. Color: As selected by A/E from manufacturer's full range.
 - 3. Application: Use pigmented mortar for exposed mortar joints with the following units:
 - a. Limestone.

2.02 GROUT MATERIALS

- A. Grout Design Mix: ASTM C476
- 1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
 - 2. Proportion grout in accordance with ASTM C 476, for specified 28-day compressive strength indicated, but not less than 3,000 psi, unless noted otherwise on Structural Drawings.
 - 3. Provide slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.
- B. Aggregate for Grout: ASTM C 404, natural or manufactured sand, gravel, crushed stone, or slag.

2.03 MORTAR AND GROUT MIXES

- A. Measure and mix in accordance with ASTM C270.
- 1. Use portland cement-lime mortar unless otherwise indicated.
- B. Mortar Proportions by Volume.

Application	Mortar Type
For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated	N
Reinforced masonry	S or N

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

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- D. Thoroughly mix cementitious materials and aggregates with the amount of water to produce satisfactory workability. All mortar shall be machine mixed.
- E. Mix mortar as required for immediate use only and discard any mixed for a period exceeding 2-1/2 hours.
- F. 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.

PART 3 - EXECUTION

3.01 APPLICATION

- A. See Section 04 20 00 for application.

END OF SECTION

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SECTION 04 20 00

UNIT MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

1.02 WORK INCLUDED

- A. Concrete Masonry.

1.03 RELATED WORK

- A. Mortar and Masonry Grout: Section 04 10 00.
- B. Masonry Accessories: Section 04 05 19.
- C. Stone Masonry: Section 04 43 00.
- D. Sheet Metal Flashing and Trim: Section 07 62 00.
- E. Joints Sealants: Section 07 92 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 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."

- B. Provide mock-ups in the location as indicated on Drawings.
 - 1. All components of wall construction, wall openings, wall base, window sills, flashing, etc. to be included in mock-up as indicated on drawings.
 - 2. Mock-up may be in-place of eight (8) square feet including outside corner. Mock-up will include entire wall system for AE approval prior to continuing work.

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 10°F.
 - 5. 40°F to 20°F: Mortar:
 - a. Heat mixing water and sand to produce mortar temperatures between 40°F and 120°F; maintain temperature of mortar on boards above freezing.
 - 6. Grout:
 - a. Heat grout materials to 90 F to produce in-place grout temperature of 70°F at end of work day.
 - 7. 25°F and Below: Mortar:
 - a. Heat mixing water and sand to produce mortar temperatures between 40°F and 120°F. Maintain temperature of mortar on boards above freezing.
 - 8. Grout: Heat grout materials to 90°F to produce in-place grout temperature of 70°F at end of work day.
 - 9. Masonry Units: Heat masonry units so that they are above 20°F at time of laying.

- a. Provide enclosure and auxiliary heat to maintain an air temperature of at least 40°F for 24 hours after laying units.
 - b. Protect completed masonry and masonry not being work on by maintaining air temperature above 40°F 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 95°F 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. Recycled content: Provide products manufactured from recycled content as specified.
 - 1. CMU: Minimum 40% pre-consumer recycled content.
- B. Regional Materials: Provide materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the project site.
 - 1. CMU: 100%.
- C. 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.

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.

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. 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.
- 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 pea gravel grout having compressive strength of 3,000 psi, with slump ranging between 7"-10", 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 04 43 00

STONE MASONRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

1.02 WORK INCLUDED

- A. Anchorage and setting systems.
- B. Accessories.

1.03 RELATED SECTIONS

- A. Section 04 05 19 Masonry Accessories
- B. Section 04 20 00 Unit Masonry
- C. Section 07 62 00 Sheet Metal Flashing and Trim
- D. Section 07 92 00 Joint Sealants

1.04 QUALITY ASSURANCE

- A. Manufacturer shall have minimum of five years production experience in work of quality and scope required on this Project.
- B. Each color, grade, finish, type, and variety of stone shall be from a single quarry with sufficient resources to furnish materials of consistent quality, appearance, and physical properties.
- C. All units, setting methods and finish shall be in strict accordance with Industry Standards and Practices set forth by the Indiana Limestone Institute of America.

1.05 SUBMITTALS

- A. Submit in accord with the general conditions of this contract.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings:
 - 1. Shop Drawings shall be complete and shall include a layout plan, fabrication details, connection and anchorage details, location of lifting devices, and member identification marks. The identification marks shall appear on the manufactured units to facilitate correct field placement. Manufacturer's standard hardware will be clearly described.
- D. Samples:
 - 1. Submit three 12 inch x 12 inch samples representative of finished units showing full range of color and texture.
- E. Mock-up:
 - 1. Provide a mock-up in place of eight (8) square feet including an outside corner. Mock-up will include entire wall system for AE approval prior to continuing work.

- 1
2 F. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone
3 fitters. Minimum 10 years experience.
4
5 G. Source Limitations for Stone: Obtain stone, regardless of finish, from one quarry with resources
6 to provide materials of consistent quality in appearance and physical properties.
7
8 H. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality,
9 including color for exposed masonry, from single manufacturer for each cementitious
10 component and from single source or producer for each aggregate.

11
12 1.06 DELIVERY, STORAGE AND HANDLING

- 13
14 A. Transport and handle with proper equipment to protect units from dirt and damage. Place non-
15 staining resilient spacers of even thickness between each unit. Units shall be palletized.
16
17 B. Store to protect units from contact with soil or ground. Store units on firm surfaces to avoid
18 warping and cracking. Place stored units so that identification marks are discernible.
19

20 1.07 PROJECT CONDITIONS

- 21
22 A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills
23 with waterproof sheeting at end of each day's work. Cover partially completed stone masonry
24 when construction is not in progress.
25 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
26
27 B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of
28 stone masonry.
29 1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on
30 the ground and over the wall surface.
31 2. Protect sills, ledges, and projections from mortar droppings.
32 3. Protect surfaces of window and door frames, as well as similar products with painted and
33 integral finishes, from mortar droppings.
34 4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from
35 splashing mortar and dirt on completed stone masonry.
36
37 C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice
38 or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by
39 frost or freezing conditions.
40 1. Comply with cold-weather construction requirements contained in
41 ACI 530.1/ASCE 6/TMS 602.
42 2. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40
43 deg F and above and will remain so until masonry has dried, but not less than 7 days
44 after completing cleaning.
45
46 D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in
47 ACI 530.1/ASCE 6/TMS 602.
48

49 1.08 ENVIRONMENTAL REQUIREMENTS

- 50
51 A. Recycled content: Provide products manufactured from recycled content as specified.
52 1. Stainless steel anchors: Minimum 60% pre consumer.
53 2. Fasteners: Minimum 60% pre consumer.
54 3. Metal flashing: Minimum 12% post-consumer recycled content.
55

1 B. Regional Materials: Provide materials or products that have been extracted, harvested, or
2 recovered, as well as manufactured, within 500 miles of the project site.

3
4 1.09 COORDINATION

5
6 A. Advise installers of other work about specific requirements for placement of reinforcement,
7 veneer anchors, flashing, and similar items to be built into stone masonry.

8
9 PART 2 - PRODUCTS

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11 2.01 LIMESTONE

12
13 A. Limestone: Comply with ASTM C 568.

14 1. Products: Subject to compliance with requirements, stone varieties to be incorporated
15 into the Work include the following:

16 a. Stone Type-1 (Rusticated): Buechel Chilton Rustic

17 1) Pattern: Random Ashlar to match Animal Health Center.

18 2) Sizes: Height 2 1/4"-10", Length 8"-36", Bed width 3 3/4" – 5".

19
20 b. Stone Type-2 (Cut): Buechel Chilton (no red)

21 1) Sizes: Sizes indicated on Drawings.

22 2) Finish: Smooth (cut).

23
24 c. Or approved equal by Halquist Stone Chilten Weather edge Seamface brown,
25 Eden Stone Chilten Weather edge No red, or approved equal.

26
27 2.02 ANCHORS

28
29 A. Veneer Anchors

30 1. Materials:

31 a. Hot dipped galvanized.

32
33 2. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone
34 masonry and with at least 5/8-inch cover on outside face.

35
36 3. Provide veneer anchors, dowels, and fasteners as required by various conditions.

37 a. Dowels to be equal to Heckman 155, hot dipped galvanized, 3/8" diameter at sill
38 pieces. by length required to securely anchor stone to back-up.

39
40 4. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both
41 tension and compression without deforming or developing play in excess of 0.05 inch.

42
43 2.03 EMBEDDED FLASHING MATERIALS

44
45 A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where
46 indicated, complying with SMACNA's "Architectural Sheet Metal Manual and Division 7
47 Section "Sheet Metal Flashing and Trim" and as follows:

48 1. 20 ga. hot dipped galvanized.

49 2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not
50 exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

51 3. Flashings are to project a minimum of 3/4" from the face of the wall, be bent down at a 45
52 degree angle to cause water to flow away from the wall and shall be hemmed.

53
54 B. Concealed portion of flashing shall have a minimum 4" vertical back dam; bend between back
55 dam and horizontal shall be slightly greater than 90 degrees. End dams shall be a minimum of
56 1-1/2" in height.

- 1
2 C. Provide prefabricated continuous pieces at all internal/external corners; pieces shall be a
3 minimum of 18" in length, in both directions from the corner.
4
5 D. Notch and lap joints 3" between sections. Apply a continuous bead of sealant within the lap.
6
7 E. Slope flashing to drain with masonry grout under horizontal portion of flashing.
8
9 F. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by
10 extending flashing 3/4 inch out from wall, with outer edge bent down 30 degrees and hemmed.
11
12 G. At caps, sills, copings, etc. flashing is to project from the wall a minimum of 1 1/2" and shall be
13 hemmed.
14

15 2.04 MISCELLANEOUS MASONRY ACCESSORIES

- 16
17 A. Compressible Filler: Pre-molded filler strips complying with ASTM D 1056, Grade 2A1;
18 compressible up to 35 percent; of width and thickness indicated; formulated from urethane.
19
20 B. Water: Potable.
21

22 2.05 MORTAR MIXES

- 23
24 A. General: As specified in Section 04 01 00.
25

26 2.06 FABRICATION

- 27
28 A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone
29 association or, if none, by stone source, for faces, edges, beds, and backs.
30
31 B. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."
32 1. Cut and select stone to produce pieces of thickness, size, and shape indicated, including
33 details on Drawings. Dress joints (bed and vertical) straight and at right angle to face
34 unless otherwise indicated.
35 2. Cut and drill sinkages and holes in stone for anchors and supports.
36 3. Carefully inspect stone at quarry or fabrication plant for compliance with requirements
37 for appearance, material, and fabrication. Replace defective units before shipment.
38 4. Clean sawed backs of stone to remove rust stains and iron particles.
39
40 C. Thickness of Stone: Provide thickness indicated, but not less than the following:
41 1. Thickness: 4 inches plus or minus 1/8 inch. Thickness does not include projection of
42 pitched faces.
43
44 D. Shape stone to match the existing profiles, details and tooling of sound units.
45 1. If existing units are eroded or details are missing, provide profiles and details with sharp
46 edges and whole details to approximate original shapes.
47

48 PART 3 - EXECUTION

49
50 3.01 EXAMINATION

- 51
52 A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with
53 requirements for installation tolerances and other conditions affecting performance.
54

- 1 B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing,
2 and other items installed in substrates and required for or extending into stone masonry are
3 correctly installed.
4
- 5 C. Proceed with installation only after unsatisfactory conditions have been corrected.
6
- 7 3.02 PREPARATION
8
- 9 A. Coordinate delivery, erection of units.
10
- 11 B. Protect the work and material of other trades during installation of units.
12
- 13 3.03 INSTALLATION
14
- 15 A. Transportation, Site Handling, Erection: Performed with acceptable equipment methods, by
16 qualified personnel acceptable to Indiana Limestone Institute of America.
17
- 18 B. Set units in full bed of mortar. Leave 3/8 inch space for end joints. Install backer rod and sealant.
19
- 20 C. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2
21 inches, through stone masonry and with at least 5/8-inch cover on outside face.
22
- 23 D. Space anchors not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, 32" if units
24 are 16", with not less than 1 anchor per 2.67 sq. ft. of wall area. Install additional anchors within
25 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.
26
- 27 E. Install embedded flashing shelf angles, lintels, ledges, other obstructions to downward flow of
28 water in wall, and where indicated.
29 1. At multi-wythe masonry walls, extend flashing through stone masonry, turned up a
30 minimum of 8 inches, and attached to concrete backup with continuous termination bar
31 and sealant.
32 2. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches
33 into masonry at each end.
34 3. At sills, extend flashing not less than 4 inches at ends.
35 4. At ends of head and sill flashing turn up not less than 2 inches to form end dams.
36 5. Extend sheet metal flashing 3/4 inch beyond face of masonry at exterior and turn
37 flashing down to form a 3/4 inch hemmed drip.
38
- 39 F. Place and align the members in final position in the structure on the accepted bearing surfaces.
40
- 41 3.04 CLEANING
42
- 43 A. After all installation procedures, including joint treatment are completed, clean exposed faces of
44 units.
45
- 46 B. All masonry shall be in final acceptance condition within 24 hours after laying and shall be
47 maintained in that condition, by meeting or exceeding the degree of cleanliness required,
48 demonstrated on the approved sample panel.
49
- 50 C. Lay masonry utilizing all necessary care to achieve cleanliness. Remove excess mortar from
51 exposed exterior and interior (stone, clay, concrete and other) masonry surfaces as the work
52 progresses and before it tenaciously adheres to the faces of the masonry.
53 1. Remove mortar protrusions and smears as masonry units are laid and tooled, as scaffolds
54 are raised, and at the start of the next day's work, leaving the surface of the masonry
55 clean and finished.

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35
36
2. Contractor may use calcimine brushes, stiff fiber brushes, other similar masonry units, burlap, rags, carpet remnants, rubber floats or other approved means. (Cleaning of masonry the morning after laying by the same masons who laid the masonry the previous day, using stiff fiber brushes with or without water and sand, concentrating on cleaning the field of the masonry units, has also been successfully used to achieve an appearance matching or exceeding the cleanliness of the approved sample panel.)
 3. USE OF CHEMICAL CLEANING OR HARSH PHYSICAL CLEANING WILL NOT BE PERMITTED. Included are chemical cleaners and most manufactured masonry cleaning solutions or compounds. Approval of DSF Representative is required before anything other than potable water is used.
 4. Equipment or methods and techniques utilized, reduced productivity, as well as weather conditions experienced will not relieve Contractor of required compliance.
- D. Protection shall be provided to prevent mortar spattering and maintain masonry in a clean condition so that the masonry is satisfactory for acceptance when masonry work is completed.
1. This may require covering portions of finished masonry which is below new work in progress with polyethylene, canvas or other approved means.
 2. Cover tops of unfinished walls and new work during inclement weather and at the end of each day's work to prevent moisture entry.
 3. Extend covering a minimum of 24 inches down both sides of wall and hold covering securely in place. Hair-pin type devices frequently spaced have been successfully used in the past.
- E. No final washdown is required unless removal of earthy construction dirt or dust is necessitated by extremely unusual site conditions.
- F. If any masonry is not cleaned as required by these specifications, or if walls have an unsatisfactory appearance upon completion of work, such violations will require additional work by the Contractor for producing acceptable masonry at no extra cost to the Owner.
1. This is not to be construed as a Contractor's option. Procedures must be submitted by the Contractor and samples approved by all other parties to the contract, prior to proceeding with such work.

END OF SECTION 04 43 00

1 SECTION 05 12 00

2
3 STRUCTURAL STEEL FRAMING

4
5 PART 1 - GENERAL

6 1.01 SUMMARY

- 7
8 A. This Section includes structural steel and grout.

9
10 1.02 SUBMITTALS

- 11
12 A. Product Data: For each type of product indicated.
13
14 B. Shop Drawings: Show fabrication of structural-steel components.
15
16 C. Welding certificates.
17
18 D. Source quality-control test reports.

19
20 1.03 QUALITY ASSURANCE

- 21
22 A. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality
23 Certification Program and is designated an AISC-Certified Plant, Category Sbd.
24
25 B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding
26 Code--Steel."
27
28 C. Comply with applicable provisions of AISC's "Code of Standard Practice for Steel Buildings
29 and Bridges."
30

31 PART 2 - PRODUCTS

32
33 2.01 STRUCTURAL-STEEL MATERIALS

- 34
35 A. W-Shapes: ASTM A 992/A 992M Grade 50.
36
37 B. Plate and Bar: ASTM A 36/A 36M.
38
39 C. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
40
41 D. Welding Electrodes: Comply with AWS requirements.

42
43
44 2.02 BOLTS, CONNECTORS, AND ANCHORS

- 45
46 A. Unheaded Anchor Rods: ASTM F 1554, Grade 36.
47 1. Configuration: As detailed .
48 2. Finish: Plain unless noted otherwise.
49

- 1 B. Headed Anchor Rods: ASTM F 1554, Grade 36, straight.
2 1. Finish: Plain unless noted otherwise.
3
4 C. Threaded Rods: ASTM A 36/A 36M.
5 1. Finish: Plain unless noted otherwise.
6
7 2.03 PRIMER
8 A. Primer: SSPC-Paint 25, Type II, iron oxide, zinc oxide, raw linseed oil, and alkyd.
9
10 B. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.
11
12 2.04 GROUT
13 A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic
14 aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for
15 application and a 30-minute working time.
16
17 2.05 FABRICATION
18 A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate
19 according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's
20 AISC's "Specification for Structural Steel Buildings (AISC 360-05)
21
22 B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances,
23 appearance, and quality of welds and for methods used in correcting welding work.
24
25 2.06 SHOP PRIMING
26
27 A. Shop prime steel surfaces except the following:
28 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded
29 members to a depth of 2 inches.
30 2. Surfaces to be field welded.
31
32 B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and
33 spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and
34 standards:
35 1. SSPC-SP 2, "Hand Tool Cleaning."
36
37 C. Priming: Immediately after surface preparation, apply primer according to manufacturer's
38 written instructions and at rate recommended by SSPC to provide a dry film thickness of not
39 less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges,
40 and exposed surfaces.
41
42 2.07 SOURCE QUALITY CONTROL
43 A. Owner will engage an independent testing and inspecting agency to perform shop tests and
44 inspections and prepare test reports. Comply with testing and inspection requirements of Part 3,
45 Article "Field Quality Control."
46
47 B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the
48 Contract Documents.
49
50 C. In addition to visual inspection, shop-welded shear connectors will be tested and inspected
51 according to requirements in AWS D1.1 for stud welding.

1
2 PART 3 - EXECUTION

3
4 3.01 ERECTION

- 5 A. Examination: Verify elevations of concrete- and masonry-bearing surfaces and locations of
6 anchor rods, bearing plates, and other embedments, with steel erector present, for compliance
7 with requirements.
8 1. Proceed with installation only after unsatisfactory conditions have been corrected.
9
10 B. Set structural steel accurately in locations and to elevations indicated and according to AISC's
11 "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for
12 Structural Steel Buildings (AISC 360-05)"
13
14 C. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing
15 materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface
16 of base and bearing plates.
17 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as
18 required.
19 2. Snug-tighten anchor rods after supported members have been positioned and plumbed.
20 Do not remove wedges or shims but, if protruding, cut off flush with edge of base or
21 bearing plate before packing with grout.
22 3. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no
23 voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply
24 with manufacturer's written installation instructions for shrinkage-resistant grouts.
25 D. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for
26 Steel Buildings and Bridges."
27

28 3.02 FIELD QUALITY CONTROL

- 29 A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to
30 inspect field welds and high-strength bolted connections.
31
32 B. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
33 1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the
34 following inspection procedures, at testing agency's option:
35 a. Liquid Penetrant Inspection: ASTM E 165.
36 b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on
37 finished weld. Cracks or zones of incomplete fusion or penetration will not be
38 accepted.
39 c. Ultrasonic Inspection: ASTM E 164.
40 d. Radiographic Inspection: ASTM E 94.
41
42 C. In addition to visual inspection, test and inspect shop and field-welded shear connectors
43 according to requirements in AWS D1.1 for stud welding and as follows:
44 1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree
45 flash or welding repairs to any shear connector.
46
47 D. Correct deficiencies in Work that test reports and inspections indicate does not comply with the
48 Contract Documents.
49

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1 SECTION 05 31 00

2
3 STEEL DECKING

4
5 PART 1 - GENERAL

6
7 1.01 SUMMARY

8
9 A. This Section includes the following:

10 1. Roof deck.

11
12 1.02 SUBMITTALS

13
14 A. Product Data: For each type of deck, accessory, and product indicated.

15
16 B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels,
17 pans, cut deck openings, special jointing, accessories, and attachments to other construction.

18
19 C. Product certificates.

20
21 D. Field quality-control test and inspection reports.

22
23 E. Research/Evaluation Reports: For steel deck.

24
25 1.03 QUALITY ASSURANCE

26
27 A. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding
28 Code - Sheet Steel."

29
30 B. AISI Specifications: Comply with calculated structural characteristics of steel deck according
31 to AISI's "North American Specification for the Design of Cold-Formed Steel Structural
32 Members."

33
34 1.04 DELIVERY, STORAGE, AND HANDLING

35
36 A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and
37 handling.

38
39 B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a
40 waterproof covering and ventilate to avoid condensation.

41
42 PART 2 - PRODUCTS

43
44 2.01 MANUFACTURERS

45
46 A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering
47 products that may be incorporated into the Work.

48
49 B. Manufacturers: Subject to compliance with requirements, provide products by one of the
50 following:

51 1. ASC Profiles, Inc.

- 1 2. Canam Steel Corp.;The Canam Manac Group.
- 2 3. Consolidated Systems, Inc.
- 3 4. DACS, Inc.
- 4 5. D-Mac Industries Inc.
- 5 6. Epic Metals Corporation.
- 6 7. Marlyn Steel Decks, Inc.
- 7 8. New Millennium Building Systems, LLC.
- 8 9. Nucor Corp.; Vulcraft Division.
- 9 10. Roof Deck, Inc.
- 10 11. United Steel Deck, Inc.
- 11 12. Valley Joist; Division of EBSCO Industries, Inc.
- 12 13. Verco Manufacturing Co.
- 13 14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

14
15 2.02 ROOF DECK

- 16
17 A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI
18 Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 30, and with the
19 following:
- 20 1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33
21 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
 - 22 a. Color: Manufacturer's standard gray or white.
 - 23 2. Galvanized Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS), Grade 33, G60
24 zinc coating.
 - 25 3. Galvanized and Shop-Primed Steel Sheet: ASTM A 653/A 653M, Structural Steel (SS),
26 Grade 33, G60 zinc coating; cleaned, pretreated, and primed with manufacturer's standard
27 baked-on, rust-inhibitive primer.
 - 28 a. Color: Manufacturer's standard gray or white .
 - 29 4. Deck Profile: As indicated.
 - 30 5. Profile Depth: As indicated.
 - 31 6. Design Uncoated-Steel Thickness: As indicated.

32
33 2.03 ACCESSORIES

- 34
35 A. General: Provide manufacturer's standard accessory materials for deck that comply with
36 requirements indicated.
- 37
38 B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically
39 driven carbon-steel fasteners; or self-drilling, self-threading screws.
- 40
41 C. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
- 42
43 D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000
44 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of
45 profile indicated or required for application.
- 46
47 E. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

48
49 PART 3 - EXECUTION

50

- 1 3.01 INSTALLATION
2
3 A. Install deck panels and accessories according to applicable specifications and commentary in
4 SDI Publication No. 30, manufacturer's written instructions, requirements in this Section, and as
5 indicated.
6
7 B. Place deck panels on supporting frame and adjust to final position with ends accurately aligned
8 and bearing on supporting frame before being permanently fastened. Do not stretch or contract
9 side-lap interlocks.
10
11 C. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
12
13 D. Cut and neatly fit deck panels and accessories around openings and other work projecting
14 through or adjacent to deck.
15
16 E. Provide additional reinforcement and closure pieces at openings as required for strength,
17 continuity of deck, and support of other work.
18
19 F. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical
20 fasteners and install according to deck manufacturer's written instructions.
21
22 G. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2
23 inches.
24
25 H. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end
26 closures, and reinforcing channels according to deck manufacturer's written instructions.
27 Mechanically fasten to substrate to provide a complete deck installation.
28
- 29 3.02 REPAIRS
30
31 A. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of
32 prime-painted deck immediately after installation, and apply repair paint.
33
34

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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: As indicated.
 - 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 .
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.
- 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 EXTERIOR NON-LOAD-BEARING WALL 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. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads.
- D. 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.
- C. Shims: Load bearing, high-density multimonomer plastic, nonleaching.
- D. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.05 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C shaped steel joists of web depths indicated, unpunched with stiffened flanges.

- B. Steel Joist Track: Manufacturer's standard U shaped joist track.
- C. Provide bridging rows at 8' oc using manufacturer's standard details.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Install load bearing shims or grout between the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets to isolate the underside of wall bottom track or rim track and the top of foundation wall or slab at stud or joist locations.

3.02 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. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- F. Install insulation, specified in Division 07 Section "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- G. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- H. 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.

3.03 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install deflection tracks or vertical deflection clips to studs as required to anchor to primary building structure.
- E. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain-wall-framing system.

3.04 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

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1 SECTION 05 50 00

2
3 METAL FABRICATIONS

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Applicable provisions of Division 1 shall govern all work under this section.

10
11 1.02 WORK INCLUDED

- 12
13 A. Wire Mesh Screen and Bug Screen.
14
15 B. Steel Handrails.
16
17 C. Steel door frame and stops, see 08 71 00 and drawings including dumpster enclosure gates.
18
19 D. All angles and miscellaneous metals to be set in concrete.
20
21 E. All angles, tubes, bent metal, lintels and miscellaneous steel supports for stone or masonry.
22
23 F. Metal accessories.
24 1. Including, but not limited to, anchors, bolts, screws, joist hangers, and fasteners.
25
26 G. Misc. Metal Brackets, supports, etc. as shown on drawings.

27
28 1.03 RELATED WORK

- 29
30 A. Cast-in-Place Concrete: Section 03 30 00.
31
32 B. Unit Masonry: Section 04 20 00.
33
34 C. Stone Masonry 04 43 00
35
36 D. Structural Steel: Section 05 12 23.
37
38 E. Finished Carpentry: Section 06 20 00.
39
40 F. Painting: Section 09 90 00.

41
42 1.04 REFERENCES

- 43
44 A. Metal Fabrications shall be in strict accord with Wisconsin Commercial Building Code, Chapter
45 11 - "Accessibility".

46
47 1.05 SUBMITTALS

- 48
49 A. Submit in accord with the General Conditions of the Contract.
50 1. Shop drawings required for all items. Show all work to be fabricated with all
51 construction details shown in appropriate scale, methods of attachments to other
52 materials, finished dimensions, shop welds and grinding of welds, field assembly joints,
53 etc.

- 1 2. Coordinate work with other suppliers and subcontractors; obtain their approved shop
2 drawing where necessary, or obtain any necessary additional detail information
3 regarding mounting conditions or other aspects of related work.
4

5 1.06 QUALITY ASSURANCE
6

- 7 A. Take field measurements prior to shop drawing preparation and fabrication.
8
9 B. Comply with the provisions of the following except as otherwise indicated:
10 1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
11 2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for
12 Buildings", including the "Commentary" and Supplements thereto as issued.
13 3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by
14 the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
15 4. AWS D1.1 "Structural Welding Code".
16
17 C. Qualify welding process and welding operators in accordance with the AWS "Standard Qualification
18 Procedure". Provide certification that welders to be employed in the work have satisfactorily passed
19 AWS qualification tests within the previous twelve months. If recertification of welders is required,
20 retesting will be the Contractor's responsibility.
21
22 D. Structural Performances
23 1. Handrails and top rails shall be capable of withstanding concentrated loads of 200 lbs. applied
24 at any point in any direction or a uniform load of 50 lbs/ft applied horizontally at the top rail,
25 whichever produces the greatest stress.
26
27 E. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
28 Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for
29 reassembly and coordinated installation.
30

31 1.07 DELIVERY, STORAGE AND HANDLING
32

- 33 A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation.
34 Damaged material will be rejected.
35
36 B. Items to be built into concrete, masonry, etc. shall be furnished by the respective contractor and the
37 contractor shall build this into the work as the work progresses.
38

39 1.08 PROJECT CONDITIONS
40

- 41 A. Verify dimensions in field for pre-cut or prefabricated items.
42
43 B. Examine job conditions and adjoining construction which may affect the acceptability of the work.
44
45 C. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates,
46 and directions for installing embedments and other items that are to be embedded in concrete.
47 Deliver such items to Project site in time for installation.
48

49 1.09 SUSTAINABLE DESIGN REQUIREMENTS
50

- 51 A. Recycled content: Provide products manufactured from recycled content as specified.
52 1. Steel: Minimum 75% post-consumer recycled content.
53 2. Stainless steel: Minimum 50% post-consumer recycled content.
54 3. Aluminum: Minimum 50% post-consumer recycled content.
55

- 1 B. Regional Materials: Provide materials or products that have been extracted, harvested, or recovered,
2 as well as manufactured, within 500 miles of the project site.
3 1. Steel: 50%.
4
- 5 C. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-
6 site must meet the limitations and restrictions concerning chemical components set by the following
7 standards:
8 1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.
9 2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints",
10 Second Edition, January 7, 1997. For applications on ferrous metal substrates.
11 3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality
12 Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on
13 January 1, 2004.
14
- 15 D. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building
16 (defined as inside the weatherproofing system and applied on site) must not exceed the following
17 requirements.
18 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD)
19 Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7,
20 2005.
21 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in
22 effect on October 19, 2000.
23

24 PART 2 - PRODUCTS

25 2.01 METAL FOR FABRICATIONS

- 26 A. Cold-rolled carbon steel sheets: ASTM A336.
27
- 28 B. Structural Steel Sheet: Hot rolled ASTM A570, or cold-rolled ASTM A611, of grade required for
29 design loading, minimum of Grade C.
30
- 31 C. Galvanized carbon steel sheets: ASTM A446, with G90 zinc coating.
32
- 33 D. Welding materials: AWS D1.1; type required for materials being welded.
34
- 35 E. Shop coat primer: FS-TT-P-32, for shop application and field touch-up.
36
- 37 F. Touch-up primer for galvanized surfaces.
38 1. Steel shapes and fasteners, in general, for exterior use and where built into exterior wall: zinc
39 coated.
40
- 41 G. Structural Steel: ASTM A36.
42
- 43 H. Structural Steel Angles: ASTM A36, hot dipped galvanized.
44
- 45 I. Steel Pipe: ASTM A53, Type S, Grade A, standard weight, schedule 40.
46
- 47 J. Steel Bars and Bar Size Shapes: ASTM A 306, Grade 65, or ASTM A 36.
48
- 49 K. Castings: Gray iron, ASTM A48-83 Class 35B; or Ductile iron ASTM A536-80 Grade 65-45-12.
50

51 2.02 GALVANIZED STEEL

- 52 A. All exterior galvanized steel shall be hot-dipped galvanized.
53

1 1. Straighten steel shapes that are warped by hot-dipped galvanizing process.

2
3 2.03 ACCESSORIES

4
5 A. Concrete Inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM
6 A 47 or cast steel ASTM A 27. Provide bolts, washers and shims as require, hot-dipped galvanized,
7 ASTM A 153.

8
9 B. Fasteners: Including, but not limited to the following;

10 1. Provide zinc-coated fasteners for exterior use where built into exterior walls or where shown
11 on drawings. Select fasteners for the type, grade and class required.

12 a. Provide hot-dipped galvanized coating for fasteners less than 1/2" diameter that are in
13 contact with pressure-treated wood.

14 2. Bolts and Nuts: Regular hexhead type, ASTM A 307, Grade A or Type 304 stainless steel,
15 ASTM A 320. High Strength bolts and nuts, ASTM A 325.

16 3. Lag Bolts: Type, FS FF-B-561.

17 4. Machine Screws: Cadmium plated steel, FS FF-S-92, Security Screw

18 5. Wood Screws: Carbon steel, FS FF-S-111.

19 6. Plain Washers: Round, carbon steel, FS FF-W-92.

20 7. Concrete Anchorage Devices: Wedge-type expansion bolts, FS FF-S-325, Group II, Type 4,
21 Class 1, zinc coated or stainless steel as shown on the drawings and installed in accordance
22 with manufacturer's recommendations.

23 a. "Kwik-bolt", Hilti Corporation.

24 b. "Wej-it", Wej-it Corporation.

25 8. Masonry Sleeve Anchors: zinc coated or stainless as shown on the drawings.

26 a. Rawl "Lok/Bolt".

27 b. HILTI - Sleeve anchor.

28 9. Toggle Bolts: Spring-wing type, FS FF-B-558, Type I, Class I and Style 1 zinc coated or
29 stainless steel as shown on the drawings.

30 10. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

31 11. Epoxy bolt anchorage: HILTI (HY-10 or equal)

32 12. Handrail brackets: Wagner 1978F stamped steel or approved equal with 1 1/2" clear from
33 finished face of building to edge of handrail. Provide back plate and spacer as required
34 for installation concealed behind fiber cement panel. Galvanize to match railing material.

35
36 C. Electrodes for Welding: Comply with AWS code.

37
38 D. Dumpster enclosure gate hardware: Provide all components for a complete installation similar to:
39 Spring Hinge LB4390C- 350 630 BOM, heavy duty cane bolt, black; hasp and latch, black; Stanley
40 Best padlock with cores to match building cores in 08 71 00.

41
42 2.04 FABRICATION

43
44 A. Weld permanent connections wherever possible; use continuous welds where exposed. Grind smooth
45 all welds where exposed; straighten members after welding.

46 1. Use materials and methods that minimize distortion and develop strength and corrosion
47 resistance of base metals.

48 2. Obtain fusion without undercut or overlap.

49 3. Remove welding flux immediately.

50 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no
51 roughness shows after finishing and contour of welded surface matches that of adjacent
52 surface.

53
54 B. Do shop cutting, drilling, fitting wherever possible. Field measure before fabrication when necessary
55 or required.

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- 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 MANUFACTURED UNITS

- 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. Wire Mesh Screen and Bug Screen:
 - a. Wire Mesh Screen: Banker Wire, Mukwonago, WI
 - 1) M22-18
 - 2) Open area: 53%
 - 3) Stainless Steel
 - 4) Or approved equal by McNichols Decorative Mesh or approved equal.
 - b. Wire Mesh Bug Screen.
 - 1) Stainless steel.

2.06 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.

2.07 SCUPPER

- A. Provide (2) welded galvanized steel plate overflow scuppers 4" high clear inside by 11 1/2" wide clear inside. Project from face of building 10" and 4" inside face of wall onto the roof.

2.08 STEEL HANDRAIL AND GUARDRAIL

- A. Railings shall be of standard weight mild steel pipe, fabricated to true lines, joints welded and ground smooth. Provide wall mounting flanges and bolts of the proper type to suit conditions of installation and provide pipe sleeves for vertical members. Provide wall returns at ends of wall mounted handrails. Close ends of exposed pipes.

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. Unit Masonry, Section 04 20 00.
- B. Solid Surface, Section 06 61 00.
- 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.
- E. Mock-up:
 - 1. Provide a wall mock-up with all components of wall construction to be included in mock-up.

1.06 REFERENCES

- 1
2 A. American Institute of Timber (AITC)
3 1. AITC, Timber Construction Manual
4
5 B. American Forest and Paper Association (AFPA)
6 1. AFPA, National Design Specification for Wood Construction.
7 2. AFPA, Design Values for Wood Construction, NDS Supplement.
8
9 C. American Plywood Association (APA)
10 1. APA, Plywood Design Specification.
11
12 D. American National Standards Institute (ANSI)
13 1. ANSI A190.1, Structural Glued Laminated Wood.
14 2. ANSI A208.1, Material Formed Wood Particle Board.
15
16 E. American Society for Testing and Materials (ASTM)
17 1. ASTM E84, Test for Surface Burning Characteristics of Building Materials.
18
19 F. American Wood Preservers Association (AWPA)
20 1. AWPA C-20, Structural Lumber - Fire Retardant Treatment by Pressure Processes.
21
22 G. American Wood Preservers Bureau (AWPB)
23 1. AWPB LP-2, Pressure Treatment with Water-Borne Preservatives.
24
25 H. National Bureau of Standards (NBS)
26 1. NBS PS 1, Voluntary Product Standard for Construction and Industrial Plywood.
27 2. NBS PS 20, Voluntary Product Standard for Lumber.
28
29 1.07 DELIVERY, STORAGE AND HANDLING
30
31 A. Deliver materials to the site dry and store above ground on level wood blocking, cover from
32 rain, allowing drainage of water from all parts. Handle with care to avoid damage.
33
34 1.08 COORDINATION
35
36 A. Correlate location of all framing, furring, blocking, grounds and similar items with all trades.
37
38 B. Verify all dimensions and shop drawing requirements prior to proceeding with work.
39
40 C. Avoid delay of work of other trades dependent on or affected by carpentry work.
41
42 1.09 ENVIRONMENTAL REQUIREMENTS
43
44 A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the
45 building (defined as inside the weatherproofing system and applied on site) must not exceed
46 the following requirements.
47 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management
48 (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment
49 date January 7, 2005.
50 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36,
51 requirements in effect on October 19, 2000.
52
53 B. Low- Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and
54 agrifiber products used inside the weatherproofing system shall contain no added urea-
55 formaldehyde resins.

- 1 1. Laminating Adhesives used to fabricate on-site and shop applied composite wood and
2 agrifiber assemblies shall contain no added urea-formaldehyde resins.
3
- 4 PART 2 - PRODUCTS
5
- 6 2.01 MATERIALS
7
- 8 A. Wood for nailers, blocking, furring, sleepers and other miscellaneous boards: Construction
9 grade, S4S, dried, 19 percent maximum moisture content. Pressure preservative treat items in
10 contact with flashing, waterproofing, masonry, concrete or the ground.
11
- 12 B. Wall Sheathing
13 1. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
14 a. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by
15 G-P Gypsum Corporation.
16 b. Type and Thickness (as indicated on drawings): Type X, 5/8 inch thick.
17 c. Size: As required for efficient installation.
18
- 19 2. Plywood sheathing shall be 5/8 inch thick (or as indicated on drawings), 5-ply, CDX
20 APA Rated, un-sanded with a minimum 24/0 span rating. Sheathing shall be by 48
21 inches wide by 96 inches long.
22
- 23 C. Exterior plywood, thickness as indicated on drawings, 7-ply, CDX APA Rated, un-sanded
24 with a minimum 16/0 span rating. Refer to drawings for sizes.
25
- 26 D. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior
27 construction not in contact with the ground, Use Category UC3b for exterior construction not
28 in contact with the ground, and Use Category UC4a for items in contact with the ground.
29 1. Treat wood materials subject to insect attack. Moisture content after treatment shall be
30 19 percent for lumber and 15 percent for plywood.
31 2. Preservative Chemicals: Water-borne, alkaline copper quaternary (ACQ) preservatives.
32 a. Acceptable to authorities having jurisdiction and containing no arsenic or
33 chromium.
34
- 35 E. Fire-retardant treated wood products shall be pressure-impregnate wood materials to comply
36 with ASTM E84, Class A and with AWPA C-20 and C-27. Each piece shall bear UL label
37 "FR-S" for 25 maximum flame spread. Moisture content after treatment shall be 19 percent
38 for lumber and 15 percent for plywood.
39 1. Treated materials shall be "Dricon" as manufactured by Koppers Company, Inc.
40 2. Application: Treat all rough carpentry, unless otherwise indicated.
41 a. Concealed blocking.
42 b. Plywood backing panels.
43
- 44 F. Rough hardware shall include all nails, spikes, screws, bolts and similar items of types and
45 sizes sufficient to draw and rigidly secure members for which they are used. Fasteners shall
46 be galvanized plated at exterior locations and at all treated wood applications.
47
- 48 G. Adhesive shall be of proper design and characteristics to rigidly secure materials for which
49 they are used. Adhesive shall be "Titebond VOC-Compliant Heavy Duty Construction
50 Adhesive" conforming with ASTM C557, as manufactured by Franklin International; or
51 approved equal.
52 1. Provide construction adhesive with a VOC content of less than 70 g/l.
53
- 54 H. Miscellaneous Materials

- 1 1. Sill-Sealer Gaskets: Glass-fiber-resilient insulation, fabricated in strip form, for use as a
2 sill sealer; 1-inch nominal thickness, compressible to 1/32 inch; selected from
3 manufacturer's standard widths to suit width of sill members indicated.
4

5 PART 3 - EXECUTION
6

7 3.01 PREPARATION
8

- 9 A. Examine all adjoining work, verify all governing dimensions, and report any unsatisfactory
10 conditions.
11
12 B. Provide temporary enclosures, partitions, or stairs to properly protect and facilitate the work.
13

14 3.02 GENERAL INSTALLATION
15

- 16 A. Install materials and systems in accordance with manufacturer's published instructions and
17 requirements. Install materials with uniform appearance and in proper relation with adjacent
18 construction.
19
20 B. Cut and frame all lumber into the respective locations, true to line, grade, plumb and level.
21 Form nailers, blockings and bucks to the shape and dimension indicated. Cut and frame all
22 rough carpentry work required by the other sections.
23
24 C. Use only sound, thoroughly seasoned materials of longest practical lengths and sizes to
25 minimize jointing. Use materials free from warp which cannot be easily corrected by
26 anchoring and attachment.
27
28 D. Treat all wood nailers, sleepers, blocking, furring, other wood in contact with concrete,
29 masonry adjacent to grade or exterior which shall be inaccessible in finished work.
30
31 E. Provide blocking, bucks and framing for all trades as required.
32
33 1. Blocking to be provided at the following locations:
34 a. All wall hung casework, cabinetry, countertops and shelving.
35 b. All wall hung/mounted equipment.
36 c. And as indicated on drawings.
37

- 38 F. Include 2 inch nominal blocking in metal stud partitions required for backing of all
39 accessories, cabinetry, and other surface or recessed items.
40
41 G. Where finish trim is applied directly to framing members or blocking, such members shall be
42 perfectly straight, clear and well seasoned. Warp or other poor characteristics not allowed.
43
44 H. Provide solid surfaces at least 1 1/2 inches wide in both directions at all corners for securing
45 finishes.
46

47 3.03 HARDWARE
48

- 49 A. Secure permanently and in proper position all materials with the necessary fastenings to
50 provide the strength and rigidity required to complete the work. Provide washers under bolt
51 heads and nuts in contact with wood.
52
53 B. Bolt nailers and blocking to steel, masonry or concrete members with bolts of proportionate
54 strength of members attached, length required, spaced 2 feet 0 inches on center and 4 inches

- 1 from each end, except as otherwise indicated. Unless otherwise indicated, anchor bolts shall
2 be 3/8 inch diameter by length required or comparable power actuated fasteners.
3
- 4 C. Nail plywood in accord with APA recommendations.
5
- 6 3.04 WALL SHEATHING
7
- 8 A. Place sheathing with all joints over supports. Provide 1 1/2 inch framing at all joints not over
9 supports where blocked joints are noted on Drawings.
10
- 11 B. Stagger end joints so that joint between adjacent panels occurs over different supports. Allow
12 1/8 inch spacing between panels on all sides.
13
- 14 C. Fasten with 8d ring-shank nails at 6 inch on center at all edges and 12 inch on center at all
15 intermediate supports, unless noted otherwise. Sheathing may be stapled with 1 1/2 inch long
16 15 gauge staples at 4 inch on center at all edges and 12 inch on center at all intermediate
17 supports, unless noted otherwise.
18
- 19 D. Install in accord with recommendations of APA.
20
- 21 3.05 ROOF SHEATHING
22
- 23 A. Place sheathing with face grain at right angles to supports and end joints over supports.
24 Provide 1 1/2 inch framing at all joints not over support where blocked joints are noted on
25 Drawings.
26
- 27 B. Stagger end joints so that joint between adjacent panels occurs over different supports. Allow
28 1/8 inch spacing between panels on all sides.
29
- 30 C. Fasten with 8d ring-shank nails at 6 inch on center at all edges and 12 inch on center at all
31 intermediate supports, unless noted otherwise. Sheathing may be stapled with 1 1/2 inch long
32 15 gauge staples at 4 inch on center at all edges and 12 inch on center at all intermediate
33 supports, unless noted otherwise.
34
- 35 D. Install in accordance with recommendations of APA.
36
- 37 E. All lumber used on this project shall be graded by an agency certified by ALSC. Softwood
38 Lumber: ALSC PS20, grade No. 2 or better; 19 percent maximum moisture content, size as
39 detailed or required.
40
- 41 F. Pressure Treated Plywood and Lumber: These products shall not be specified or provided for
42 use in roofing projects as a substrate material intended to receive mechanical fasteners used to
43 secure metal roof panels, panel clips, metal coping, roof penetration curbs cap and
44 counterflashing, all other metal flashing, roofing insulation and membrane installations that
45 are a part of the roof system.
46
- 47 G. The manufacture shall approve of all mechanical fasteners used to secure all roof system
48 components.
49
- 50 3.06 TEMPORARY ENCLOSURES
51
- 52 A. The Subcontractor shall furnish, erect, keep in good repair and remove all necessary
53 temporary guard rails, barricades, pedestrian walkways, temporary ladders, building
54 enclosures and partitions (including temporary wood doors hung on temporary wood bucks at

1 exterior door entrances, doors to allow emergency egress by building occupants) and all other
2 necessary temporary enclosures as required as the work progresses.

3
4 3.07 CLEANING

5
6 A. Remove from the site all debris resulting from the Work of this Section.

7
8
9 END OF SECTION 06 10 00

1 SECTION 06 12 00
2 STRUCTURAL INSULATED PANELS
3

4 PART 1 – GENERAL
5

6 1.1 RELATED DOCUMENTS
7

- 8 A. Drawings and general provisions of the Contract, including General and Supplementary
9 Conditions and Division 1 Specification Sections, apply to this Section.
10

11 1.2 SUMMARY
12

- 13 A. This Section includes Structural Insulated Panels (SIP).
14

- 15 B. Related Sections include the following:
16

- 17 1. Section 06 10 00 – Rough Carpentry
18 2. Section 06 13 00 – Timber Framing
19

20 1.3 PERFORMANCE REQUIREMENTS
21

- 22 A. Structural Performance: Provide SIPs capable of withstanding design loads including dead
23 load, live loads, wind loads and seismic loads. Design loads shall be in compliance with the
24 requirements of the local Building Code.
25

26 1.4 SUBMITTALS
27

- 28 A. Product Data: SIP manufacturer's product literature including structural properties and
29 installation instructions.
30

- 31 B. Shop Drawings: Show fully dimensioned fabrication and installation details for SIPs. Shop
32 drawings shall be prepared under the supervision of a Professional Engineer.
33

- 34 C. Evaluation report from ICC-ES or Canadian Construction Materials Centre.
35

36 1.5 QUALITY ASSURANCE
37

- 38 A. SIP Manufacturer shall be a member of the Structural Insulated Panel Association (SIPA).
39

- 40 B. Structural Design: A Professional Engineer shall perform a structural analysis and design of
41 the SIP assemblies in accordance with the design loads. Engineer shall have a minimum of 5
42 years of experience in the design of SIP's. Calculations and shop drawings shall be furnished
43 to A/E for review.
44

- 45 C. Installation Contractor must have experience on projects of similar size and scope. Lead
46 installer / supervisor shall have a minimum of 5 years documented experience installing SIPs.
47 The Contractor shall be qualified and approved to install the panels provided by the panel
48 fabricator.
49

50 1.6 DELIVERY, STORAGE, AND HANDLING
51

- 52 A. SIPs shall be kept dry and protected with waterproof covering during transportation and
53 storage.

- 1
2 B. Exercise care to prevent crushing of SIP edges with cargo hold down straps during
3 transportation.
4
5 C. Carefully load and unload SIPs from trucks to prevent damage to the panels.
6
7 D. Store SIPs elevated off of the ground on sleepers.
8
9 E. Take care in handling SIPs to prevent delamination. Do not lift panels by the top skin.

10
11 1.7 COORDINATION

- 12
13 A. Time delivery and installation of SIPs to avoid extended on-site storage and to avoid delaying
14 progress of other trades whose work must follow the installation of SIPs.
15

16
17 PART 2 – PRODUCTS

18
19 2.1 STRUCTURAL INSULATED PANELS (SIP)

- 20
21 A. Oriented Strand Board (OSB): 7/16” thick minimum.
22
23 B. Core: Expanded Polystyrene (EPS) shall comply with ASTM C578 and shall have a minimum
24 density of 0.9. pcf., polyurethane foam core, extruded polystyrene (XPS) shall comply with
25 ASTM C578 and shall have a minimum density of 1.3 pcf , R-Value of full panel shall be 50,
26 minimum
27
28 C. Adhesive: ASTM D2559
29

30 2.2 LUMBER

- 31
32 A. Grade and Species: Visually graded dimension lumber No. 2 or better of any of the following
33 species:
34 1. Spruce-Pine-Fir; NLGA
35 2. Hem-Fir (North); WCLIB or WWPA
36 3. Douglas Fir – Larch; WCLIB or WWPA 4. Southern Pine; SPIB
37
38 B. Lumber shall be kiln dried to not more than 19% moisture content
39
40 C. Lumber shall be clearly marked with grade stamp of grading agency.
41
42 D. Engineered wood products shall be used where required for structural adequacy.
43 1. Laminated Veneer Lumber (LVL)
44 2. Parallel Strand Lumber (LSL)
45 3. Laminated Strand Lumber (LSL)
46

47 2.3 FASTENERS

- 48
49 A. Common Nails: ASTM F1667.
50
51 B. Panel Screws: screws with pancake head, minimal thread diameter 0.255 inches, minimum
52 shank diameter 0.190 inches and a minimum head diameter 0.625 inches.
53

1 2.4 FABRICATION

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9

- A. Cut SIPs to accurate lengths, angles, and sizes to produce close fitting joints.
- B. Remove foam as required to accommodate wood blocking and splines.
- C. Provide electrical wiring chases in foam core where required.

10 PART 3 – EXECUTION

11
12

3.1 PREPARATION

13
14
15
16
17
18

- A. Examine foundations, sills, framing and other surfaces to receive SIPs and verify that conditions are suitable for the installation of SIPs. Report any unsatisfactory conditions to the Contractor. Do not proceed with installation until unsatisfactory conditions have been corrected.

19 3.2 INSTALLATION

20
21
22
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- A. Hoist SIPs in place by lifting equipment suited to size of panels. Exercise care to prevent damage to SIPs.
- B. Install SIPs plumb, square and true to line.
- C. Fill all panel joints with expanding urethane foam or seal by other approved method.
- D. Repair or replace all damaged SIPs.
- E. Remove debris from project site and legally dispose of debris.

END OF SECTION 06 12 00

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1 SECTION 06 18 00

2
3 GLUED-LAMINATED CONSTRUCTION

4 PART 1 - GENERAL

5 1.1. DESCRIPTION

- 6 A. The General and Supplementary Conditions of the Construction Contract and Division 1 -
7 General Requirements apply to the work specified in this section.
- 8 B. This section includes the design and construction of framing using structural glued-
9 laminated timber.
- 10 C. Refer to Division 06 Section "Rough Carpentry" for dimension lumber items associated
11 with structural glued-laminated timber.
- 12 D. Structural notes indicated on the drawings regarding structural glued-laminated timber
13 shall be considered a part of this specification.

14 1.2. DEFINITIONS

- 15 A. Structural Glued-Laminated (Glulam) Timber: An engineered, stress-rated timber
16 product assembled from selected and prepared wood laminations bonded together with
17 adhesives and with the grain of the laminations approximately parallel longitudinally.

18 1.3. DESIGN REQUIREMENTS

- 19 A. Delegated Design: Design structural glued-laminated timber and connectors, including
20 comprehensive engineering analysis by a qualified professional engineer, using
21 performance requirements and design criteria indicated.
- 22 B. Structural Performance: Structural glued-laminated timber and connectors shall
23 withstand the effects of structural loads shown on Drawings without exceeding allowable
24 design working stresses listed in AITC 117 or determined according to ASTM D 3737
25 and acceptable to authorities having jurisdiction.

26 1.4. SUBMITTALS

- 27 A. Product Data: For each type of product indicated.
- 28 1. Include data on lumber, adhesives, fabrication, and protection.
- 29 2. For preservative-treated wood products, include chemical treatment
30 manufacturer's written instructions for handling, storing, installing, and finishing
31 treated material.
- 32 3. For connectors, include installation instructions.
- 33 B. Shop Drawings:
- 34 1. Show layout of structural glued-laminated timber system and full dimensions of
35 each member.
- 36 a. Include large scale details of connections
- 37 b. Include structural analysis data signed and sealed by a professional
38 engineer registered in the state of Wisconsin.

- 1 c. Shop drawings to be signed and sealed by a professional engineer
2 registered in the state of Wisconsin.
- 3 2. Indicate species and laminating combination adhesive type, and other variables in
4 required work.
- 5 C. Certificates of Conformance: Issued by a qualified testing and inspecting agency
6 indicating that structural glued-laminated timber complies with requirements in
7 AITC A190.1.
- 8 D. Material Certificates: For preservative-treated wood products, from manufacturer.
9 Indicate type of preservative used and net amount of preservative retained.

10 1.5. QUALITY ASSURANCE

- 11 A. Manufacturer Qualifications: Provide factory-glued structural units produced by an
12 AITC- or APA-licensed firm.
- 13 1. Factory mark each piece of structural glued-laminated timber with AITC Quality
14 Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed
15 in the completed Work.
- 16 B. Quality Standard: Comply with AITC A190.1.

17 1.6. DELIVERY, STORAGE, AND HANDLING

- 18 A. General: Comply with provisions in AITC 111.
- 19 B. Individually wrap members using plastic-coated paper covering with water-resistant
20 seams.

21 PART 2 - PRODUCTS

22 2.1. STRUCTURAL GLUED-LAMINATED TIMBER

- 23 A. General: Provide structural glued-laminated timber that complies with AITC 117.
- 24 1. Provide structural glued-laminated timber made from single species.
- 25 2. Provide structural glued-laminated timber made from solid lumber laminations;
26 do not use laminated veneer lumber.
- 27 3. Provide structural glued-laminated timber made with wet-use adhesive
28 complying with AITC A190.1.
- 29 B. Species and Grades for Structural Glued-Laminated Timber: Western Species,
30 conforming to structural documents.
- 31 C. Appearance Grade: Architectural, complying with AITC 110.
- 32 1. For Architectural appearance grades, fill voids as required by AITC 110.
- 33 D. End Sealer: Manufacturer's standard, transparent, colorless wood sealer that is effective
34 in retarding the transmission of moisture at cross-grain cuts and is compatible with
35 indicated finish.
- 36 E. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer that is
37 compatible with indicated finish.

1 2.2. TIMBER CONNECTORS

2 A. General: Unless otherwise indicated, fabricate from the following materials:

3 1. Structural-steel shapes, plates, and flat bars complying with ASTM A 36/A 36M.

4 B. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.

5 2.3. FABRICATION

6 A. Shop fabricate for connections to greatest extent possible, including cutting to length and
7 drilling bolt holes.

8 1. Dress exposed surfaces as needed to remove planing and surfacing marks.

9 B. End-Cut Sealing: Immediately after end cutting each member to final length, apply a
10 saturation coat of end sealer to ends and other cross-cut surfaces, keeping surfaces flood
11 coated for not less than 10 minutes.

12 C. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat
13 of penetrating sealer on surfaces of each unit.

14 2.4. FACTORY FINISHING

15 A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain
16 and sealer; oven dried and resistant to mildew and fungus.

17 1. Color: As selected by Architect from manufacturer's full range.

18 B. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew
19 and fungus.

20 PART 3 - EXECUTION

21 3.1 EXAMINATION

22 A. Examine substrates in areas to receive structural glued-laminated timber, with Installer
23 present, for compliance with requirements, installation tolerances, and other conditions
24 affecting performance of structural glued-laminated timber.

25 B. Proceed with installation only after unsatisfactory conditions have been corrected.

26 3.2 INSTALLATION

27 A. General: Erect structural glued-laminated timber true and plumb, and with uniform,
28 close-fitting joints. Provide temporary bracing to maintain lines and levels until
29 permanent supporting members are in place.

30 1. Lift with padded slings and protect corners with wood blocking.

31 2. Install structural glued-laminated timber to comply with Shop Drawings.

32 3. Install timber connections as indicated.

33 B. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match
34 specified surfacing.

35 1. Dress exposed surfaces as needed to remove planing and surfacing marks.

- 1 2. Coat cross cuts with end sealer.
- 2 C. Cutting: Avoid cutting after fabrication. Where field fitting is unavoidable, comply with
- 3 requirements for shop fabrication.

4 3.3 ADJUSTING

- 5 A. Repair damaged surfaces after completing erection. Replace damaged structural glued-
- 6 laminated timber if repairs are not approved by Architect.

7 3.4 PROTECTION

- 8 A. Do not remove wrappings on individually wrapped members until they no longer serve a
- 9 useful purpose including protection from weather, sunlight, soiling, and damage from
- 10 work of other trades.

- 11 1. Coordinate wrapping removal with finishing work specified in Division 09.
- 12 Retain wrapping where it can serve as a painting shield.

- 13 2. Slit underside of wrapping to prevent accumulation of moisture inside the
- 14 wrapping.

15 END OF SECTION

16

17

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

1.02 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 trim.
 - 2. Wood ceiling
- C. Backpriming of exterior wood components.

1.03 RELATED WORK

- A. Related Sections: The following sections contain requirements that relate to this section:
- B. Rough Carpentry: Section 06 10 00.
- C. Joint Sealants: Section 07 92 00.
- D. Painting: Section 09 90 00.

1.04 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:
 - a. One 12-inch- long section of wood running trim, casing, molding, or similar lineal mill work.
 - b. One 2 square foot sample of decking or similar flat surfaces.
- 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.

1.05 REFERENCES

- A. Western Red Cedar Lumber Association "Designer's Handbook".

1.06 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.

- 1
2 C. Deviations from quality, grade, species, and finish specified under AWI Interior Woodwork for
3 Transparent Finish and Interior Woodwork for Paint Finish will be allowed for individual items or
4 components only if specified under separate headings covering such items.
5

6 1.07 DELIVERY, STORAGE AND HANDLING
7

- 8 A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage,
9 soiling and deterioration.
10
11 B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations
12 which could damage, soil or deteriorate woodwork have been completed.
13
14 C. If finish carpentry materials must be stored in other than installation areas, store only in areas
15 meeting requirements specified for installation areas.
16 1. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for
17 finish carpentry installation areas. Do not install finish carpentry until required temperature
18 and relative humidity have been stabilized and will be maintained in installation areas.
19 2. Maintain temperature and humidity in installation area as required to maintain moisture
20 content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture
21 content, from date of installation through remainder of construction period. The fabricator of
22 woodwork shall determine optimum moisture content and required temperature and humidity
23 conditions.
24

25 PART 2 - PRODUCTS
26

27 2.010 MATERIALS, GENERAL
28

- 29 A. Lumber standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber
30 and with applicable grading rules of inspection agencies certified by American Lumber Standards
31 Committee Board of Review.
32
33 B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the
34 following:
35 1. NELMA – Northeastern Lumber Manufacturers Association.
36 2. NHLA – National Hardwood Lumber Association.
37 3. NLGA – National Lumber Grades Authority.
38 4. SPIB - Southern Pine Inspection Bureau.
39 5. WCLIB – West Coast Lumber Inspection Bureau.
40 6. WWPA – Western Wood Products Association.
41
42 C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection
43 agency evidencing compliance with grading rule requirements and identifying grading agency,
44 grade, species, moisture content at time of surfacing, and mill.
45
46 D. For exposed lumber, furnish pieces with grade stamps applied to ends of back of each piece, or omit
47 grade stamps entirely and provide certificates of grade compliance issued by inspection agency.
48

49 2.02 SOLID STOCK
50

- 51 A. Exterior and Interior Wood Ceiling Paneling
52 1. Species: Western Red Cedar,
53 2. Grade: WRCLA, A Clear.
54 3. Pattern: Tongue and Groove, V-groove, 1" x 6" nominal.
55 4. Lengths: 12' nominal

- 1 5. Texture: Smooth.
2 6. Moisture Content: Seasoned.
3
4 B. Interior Trim for Transparent Finish
5 1. Interior: AWI 300 Custom Grade.
6 1. Species: White Oak, quarter-sawn.
7 2. Texture: S2S2E, (smooth).
8
9 2.03 ACCESSORIES
10
11 A. Provide nails, screws and other anchoring devices of the proper type, size, material and finish for
12 application to provide secure attachment, concealed where possible, and complying with applicable
13 Federal Specifications.
14 1. Nails, Wire, Brads and Staples: FS FF-N-105.
15 2. Power-Driven Fasteners: CABO NER-272.
16 3. Cedar to be fastened with 304 (18-8) or better stainless steel fasteners only.
17
18 B. Where interior finish carpentry materials are exposed in areas of high humidity, provide fasteners
19 and anchorages with hot-dip galvanized coating complying with ASTM A 153 or No. 304 stainless
20 steel.
21
22 C. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry
23 use. Exterior rated for exterior use.
24
25 D. Sealants: Comply with requirements of Division 7 Section "Joint Sealants" for materials required for
26 sealing work.
27
28 2.04 FABRICATION
29
30 A. Wood Moisture Content: Comply with requirements of specified inspection agencies and
31 manufacturer's recommendations for moisture content of finish carpentry on relative humidity
32 conditions existing during time of fabrication and in installation areas.
33
34 B. Field Dimensions
35 1. Millwork Manufacturer: Responsible for details, dimensions not controlled by job
36 conditions; show on shop drawing all field measurements beyond his control. Contractor,
37 Woodwork Manufacturer: Cooperate to establish, maintain these field dimensions.
38
39 C. Leave all surfaces clean and true and all exposed wood surfaces sanded parallel with grain, free of
40 discernible marks and ready for work under Division 9 Section "Painting".
41
42 D. Cutouts: Make those required for mechanical and electrical items.
43
44 E. Back out or kerf backs of the following members, except members with ends exposed in finished
45 work:
46 1. Standing and running trim wider than 5 inches.
47
48 F. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius.
49
50 G. Ease edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.
51
52 PART 3 - EXECUTION
53
54 3.01 EXAMINATION
55

- 1 A. Examine substrates, with Installer present, for compliance with requirements for installation
2 tolerances and other conditions affecting installation and performance of finish carpentry. Do not
3 proceed with installation until unsatisfactory conditions have been corrected.
4

5 3.02 PREPARATION
6

- 7 A. Condition wood materials to average prevailing humidity conditions in installation areas prior to
8 installing.
9
10 B. Examine substrate before installation. Verify that substrate is sound and plumb/level. Proceed with
11 installation only after unsatisfactory conditions have been corrected.
12
13 C. Wood frame walls shall be dry, clean, sound, well-nailed, free of voids, and without offsets at joints.
14 Ensure that nail heads are driven flush with surfaces. Leave no hammer or automated fastener dents
15 or scuffs.
16
17 D. Coordinate woodwork installation with wall flashings and other built-in components.
18
19 E. Prime and backprime exterior wood, including cut ends, for painted, stained and oil finish exposed
20 on the exterior. Comply with requirements for surface preparation and application in Division 9
21 Section "Painting".
22

23 3.03 INSTALLATION
24

- 25 A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished,
26 inadequately seasoned, or too small to fabricate with proper jointing arrangements.
27 1. Do not use manufactured units with defective surfaces, sizes or patterns.
28
29 B. Install finish carpentry plumb, level, true and aligned with adjacent materials. Use concealed shims
30 where required for alignment.
31
32 C. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by
33 manufacturer.
34 1. Countersink nails; fill surface flush and sand where face nailing is unavoidable.
35
36 D. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry
37 with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal
38 installation.
39
40 E. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim
41 and rails.
42 1. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim
43 and rails.
44
45 F. Finish according to specified requirements.
46 1. Refer to Division 9 Sections for final finishing of finish carpentry.
47

48 3.04 STANDING AND RUNNING TRIM INSTALLATION
49

- 50 A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of
51 lumber available. Do not use pieces less than 24 inches long, except where necessary.
52 1. Stagger joints in adjacent and related standing and running trim.
53 a. Cope at returns and miter at corners to produce tight-fitting joints with full-surface
54 contact throughout length of joint.

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1 SECTION 06 61 18

2
3 SOLID SURFACE

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Applicable provisions of Division 1 shall govern all work under this section.

10
11 1.02 WORK INCLUDED

- 12
13 A. Solid surface countertops, trim and window stools.

14
15 1.03 RELATED WORK

- 16
17 A. Finish Carpentry: Section 06 20 00.

18
19 1.04 SUBMITTALS

- 20
21 A. Submit in accord with the General Conditions of the Contract.
22 1. Product Data: Manufacturer's catalog information edited to indicate products to be
23 provided for this Project.
24 a. Joint adhesives or mastics, color matched.
25 b. Joint sealants.
26 c. Fastening adhesive
27
28 2. Samples:
29 a. Solid surface sheet material.
30 b. Include color chart showing full range of available colors for sheet

31
32 1.05 QUALITY ASSURANCE

- 33
34 A. Fabricator/Installer Qualifications: Minimum three years experience in fabrication and
35 installation of solid surface materials or certification by Distributor.
36 1. Qualifications: Proof of fabricator qualifications.
37 2. Certificates: Copies of ISO certifications.
38 3. Test Reports:
39 a. Flammability test reports.
40 b. Food preparation zone use test reports.
41 4. Manufacturer's Fabrication and Installation Manual.
42 5. Manufacturer's Fabrication and Installation Check List.

43
44 1.06 WARRANTY

- 45
46 A. Provide manufacturer's standard 10 year warranty against defects in workmanship.

47
48 1.07 MAINTENANCE

- 49
50 A. Extra Materials: Provide for future repair use by Owner.
51 1. Minimum 4 sf per 50 lf of each countertop color.

52
53 1.08 SPECIAL INSTRUCTIONS

- 54
55 A. Do not deliver components to project site until spaces are ready for installation.

1
2 1.09 ENVIRONMENTAL CONDITIONS

- 3
4 A. Installation spaces must be maintained at normal occupancy temperature and humidity levels for
5 minimum 72 hours prior to and continuously following installation.
6

7 1.010 ENVIRONMENTAL REQUIREMENTS

- 8
9 A. Recycled content: Provide products manufactured from recycled content as specified.
10 1. Solid surface: Minimum 50% post-consumer recycled content.
11
12 B. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied
13 on-site must meet the limitations and restrictions concerning chemical components set by the
14 following standards:
15 1. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality
16 Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect
17 on January 1, 2004.
18
19 C. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building
20 (defined as inside the weatherproofing system and applied on site) must not exceed the
21 following requirements.
22 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management
23 (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment
24 date January 7, 2005.
25 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36,
26 requirements in effect on October 19, 2000.
27

28 PART 2 - PRODUCTS

29
30 2.01 MATERIALS

- 31
32 A. Solid Surface
33 1. Solid Surface: Formica
34 a. Color and finish: (2) colors to be selected by Architect from full range of colors
35 and finishes.
36 b. Or approved equal
37
38 B. No cracked, chipped, broken, stained, or defective material will be accepted.
39 1. Materials fabricated to thickness and size shown on drawings.
40 a. All sizes to be field verified.
41
42 C. Color Match Differences: Minimal.
43
44 D. Adhesives: Use manufacturer's recommended adhesives, and installation instructions. See
45 product fabrication manuals for application techniques and surface preparation.
46
47 E. Accessories: provide wall brackets and fasteners.
48

49 2.02 FABRICATION

- 50
51 A. Field verify measurements.
52
53 B. Finished Surfaces: Uniform as chosen by A/E from full range with all edge profiles as shown
54 on drawings.
55

- 1 PART 3 - EXECUTION
2
3 3.01 EXAMINATION
4
5 A. Examine walls upon which base will be installed.
6 1. Verify wall is flat and acceptable for base application.
7 2. Review manufacturer's Fabrication and Installation Check List.
8
9 B. Coordinate with responsible entity to correct unsatisfactory conditions.
10
11 C. Commencement of work by installer is acceptance of conditions.
12
13 3.02 INSTALLATION
14
15 A. Install fabricated items according to material manufacturers printed instructions.
16
17 B. Set all items square and true with edges of face joints smooth, even, neat and tight against other
18 materials.
19
20 3.03 PROTECTION, REPAIRING AND CLEANING
21
22 A. Replace damaged and defective work.
23
24 B. Clean according to manufacturer's directions. Use no acids or harsh abrasives.
25
26
27

END OF SECTION

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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. Cavity Wall Insulation.
- E. Foundation Wall/Below Grade Insulation.
- F. Slab Edge Insulation.
- G. 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 07 28 00, Water-resistive Barriers for tape over insulation at joints in the cement fiber panel system.
- D. 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.
- B. Mock up: provide all exterior insulations and vapor barriers in a mock up as designed by A/E. Show all conditions expected and as shown in mock-up design.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver material to the site in unopened packages, with identification labels intact.

- 1 B. Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or
2 snow. Comply with manufacturer's recommendations for handling, storage and protection during
3 installation.
- 4
- 5 C. Protect plastic insulation against ignition at all times.
- 6
- 7 D. Remove damaged materials from site.
- 8

9 1.06 ENVIRONMENTAL REQUIREMENTS

- 10
- 11 A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building
12 (defined as inside the weatherproofing system and applied on site) must not exceed the following
13 requirements.
 - 14 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management
15 (SCAQMD) Rule # 1168, requirements in effect on July 1, 2005, and rule amendment
16 date January 7, 2005.
 - 17 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements
18 in effect on October 19, 2000.
- 19

20 PART 2 - PRODUCTS

21

22 2.01 INSULATION TYPE 1: BATT INSULATION

- 23
- 24 A. Batt Insulation:
 - 25 1. Unfaced Fiberglass batts per ASTM C665, Type I. Thickness as indicated on Drawings.
 - 26 a. Provide batt insulation that is a GreenGuard Indoor Air Quality Certified, low-
27 emitting product.
 - 28 b. Manufacturers: CertainTeed, Guardian, Knauf, Owens Corning, or approved equal.
- 29
- 30 B. Vapor Retarder:
 - 31 1. Class II, tested in accordance with ASTM E 96.
 - 32 2. 4 mil polyethylene, see drawings where black required.
- 33
- 34 C. Vapor Retarder Tape: As recommended by vapor retarder manufacturer.
- 35

36 2.02 INSULATION TYPE 2: TAPERED POLYISOCYANURATE

- 37
- 38 A. See Section 07 53 23, Ethylene-Propylene-Diene-Monomer Roofing
- 39

40 2.03 INSULATION TYPE 3: CAVITY WALL INSULATION

- 41
- 42 A. Board:
 - 43 1. Styrofoam Square Edge as manufactured by Dow Chemical Company.
 - 44 2. Owens Corning Foamular 250.
 - 45 3. Certifoam by Minnesota Diversified.
 - 46 4. Amofoam.
 - 47 5. Or approved equal.
- 48
- 49 B. Adhesives:
 - 50 1. Styrofoam Brand.
 - 51 2. Contech PL300.
 - 52 3. Or Approved equal.
- 53

54 2.04 INSULATION TYPE 4: FOUNDATION WALL/BELOW GRADE/SLAB EDGE/UNDER-SLAB
55 INSULATION

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- A. Under-slab insulation shall be minimum 1 1/2 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.

2.05 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. Blanket Insulation
 1. Install blanket with vapor retarder to warm side of wall.
 2. Use loose blanket insulation to tightly seal all cracks, openings, spaces causing drafts into heated spaces at furred ceiling, tops of walls, door rough openings, at deck and joist bearing on perimeter walls, etc.
 3. Use to close space around ducts where they pass through walls.
 4. Install ventilation baffles per manufacturer's instructions.
 5. Provide insulation supports at horizontal applications where friction fit is not adequate to hold insulation in proper position.

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- C. 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. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners.
- C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- D. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.
- E. Vapor retarder shall be installed in maximum material sizes so as eliminate intermediate horizontal joints and to achieve a minimum vertical joint spacing of 90-feet. The vertical joints shall have 12-inch overlaps and shall include two continuous runs of specified tape. The tape shall be used at the top and bottom seals.

3.05 PROTECTION

- A. Protect installed insulation and vapor barriers from harmful weather exposures and 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

SECTION 07 28 00

WATER-RESISTIVE BARRIERS

PART 1 - GENERAL

1.01 SUMMARY OF WORK

- A. This Section specifies water-resistive barriers and accessories.
- B. Include self-adhesive strips for use of over exposed areas of substrates at open joints of fiber cement panels.

1.02 RELATED REQUIREMENTS

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

1.03 REFERENCE STANDARDS

- A. Air Barrier Association of America (ABAA)
 - 1. ABAA [2011], Installer's Certification Program.
 - 2. ABAA [2012], Water-resistive Barrier Installation Guideline.
- B. American Association of Textile Chemists and Colorists (AATCC)
 - 1. AATCC 42 [2007], Water Resistance: Impact Penetration Test.
- C. ASTM International (ASTM).
 - 1. ASTM D882-[2010], Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
 - 2. ASTM E84-[2010b], Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E96/96M-[2010], Standard Test Methods for Water Vapor Transmission of Materials.
 - 4. ASTM E2178-[2003], Standard Test Method for Air Permeance of Building Materials.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate work of this Section with work of other trades for proper time and sequence to avoid construction delays.
- B. Pre-installation Meeting: Convene pre-installation meeting after Award of Contract and one week prior to commencing work of this Section to verify project requirements, substrate conditions and coordination with other building sub-trades, and to review manufacturer's written installation instructions.

1.05 ACTION AND INFORMATIONAL SUBMITTALS

- A. Product Data: Submit product data including manufacturer's literature for water-resistive barrier membrane and accessories, indicating compliance with specified requirements and material characteristics.
 - 1. Submit list on water-resistive barrier manufacturer's letterhead of materials, components and accessories to be incorporated into Work.
 - 2. MSDS report.
 - 3. Include product names, types and series numbers.
 - 4. Include contact information for manufacturer and their representative for this Project.
- B. Samples:
 - 1. Submit duplicate 12 x 12 inches sample of membrane.
 - 2. Submit duplicate 12 inches long samples of seam tape and each type of flashing materials.
- D. Test Reports:

1 .1 Submit test reports showing compliance with specified performance characteristics and physical
2 properties including air permeance, water vapour permeance and structural performance.
3

4 E. Field Reports: Submit manufacturer's field reports within 3 days of each manufacturer representative's site
5 visit and inspection.
6

7 F. Installer Qualifications:

8 .1 Submit letter verifying installer's experience with work similar to work of this Section.
9

10 **1.06 CLOSEOUT SUBMITTALS**

11 A. Operation and Maintenance Data: Supply maintenance data for water-resistive barrier materials.
12

13 B. Warranty: Submit warranty documents specified.
14
15

16 **1.07 QUALITY ASSURANCE**

17 A. Installer Quality Assurance: manufacturer's approval of installer or [2] years' experience with work similar
18 to work of this Section or ABAA certification.
19

20 B. Mock-up: Construct full size 10 ft x 10 ft mock-up of wall showing water-resistive barrier using proposed
21 procedures, materials and quality of work.
22

23 1. Include examples of window frame, door frame, interior corner, exterior corner and common
24 protrusions or penetrations of barrier membrane.

25 2. Purpose: To judge quality of work and material installation.

26 3. Do not proceed with work prior to receipt of written acceptance of mock-up by Architect.

27 5. When accepted, mock-up will demonstrate minimum standard of quality required for work of this
28 Section.
29

30 **1.08 DELIVERY STORAGE AND HANDLING**

31 A. Delivery and Acceptance Requirements:

32 1. Deliver materials and components in manufacture's original packaging with identification labels
33 intact and in sizes to suit project.
34
35

36 B. Storage and Handling Requirements: Store materials off ground and protected from exposure to harmful
37 weather conditions and at temperature conditions recommended by manufacturer.

38 1. Ensure materials are protected from sunlight and UV radiation.
39

40 **1.09 WARRANTY**

41 A. Project Warranty: Refer to Contract Conditions for project warranty provisions.
42

43 B. Manufacturer's warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document
44 executed by authorized company official. Manufacturer's warranty is in addition to and not intended to limit other
45 rights Owner may have under Contract Conditions.

46 1. [10] years limited material warranty.

47 C. Warranty period: [1] years commencing on Date of Substantial Performance of Work.
48

49 **2 PRODUCTS**

50 **2.01 MANUFACTURER**

51 A. Manufacturer: Cosella-Dörken Products Inc., 4655 Delta Way, Beamsville, Ontario, L0R 1B4, Canada,
52 Phone: 1-905-563-3255, Toll Free: 1-888-4DELTA4 (1-888-433-5824), e-mail: info@cosella-dorken.com ,
53 URL: <http://www.cosella-dorken.com> .
54

55 B. Or approved equal.

1
2 **2.02 DESCRIPTION**
3

- 4 A. Vapor permeable water-resistive barrier with highly tear-resistant thermo-bonded non-woven polyester
5 substrate, and waterproof acrylic highly UV resistant coating.
6 1. Include factory applied self-adhesive strip at longitudinal edges of barrier membrane.
7 2. Include self-adhesive strips for use of over exposed areas of substrates at open joints of fiber
8 cement panels.
9

10 **2.03 DESIGN CRITERIA**
11

- 12 A. Water Vapor Permeance: To ASTM E96 (Procedure A), 204 perms minimum.
13
14 B. Water Impact Penetration Resistance: To AATCC 42, no water passing.
15
16 C. Air Permeance: To ASTM E2178, 0.9 L/(s x m²) @ 75 Pa.
17
18 D. Tear Resistance: To ASTM D 1922, [1916] [2564] g minimum.
19
20 E. Dry Tensile Strength: To ASTM D882, MD 47.4 lb/in², CD 28.7 lb/in² minimum.
21
22 F. Elongation at Break: To ASTM D882, MD 40 %, CD 45 % minimum.
23
24 G. Fire Rating Characteristics to ASTM E84:
25 1. Rating: NFPA Class A, IBC Class A minimum.
26 2. Flame Spread: 10 maximum.
27 3. Smoke Developed: 145 maximum.
28

29 **2.04 MATERIALS**
30

- 31 A. Water-resistive Barrier for Walls: Vapor permeable water-resistive barrier with tear-resistant thermo-
32 bonded, non-woven polyester substrate and waterproof acrylic polymeric coating stabilized against oxidation and
33 UV degradation and factory applied adhesive edge strips.
34 1. Service Life Expectancy: > 25 years.
35 2. Weight: 5.5 lb/100 ft², 270 g/m², 44 lb/roll nominal.
36 3. Roll Dimensions: 4' 11" x 164'.
37 4. Color: Black
38

39 **2.05 ACCESSORIES**
40

- 41 A. Seam tape: In accordance with water-resistive barrier manufacturer's written recommendations.
42 1. Acceptable materials: Cosella-Dörken Products Inc., DELTA[®]-FASSADE TAPE (2-1/2" x 65' 7")
43
44 B. Flashings: Self-adhering, water-resistive flashing membrane in accordance with water-resistive barrier
45 manufacturer's written recommendations and in accordance with Section 07 65 00 – Flexible Flashing.
46 1. Acceptable materials: Cosella-Dörken Products Inc., DELTA[®]-FASSADE FLASHING or
47 approved equal.
48
49 C. Fasteners: Water and vapour resistant fasteners in accordance with water- resistive barrier manufacturer's
50 written recommendations.
51
52 D. Sealants and Adhesives: Elastomeric sealant and adhesive in accordance with water-resistive barrier
53 manufacturer's written recommendations.
54 1. Ensure sealants are UV resistant and compatible with adjacent materials.
55 2. Acceptable materials: Cosella-Dörken Products Inc., DELTA[®]-THAN.
56
57 E. Primers: In accordance with flashing manufacturer's written recommendations.
58

1 **2.06 PRODUCT SUBSTITUTIONS**

2
3 A. Ensure all accessories such as seam tape, flashing membranes, fasteners and sealants come from same
4 source as water-resistive barrier membrane.

5 **3 EXECUTION**

6 **3.01 INSTALLERS**

7 A. Use only manufacturers authorized installers or installers with 2 years minimum experience in work or
8 ABAA certified installers for work of this Section.
9

10 **3.02 EXAMINATION**

11
12 A. Verification of Conditions: Verify that conditions of substrate previously installed under other Sections or
13 Contracts are acceptable for water-resistive barrier installation in accordance with manufacturer's written
14 recommendations.

- 15 1. Visually inspect substrate in presence of Consultant.
- 16 2. Inform Consultant of unacceptable conditions immediately upon discovery.
- 17 3. Proceed with installation only after unacceptable conditions have been remedied and after receipt
18 of written approval to proceed from Consultant.
19

20 **3.03 PREPARATION**

21
22 A. Ensure step flashings and kick-out flashings are installed before beginning installation of water-resistive
23 barrier membrane.
24

25 B. Ensure protrusions that may penetrate water-resistive barrier membrane are removed before beginning
26 installation.
27

28 **3.04 INSTALLATION**

29
30 A. Install water-resistive barrier before installation of windows and doors in accordance with manufacturer's
31 written recommendations.
32

33 B. Do installation in accordance with ABAA written recommendations for installation of water-resistive
34 barriers.
35

36 C. Unroll water-resistive barrier with printed side out, wrapping entire building, including rough openings for
37 windows, doors and other protrusions or penetrations.

- 38 1. Install water-resistive barrier plumb and level to exterior face of substrate or directly to framing
39 members in accordance with manufacturer written recommendations.
- 40 2. Ensure water-resistive barrier is installed with textured side facing substrate.
41

42 D. Start installation of water-resistive barrier at building corner, leaving 6"-12" of membrane extended beyond
43 corner.
44

45 E. Install horizontally starting at bottom of wall.

- 46 1. Overlap water-resistive barrier membrane as follows:
47 a. Exterior Corners: [12] inches minimum.
48 b. Vertical and horizontal seems: [6] inches minimum.
49 c. Other seams, joints or at protrusions and penetrations: [6] inches minimum.
50

51 F. Sill Plate Interface: Extend lower edge of water-resistive barrier over sill plate interface 3"- 6".

- 52 1. Secure to substrate with elastomeric sealant in accordance with water-resistive barrier
53 manufacturer's written recommendation.
54

55 G. Attachment of Water-resistive Barrier Membrane to Substrate:

- 1
2 1. Attach water-resistive barrier to steel studs through exterior sheathing with mechanical fasteners
3 and elastomeric adhesive in accordance with manufacturer’s written recommendations.
4 **3.05 FIELD QUALITY CONTROL**
5
6 A. Field Inspection: Coordinate field inspection as required for manufacturer’s assurance of installation in
7 compliance with manufacturer’s requirements.
8
9 **3.06 CLEANING**
10 A. Progress Cleaning: Perform cleanup as work progresses.
11
12 B. Final Cleaning: Upon completion, remove surplus materials, rubbish, tools, and equipment.
13
14 **3.07 PROTECTION**
15
16 A. Protect installed products and components from damage during construction.
17
18 B. Repair damage to adjacent materials caused by water-resistive barrier installation.
19
20
21 **END OF SECTION 07 28 00 – WATER-RESISTIVE BARRIERS**

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SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR AND VAPOR BARRIERS

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. Fluid-applied membrane air barrier, vapor retarding.
- B. Related Sections include the following:
 - 1. Division 7 Section "Sheet Metal Flashing and Trim" for sheet metal flashings.
 - 2. Division 7 Section "Joint Sealants" for joint-sealant materials and installation.

1.03 DEFINITIONS

- A. ABAA: Air Barrier Association of America.
- B. Air Barrier Assembly: The collection of air barrier materials and auxiliary materials applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Air barrier shall be capable of performing as a continuous vapor-retarding air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration.
- B. Air barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- C. Air Barrier Assembly Air Leakage: Not to exceed 0.06 cfm x sq. ft. of surface area at 0.30 inches H₂O when tested in accordance with ASTM E 783.

1.05 SUBMITTALS

- A. Submit in accord with the general requirements of this contract.
- B. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate; technical data; and tested physical and performance properties of air barrier.
- C. Shop Drawings: Show locations and extent of air barrier. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
 - 1. Include details of interfaces with other materials that form part of air barrier.
 - 2. Include details of adequate substrate.

- 1 D. Product Certificates: For air barriers, certifying compatibility of air barrier and accessory
2 materials with Project materials that connect to or that come in contact with the barrier; signed
3 by product manufacturer.
- 4
- 5 E. Qualification Data: For Applicator.
- 6
- 7 F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified
8 testing agency, for air barriers.
- 9

10 1.06 QUALITY ASSURANCE

- 11
- 12 A. Applicator Qualifications: A firm experienced in applying air barrier materials similar in
13 material, design, and extent to those indicated for this Project, whose work has resulted in
14 applications with a record of successful in-service performance and that is an ABAA-licensed
15 contractor, employs certified and registered installers, and complies with ABAA's Quality
16 Assurance Program.
- 17
- 18 B. Preinstallation Conference: Conduct conference at Project site.
 - 19 1. Include installers of other construction connecting to air barrier, including roofing,
20 waterproofing, concrete, masonry, sealants, windows and door frames.
 - 21 2. Review air barrier requirements including surface preparation, substrate condition and
22 pretreatment, minimum substrate curing period, forecasted weather conditions, special
23 details and sheet flashings, installation procedures, sequence of installation, testing and
24 inspecting procedures, and protection and repairs.
 - 25

26 1.07 DELIVERY, STORAGE, AND HANDLING

- 27
- 28 A. Store liquid materials in their original undamaged packages in a clean, dry, protected location
29 and within temperature range required by air barrier manufacturer.
- 30
- 31 B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- 32
- 33 C. Store rolls according to manufacturer's written instructions.
- 34
- 35 D. Protect stored materials from direct sunlight.
- 36

37 1.08 PROJECT CONDITIONS

- 38
- 39 A. Environmental Limitations: Apply air barrier within the range of ambient and substrate
40 temperatures recommended by air barrier manufacturer. Protect substrates from environmental
41 conditions that affect performance of air barrier. Do not apply air barrier to a damp or wet
42 substrate or during snow, rain, fog, or mist.
- 43

44 1.09 ENVIRONMENTAL REQUIREMENTS

- 45
- 46 A. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building
47 (defined as inside the weatherproofing system and applied on site) must not exceed the following
48 requirements.
 - 49 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management
50 (SCAQMD) Rule #1168, requirements in effect on July 1, 2005, and rule amendment
51 date January 7, 2005.
 - 52 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements
53 in effect on October 19, 2000.
 - 54

55 PART 2 - PRODUCTS

- 1 2.01 FLUID-APPLIED MEMBRANE AIR BARRIER AT CAVITY WALL
2
3 A. Fluid-Applied, Vapor-permeable Membrane Air Barrier: Synthetic polymer membrane.
4 1. Available Products: Subject to compliance with requirements, products that may be
5 incorporated into the Work include, but are not limited to, the following:
6 a. Synthetic Polymer Membrane:
7 1) Rubber Polymer Corporation; "Rub-R-Wall Airtight VP".
8 2) Or approved equal
9
10 2. Physical and Performance Properties:
11 a. Air Leakage Rating: less than 0.004 cfm x sq. ft. of surface area; ASTM E 2178.
12 b. Water Vapor Permeance: 12 perms; ASTM E 96 and elongation > 1,000%
13
- 14 2.02 FLUID-APPLIED MEMBRANE AIR AND VAPOR BARRIER AT STUD WALL
15
16 A. Fluid-Applied, Vapor-Retarding Membrane Air Barrier: Synthetic polymer membrane.
17 1. Available Products: Subject to compliance with requirements, products that may be
18 incorporated into the Work include, but are not limited to, the following:
19 a. Synthetic Polymer Membrane:
20 1) Rubber Polymer Corporation; "Rub-R-Wall Airtight".
21 2) Grace Construction Products; "Perm-A-Barrier Liquid".
22 3) Henry Company; "Air-Bloc 32".
23
24 2. Physical and Performance Properties:
25 a. Membrane Air Permeance: Not to exceed 0.0004 cfm x sq. ft. of surface area at
26 1.6-lbf/sq. ft. pressure difference; ASTM E 2178.
27 b. Membrane Vapor Permeance: Not to exceed 0.08 perm; ASTM E 96.
28 c. VOC Content: Less than 100 g/L.
29
- 30 2.03 AUXILIARY MATERIALS
31
32 A. General: Auxiliary materials recommended by air barrier manufacturer for intended use and
33 compatible with air barrier membrane. Liquid-type auxiliary materials shall comply with VOC
34 limits of authorities having jurisdiction.
35
36 B. Primer: Liquid waterborne primer recommended for substrate by manufacturer of air barrier
37 material.
38 1. Primer for self-adhering membranes: "Aquatac Primer" as manufactured by Henry, or
39 approved equal, polymer emulsion based adhesive type, quick setting, having the
40 following physical properties:
41 a. Water based, no solvent odors.
42
43 C. Counterflashing Strip: Modified bituminous, 40-mil- thick, self-adhering sheet consisting of 32
44 mils of rubberized asphalt laminated to an 8-mil- thick, cross-laminated polyethylene film with
45 release liner backing.
46
47 D. Joint Reinforcing Strip: Air barrier manufacturer's glass-fiber-mesh tape.
48
49 E. Substrate Patching Membrane: Manufacturer's standard trowel-grade substrate filler.
50
51 F. Adhesive and Tape: Air barrier manufacturer's standard adhesive and pressure-sensitive
52 adhesive tape.
53 1. Liquid air seal mastic and insulation adhesive: "Air-Bloc 21 Insulation Adhesive" as
54 manufactured by Henry, or approved equal, synthetic, trowel applied, rubber based
55 adhesive type, having the following characteristics:
56 2. Compatibility: With air/vapor barrier membrane, substrate and insulation.

3. Air leakage: 0.0026 CFM/ft² @ 2.1 lbs/ft² to ASTM E283;
 4. Water vapor permeance: 0.03 perms to ASTM E96
 5. Long term flexibility: CGSB 71-GP-24M;
 6. Chemical resistance: Alkalis and salt.
- G. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 26 gauge, and Series 300 stainless-steel fasteners.
- H. Sprayed Polyurethane Foam Sealant: 1- or 2-component, foamed-in-place, polyurethane foam sealant, 1.5 to 2.0 lb/cu. ft density; flame spread index of 25 or less according to ASTM E 162; with primer and noncorrosive substrate cleaner recommended by foam sealant manufacturer.
1. Provide products that meet specified maximum allowable VOC content requirements.
- I. Modified Bituminous Transition Strip: Vapor-retarding, 40-mil- thick, smooth-surfaced, self-adhering; consisting of 36 mils of rubberized asphalt laminated to a 4-mil-thick polyethylene film with release liner backing.
- J. Elastomeric Flashing Sheet: ASTM D 2000, 2BC415 to 3BC620, minimum 50- to 65-mil- thick, cured sheet neoprene with manufacturer's recommended contact adhesives and lap sealant with stainless-steel termination bars and fasteners.
- K. Preformed Silicone-Sealant Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
- L. Joint Sealant: ASTM C 920, single-component, neutral-curing silicone; Class 100/50 (low-modulus), Grade NS, Use NT related to exposure, and, as applicable to joint substrates indicated, Use O. Comply with Division 7 Section "Joint Sealants."

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.
1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
 2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
 3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
 4. Verify that masonry joints are flush and completely filled with mortar.
 5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 SURFACE PREPARATION

- A. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

- 1 D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes,
2 and other voids in concrete with substrate patching membrane.
3
4 E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
5
6 F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and
7 edges to form a smooth transition from one plane to another.
8
9 G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another
10 with stainless-steel sheet mechanically fastened to structural framing to provide continuous
11 support for air barrier.
12

13 3.03 JOINT TREATMENT
14

- 15 A. Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C 1193
16 and with air barrier manufacturer's written instructions. Apply first layer of fluid air barrier
17 membrane at joints. Tape joints with joint reinforcing strip after first layer is dry. Apply a
18 second layer of fluid air barrier membrane over joint reinforcing strip.
19

20 3.04 TRANSITION STRIP INSTALLATION
21

- 22 A. Install strips, transition strips, and auxiliary materials according to air barrier manufacturer's
23 written instructions to form a seal with adjacent construction and maintain a continuous air
24 barrier.
25 1. Coordinate the installation of air barrier with installation of roofing membrane and base
26 flashing to ensure continuity of air barrier with roofing membrane.
27 2. Install modified bituminous strip on roofing membrane or base flashing so that a
28 minimum of 3 inches of coverage is achieved over both substrates.
29
30 B. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be
31 covered by air barrier sheet in same day. Re-prime areas exposed for more than 24 hours.
32
33 C. Connect and seal exterior wall air barrier membrane continuously to roofing membrane air
34 barrier, concrete below-grade structures, exterior glazing and window systems, exterior door
35 framing, and other construction used in exterior wall openings, using accessory materials.
36
37 D. At end of each working day, seal top edge of strips and transition strips to substrate with
38 termination mastic.
39
40 E. Apply joint sealants forming part of air barrier assembly within manufacturer's recommended
41 application temperature ranges. Consult manufacturer when sealant cannot be applied within
42 these temperature ranges.
43
44 F. Wall Openings: Prime concealed perimeter frame surfaces of windows and doors. Apply
45 modified bituminous transition strip so that a minimum of 3 inches of coverage is achieved over
46 both substrates. Maintain 3 inches of full contact over firm bearing to perimeter frames with not
47 less than 1 inch of full contact.
48 1. Modified Bituminous Transition Strip: Roll firmly to enhance adhesion.
49 2. Elastomeric Flashing Sheet: Apply adhesive to wall, frame, and flashing sheet. Install
50 flashing sheet and termination bars, fastened at 6 inches o.c. Apply lap sealant over
51 exposed edges and on cavity side of flashing sheet.
52 3. Preformed Silicone-Sealant Extrusion: Set in full bed of silicone sealant applied to walls,
53 frame, and membrane.
54
55 G. Fill gaps in perimeter frame surfaces of windows, doors, and miscellaneous penetrations of air
56 barrier membrane with foam sealant.

- 1
2 H. Seal strips and transition strips around masonry reinforcing or ties and penetrations with
3 termination mastic.
4
5 I. Seal top of through-wall flashings to air barrier with an additional 6-inch- wide, counterflashing
6 strip.
7
8 J. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by
9 metal counterflashings or ending in reglets with termination mastic.
10
11 K. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and
12 flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired
13 areas in strip direction.
14

15 3.05 AIR BARRIER MEMBRANE INSTALLATION
16

- 17 A. Apply air barrier membrane to form a seal with strips and transition strips and to achieve a
18 continuous air barrier according to air barrier manufacturer's written instructions.
19
20 B. Apply air barrier membrane within manufacturer's recommended application temperature
21 ranges.
22
23 C. Apply primer to substrates at required rate and allow to dry. Limit priming to areas that will be
24 covered by air barrier sheet in same day. Re-prime areas exposed for more than 24 hours.
25
26 D. Apply a continuous unbroken air barrier to substrates according to the following minimum
27 thickness. Apply membrane in full contact around protrusions such as masonry ties.
28 1. Vapor-Retarding Membrane Air Barrier: 120-mil wet film thickness.
29
30 E. Apply strip and transition strip over cured air membrane overlapping 3 inches onto each surface
31 according to air barrier manufacturer's written instructions.
32
33 F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair
34 substrates and reapply air barrier components.
35

36 3.06 FIELD QUALITY CONTROL
37

- 38 A. Inspections: Air barrier materials and installation are subject to inspection for compliance with
39 requirements. Inspections may include the following:
40 1. Continuity of air barrier system has been achieved throughout the building envelope with
41 no gaps or holes.
42 2. Continuous structural support of air barrier system has been provided.
43 3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and
44 mortar droppings.
45 4. Site conditions for application temperature and dryness of substrates have been
46 maintained.
47 5. Maximum exposure time of materials to UV deterioration has not been exceeded.
48 6. Surfaces have been primed, if applicable.
49 7. Laps in strips and transition strips have complied with minimum requirements and have
50 been shingled in the correct direction (or mastic has been applied on exposed edges), with
51 no fishmouths.
52 8. Termination mastic has been applied on cut edges.
53 9. Strips and transition strips have been firmly adhered to substrate.
54 10. Compatible materials have been used.
55 11. Transitions at changes in direction and structural support at gaps have been provided.

- 1 12. Connections between assemblies (membrane and sealants) have complied with
2 requirements for cleanliness, preparation and priming of surfaces, structural support,
3 integrity, and continuity of seal.
4 13. All penetrations have been sealed.
5
6 B. Remove and replace deficient air barrier components.
7
8 3.07 CLEANING AND PROTECTION
9
10 A. Protect air barrier system from damage during application and remainder of construction period,
11 according to manufacturer's written instructions.
12 1. Protect air barrier from exposure to UV light and harmful weather exposure as required
13 by manufacturer. Remove and replace air barrier exposed for more than (45) days.
14 2. Protect air barrier from contact with creosote, uncured coal-tar products, EPDM, and
15 sealants not approved by air barrier manufacturer.
16
17 B. Clean spills, stains, and soiling from construction that would be exposed in the completed work
18 using cleaning agents and procedures recommended by manufacturer of affected construction.
19
20 C. Remove masking materials after installation.
21
22
23

END OF SECTION 07 27 26

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SECTION 07 46 46

MINERAL-FIBER-REINFORCED CEMENTITIOUS 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 WORK INCLUDED

- A. Through color high density fiber cement panels
- B. Cladding attachment system.

1.03 RELATED WORK

- A. Cold Formed Metal Framing: Section 05 40 00.
- B. Rough Carpentry: Section 06 10 00.

1.04 REFERENCES

- A. ASTM International (ASTM):
 1. ASTM C 1185 - 08 Standard Test Methods for Sampling and Testing Non-Asbestos Fiber-Cement Flat Sheet, Roofing and Siding Shingles, and Clapboards.
 2. ASTM C 1186 - 08 Standard Specification for Flat Fiber-Cement Sheets.
 3. ASTM E 84 - Surface Burning Characteristics of Building Materials.
 4. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 degree C.

1.05 SUBMITTALS

- A. Submit the following:
 1. Manufacturer's product data including preparation instructions, storage and handling requirements, installation methods.
 2. Shop Drawings: provide detailed drawings of non-standard applications of fiber cement materials. Submit engineering attachment drawings, installation drawings and details.
 3. Samples: Minimum 6" samples of each product.
 4. Submit installer qualifications with a minimum of 2 years of experience with installation of similar products.
 5. Provide a mock up including typical installation conditions at jambs, heads, sills and a pre-installation conference for acceptance of work prior to proceeding.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation in accordance with manufacturer's recommended guidelines.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.07 WARRANTY

- 1
2 A. Manufacturer's limited product warranty against manufacturing defects in materials and workmanship.
3

4 PART 2:PRODUCTS

5
6 2.01 MANUFACTURERS

- 7
8 A. Basis of Design: AFC Cladding Fiber Cement Panels by American Fiber Cement Corp.; 6901 S.
9 Pierce St. Suite 260, Littleton, CO 80128. ASD. Toll Free Tel: (800) 688-8677 ext. 102. Tel: (303)
10 978-1199. Fax: (303) 978-0308. Email: danglada@afcccladding.com. Web:
11 <http://www.americanfibercement.com>.
12

- 13 B. or approved equal.
14

15 2.02 THROUGH COLOR HIGH DENSITY FIBER CEMENT PANELS

- 16
17 A. Cembonit (Cembrit Patina Board) as manufactured by American Fiber Cement Corp.
18 1. Application: Exterior and Interior
19 2. Thickness: 5/16"
20 3. Finish: Through-colored, muted, matte finish with a unique weather-proof treatment which makes
21 it resistant to staining and surface dirt.
22 4. One color to be selected from manufacturer's full range.
23 5. Physical Characteristics: EN 12467 'Fiber-cement flat sheets'.
24 1) Density Dry: 1500 kg/m³ .
25 2) Bending strength at with grain: 32.0 MPa.
26 3) Bending strength at across grain: 22.0 MPa.
27 4) Modulus of elasticity at with grain: greater than 16 GPa.
28 5) Modulus of elasticity at across grain: greater than 14 GPa.
29 6) Hygric movement wet-dry-wet (max), mean: 2.60 mm/m.
30 7) Durability classification (EN 12467): Category A.
31 8) Strength classification (EN 12467): Class 4.
32 9) Fire reaction (EN 13501-1): A2-s1-d0.
33 10) Warm water test: Ok.
34 11) Soak dry test: Ok.
35 12) Freeze thaw test: greater than 100 cyc
36 13) Thermal conductivity e: 0.4 W/mK
37

38 2.03 MISCELLANEOUS CLADDING MATERIALS

- 39 A. Refer to section 07 28 00 for Building Wrap, Building Wrap Tape or Henry Roll on over substrate
40 at exposed joints.
41

42 2.04 ATTACHMENT SYSTEMS AND FIXING

- 43 A. Attachment system for ventilated rain screen construction of exterior cladding panels.
44 1. Product: R-TEC CI System as manufactured/supplied by American Fiber Cement Corp. for
45 compliance with ASHRAE 90.1-2013 continuous insulation definitions and requirements.
46 a. Material: Aluminum.
47 2. Accessories: a. R-TEC CI Bracket b. Aluminum "L," "T," "Hat" or "Z" profiles as indicated on
48 engineered design submittal.
49 c. Fixing: As selected and engineered by attachment manufacturer to conform with the specified
50 cladding and the exterior insulation in both thickness and type. i.e. Foam (high or low density) or
51 mineral wool.
52 3. UV Protective membrane: Refer to section 07 28 00. UV protective membrane shall be installed at
53 all exposed joints.
54 a. For open joint ventilated rain screen systems.
55 b. For exterior insulation requiring UV protection.

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- 4. Fixing Accessories:
 - a. Color-matched stainless steel Astro rivets.

PART 3:EXECUTION

3.01EXAMINATION

- A. Examine substrate to verify acceptable conditions prior to installing.
- B. Notify architect of unsatisfactory preparation before proceeding.

3.02INSTALLATION

- A. Clean surfaces prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install in accordance with manufacturer's instructions and approved submittals.
- D. For exterior applications, comply with local codes and structural engineer's fastening calculations along with manufacturer's recommendations for fastener spacing.
- E. Air space at top and bottom of building or wall termination shall be 3/4 inch (20 mm) to facilitate airflow from behind the panels. Do not block vertical airflow at windows, doors, eaves, or at the base of the building. Airflow shall be continuous from bottom to top so there is air movement behind each panel.
- F. Fasteners in profile shall accommodate thermal expansion/contraction of metal and not interfere with panel application.
- G. Install panels from top of building to bottom.
- H. For straight walls, start panel installation in center and work outward.
- I. For walls with inside corners, start installation at corner and work across wall.
- J. Pattern: Semi pattern with horizontal panels. Panel size as indicated.
- K. Rain Screen Installation: Comply with manufacturer's installation requirements.
 - a. Attachment System: Comply with manufacturer's engineered design for cladding support framing.

3.03CLEANING

- A. Protect installed products and replace damaged products.

END OF SECTION 07 46 46

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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.

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- 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: "New products installed on this project do not contain asbestos".
- 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

- 1 good standing, for the work specified herein shall to be submitted to Owner at the
2 preconstruction meeting. Document shall be up to date, indicate Contractor name,
3 certification status, year of issue and duration of such status.
- 4 a. Submit: an electronic copy of the membrane supplier's certificate of successful
5 completion (if available from membrane supplier) of training for each roofer employed
6 on this project shall be submitted to Owner at the preconstruction meeting. Document
7 shall be up to date, indicate worker name, certification status, year of issue and duration
8 of such status.
- 9 b. Submit: an electronic copy of a list of all workers to be employed on this project. The list
10 shall indicate each workers name and trade. Project supervisor and main contact person
11 shall be identified.
- 12
- 13 7. Roof Guarantee and Warranty
- 14 a. Submit one (1) original guarantee as required herein. (Refer to GUARANTEE article in
15 Part 1 of this Section).
- 16
- 17 8. Membrane Supplier Roof Warranty
- 18 a. Submit one (1) of the original membrane suppliers warranty of all membrane warranties
19 required herein. (Refer to GUARANTEE article in Part 1 of this Section).
- 20
- 21 9. Miscellaneous Metal Warranty:
- 22 a. Submit one (1) original of manufacturer warranty as required by Specification Section.
- 23
- 24 10. Safety Report: Submit and electronic copy of a written report to be given to the Owner
25 Representative at the preconstruction meeting, describing in detail the Contractors
26 implementation of specific OSHA regulations, Contractor's worker safety program
27 methods/means, roof perimeter safety and identification of the "watch person" required at all
28 roof levels. Identify fire extinguisher and their locations, all equipment/operators on
29 roof/ground in setup/storage area and travel routes used while performing the work.
- 30
- 31 C. MSDS Data:
- 32 1. Submit and electronic copy of all MSDS paperwork for each product used on this project.
- 33
- 34 D. During construction, maintain at least one (1) copy of the following at the project site:
- 35 1. These Contract Documents (specifications, drawings and any addenda).
- 36 2. All approved submittals.
- 37 3. The latest version of the manufacturer's handbook or cut sheets showing technical
38 information and application techniques for all primary roofing system materials.
- 39 4. Material Safety Data Sheets (MSDS) for all materials used on this project.
- 40
- 41 E. After the completion of the project, and prior to final payment, submit:
- 42 1. An Electronic and three (3) copies of a fully dimensioned as-built roof plan showing all seam
43 and patch locations, actual locations and sizes of roof drains, vents, fans, etc.
- 44 2. The original and one electronic copy of all roof guarantee/warranty documents.
- 45 3. The following information shall be included on all guarantees, warranty and other submittal
46 documents:
- 47 a. Street address where work was performed, building name, Owner Project number and
48 total sq. ft. of all roof areas.
- 49
- 50 F. Contractor On-Site Approved Documents:
- 51 1. Contractor shall maintain at least one (1) copy each of the construction set specification and
52 drawings, addenda, value enhancement, "Request for Information" (RFI), "Construction
53 Bulletin" (CB) and "Change Order" (CO) documents and all other approved signed submittals
54 on site throughout construction.

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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.
 - 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.

23 1.06 QUALITY ASSURANCE

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- 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.

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- 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.

- 1 E. Store materials on clean, raised platforms, with breathable, weather protective covering when
2 stored outdoors. Provide continuous protection from materials against weathering and moisture
3 absorption. Factory applied "shrink-wrapping" is not considered to be an acceptable weather
4 protective covering. Improper storage practices will be grounds for rejection of questionable
5 materials.
6
7 F. Store primers, coatings, sealants and similar materials between 60 degrees and 80 degrees
8 Fahrenheit.
9
10 G. DO NOT store materials in a manner which will overload any portion of the building.
11
12 H. Handle all materials in a manner which will not damage the material. All damaged materials shall
13 be removed from project site.
14
15 I. Select and operate material handling equipment and store materials as not to damage existing
16 construction or applied roofing, and without overloading the building structural system.
17

18 1.08 JOB CONDITIONS

- 19
20 A. Apply roofing in dry weather. All roofing materials installed during rain shall be removed and
21 replaced with dry materials at the Contractor's expense.
22
23 B. DO NOT apply roofing unless authorized by the Project Representative when the ambient
24 temperature is below 32 degrees Fahrenheit. Under no circumstances will any seaming, flashing
25 or adhesive activities be allowed when the ambient temperature is below 20 degrees Fahrenheit, or
26 the wind chill factor is below 0 degrees Fahrenheit.
27
28 C. Install all rooftop mounted equipment in a watertight manner and repair any damage to sheet metal
29 or other components related to connection and protection of the roof system.
30
31 D. Prevent materials from entering and clogging roof drains and conductors. Remove roof drain
32 plugs when no work is taking place or when rain is forecast.
33
34 E. Protection of surfaces:
35 1. Take every precaution to prevent water leakage, or debris falling into the building interior, or
36 other such occurrences. Contractor is responsible for any and all damage to the building
37 interior or its contents that occur as a direct cause of the Work and due to the Contractors
38 methods and mean practice to accomplish the Work required herein.
39 2. Provide special protection or avoid heavy traffic on completed work. Temporary walkways
40 and work platforms shall be provided as necessary.
41 3. Wall surfaces shall be protected with tarpaulins or other suitable cover to prevent damage,
42 staining or discoloration that might result from operations such as removal, disposal, or
43 removing of equipment or materials to the roof surface. Windows, doorways, walkways, etc.
44 may require special protection measures.
45
46 F. Disposal of materials:
47 1. All materials to be disposed of shall be loaded directly into trucks by means that will prevent
48 damage to existing or new surfaces and to control pollution. Free-fall of debris from heights
49 over 15' will not be allowed.
50 2. Contractor is responsible for any charges, such as landfill fees, incurred for disposal of
51 materials.
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53 1.09 GUARANTEE

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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, 90 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.

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- D. Uncured Flashing: 90 mil, uncured EPDM elastomer as recommended and supplied by the membrane manufacturer.
- E. Cured Flashing: ASTM D4637, Type I; black, non-reinforced, 90 mil EPDM elastomer as recommended and supplied by the membrane manufacturer.
- F. Perimeter Securement Strip: ASTM D4637, Type II; reinforced, 90 mil EPDM elastomer as recommended and supplied by the membrane manufacturer.

2.03 INSULATION

- A. Insulation Type 2: Tapered Polyisocyanurate, factory tapered 1/4"/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 drawings.
 - 2. Roof Cover Board: DensDeck Prime Roof Board, thickness as indicated on drawings.

2.06 AUXILIARY MEMBRANE ROOFING MATERIALS

- A. Bonding Adhesives, Cements, Tapes, Sealants and Accessories:

- 1 1. Foam and solvent based adhesives and related prepping and cleaning agents required for the
2 installation of a fully-adhere system membrane, seams, membrane flashing, membrane to
3 insulation, insulation to insulation and deck shall be approved and supplied by the approved
4 membrane provider.
5 2. Adhesives for splicing shall be butyl based.
6 3. Water-base adhesives: These products are not an acceptable for use in cold climate.
7 4. Asphalt: is NOT an acceptable insulation adhesive.
8
9 B. Plumbing Vent Flashing: Premolded boot with stainless steel drawband clamp as recommended
10 and supplied by the membrane manufacturer.
11
12 C. Termination Bar: ASTM B209, Series 3000, Temper H-14; minimum 0.10" thick, 1.25" wide
13 aluminum with reverse bend for sealant application along top edge shall be approved and supplied
14 by the membrane provider.
15
16 D. Fasteners:
17 1. Fasteners shall be approved and supplied by the membrane provider.
18 2. For Fastening Perimeter Securement Strip: Polymer coated screw and plate as recommended
19 and supplied by the membrane manufacturer.
20 3. For Fastening Membrane to Wood: 1-1/4" galvanized roofing nails through 1" metal discs.
21 4. For Fastening Termination Bar to Concrete or Masonry: Zinc alloy expansion shield with
22 hardened steel pin.
23
24 E. Pourable Sealer (if required): 2-part polyurethane sealer intended for use by the manufacturer to
25 seal pitch pans and other penetrations.
26
27 F. Sealant: ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, A or O; FS TT-S-00230C,
28 Type II, Class A; one-part polyurethane base, elastomeric joint sealing compound such as Sika
29 Chemicals "Sikaflex 1a", Sonneborn-Contech "Sonolastic NP1" or Tremco "Vulkem 116" or
30 "Dymonic".
31
32 G. Other products, not specifically described, but required for a complete and proper warranted
33 system installation as required by this section shall be selected by the Contractor to be included in
34 the Work, identified on a materials list and subject to the approval of the Architect/Engineer..
35
36

37 PART 3 – EXECUTION

38 3.01 EXAMINATION

- 39
40
41 A. Examine the areas and conditions under which work in this section will be installed. Bring to the
42 Project Representative's attention any conditions detrimental to the proper and timely completion
43 of the work. Do not proceed until unsatisfactory conditions have been corrected.
44
45 B. Proceeding with the work shall signify the Contractor's acceptance of the substrate being covered
46 by this Work.
47
48 C. General Contractor to call a meeting between the roofing contractor and plumbing contractor to
49 coordinate the final drain location. Tapered insulation drawing shall be re-submitted to the AE
50 after drain locations are approved by all, in writing. Tapered insulation installed contrary to the
51 low point of the drain, over flow or scupper locations shall be cause for rejection of the work.
52

- 1 D. Approved tapered insulation drawing layouts shall be reviewed by the Contractor installing the
2 work in this section prior to start of such work, and before ordering the materials, to assure that the
3 tapered insulation layout will correspond with the exact location of new and/or existing roof drains
4 and primary through-wall and/or roof edge drain scupper locations.
5
6 E. Tapered insulation systems that are not installed such that they drain directly and positively to the
7 roof drain shall be removed and installed correctly by the roofing Contractor at no additional cost
8 to the project.
9

10 3.02 SUBSTRATE PREPARATION
11

- 12 A. Plan work and take whatever action is necessary to prevent dirt and debris from entering the
13 building during the Work required by this section.
14
15 B. An existing bituminous vapor retarder, if found to be present, may remain if well adhered.
16
17 C. Remove existing stone ballast and stockpile on the ground for reuse.
18
19 D. All vertical surfaces to receive new flashing materials shall be thoroughly cleaned of existing
20 adhesives, sealants, bituminous materials, etc.
21
22 E. Verify that wood blocking, curbs and nailers are securely anchored and that roof openings and
23 penetrations are in place and set and braced. Verify that roof drains are properly clamped into
24 position.
25
26 F. The membrane supplier shall approve of all mechanical fasteners used to secure all roof system
27 components.
28
29 G. Contractor shall take multiple digital photos to be submitted electronically to the Owner showing
30 the various locations and types of mechanical fastening that will be hidden from view or otherwise
31 concealed beneath the completed roof system.
32
33 H. Verify that the substrate is clean, dry and free from sharp projections and depressions and that all
34 surfaces and site conditions are ready to receive new materials. Bottom flanges (ribs) of steel deck
35 shall be void of moisture and other debris.
36

37 3.03 INSTALLATION OF VAPOR RETARDER
38

- 39 B. Vapor Retarder Over Steel Deck:
40 1. A vapor retarder is required over the entire metal roof deck and be tape sealed at membrane
41 lap, perimeter and all penetrations.
42 2. Minimum lap requirements:
43 a. Sheeting lapped minimum 1'-0"
44 b. Turned up at the perimeter and penetrations a minimum 4".
45 c. Provide "duct" tape type seal at all laps, perimeter and all penetrations.
46

47 3.04 INSTALLATION OF NEW ROOF SYSTEM
48

- 49 A. Install all nailers and wood blocking in accordance with Section 06 10 00, Rough Carpentry.
50
51 B. Install insulation as follows:
52 1. Repair all damage to vapor retarder before installation of first layer of insulation.
53 2. Loose lay tapered insulation in accordance with the approved shop drawings.

- 1 3. Loose lay multiple layer(s) of polyisocyanurate insulation.
- 2 4. Stagger all joints a minimum of 6" in both directions between insulation layers.
- 3 5. Install insulation boards with edges in moderate contact without forcing. Cut insulation to fit
- 4 neatly to perimeters of roof areas and around penetrations and projections.
- 5 6. Provide: Sumps around all roof drains using tapered insulation as required or detailed. Unless
- 6 otherwise indicated, sump shall be 48" x 48". Insulation shall have a constant, gradual slope
- 7 from the perimeter of the sump to the drain bowl. Severely sloped sumps will be rejected.
- 8 7. For cold weather installation of mechanically fastened roofing system: Prepare
- 9 screw/plate/insulation to receive application of a minimum 6" x 6" piece of manufacturer
- 10 peel-and-stick over each screw/plate mechanical fastener to entomb the application and aid in
- 11 preventing direct condensation/moisture contact with the screw/plate.
- 12 8. Standing water shall be diverted by use of saddles or cricket. Ponding water is defined as
- 13 standing water on the surface of the roof membrane after 72 hours of reasonable drying
- 14 weather, after a rain.
- 15 9. Fully-adhered insulation over mechanically fastened insulation over metal deck: Fasten first
- 16 layer of insulation per manufacturer recommendations over existing or specified vapor
- 17 retarder, if required, and adhere additional layers in solvent bases adhesives as recommended
- 18 by membrane supplier. Metallic mechanical fastener plates are acceptable for use in the
- 19 system. Plastic or other plate materials are not acceptable.
- 20 10. Mechanical Fasteners: Shall be sized to be long enough to fasten into the upper flute of the
- 21 metal deck only, with a maximum 3/4" penetration unless membrane supplier requires
- 22 additional penetration, in writing. No fasteners shall be installed that could be long enough to
- 23 penetrate the lower flute of the metal deck. Fasteners installed that are longer than stated
- 24 herein shall be cause for rejection of the Work, removal of such fasteners and repair of the
- 25 metal deck, to the Owners satisfaction.
- 26 11. Exposed to Interior Fasteners: Shall be color coordinated to match the interior color of the
- 27 metal deck and submitted for Owner review and written approval. Un-approved or incorrect
- 28 colored fasteners shall be cause for rejection of the Work or be painted to match the color of
- 29 the metal deck.
- 30 12. "New Construction Fully-Adhered Systems" Requiring Mechanical Fastening To Metal Deck:
- 31 The first layer of insulation (Min. 1-1/2") only shall be mechanically fastened over existing or
- 32 specified vapor retarder, if required, over metal deck. Additional layers of insulation shall be
- 33 fully-adhered over the first layer in membrane suppliers approved adhesives to encapsulate
- 34 the mechanical fastener and its fastener plate. Metallic mechanical fastener plates are
- 35 acceptable for use in the system. Plastic or other materials plates are not acceptable.
- 36
- 37 C. Install membrane as follows:
- 38 1. Install membrane in accordance with the manufacturer's recommendations and the following:
- 39 2. Use largest membrane panels practical to minimize field seams; where necessary, lap all
- 40 seams in direction of flow.
- 41 3. Unroll membrane over the insulation and position without stretching. Allow to relax
- 42 approximately 30 minutes or more, per membrane supplier's instructions, prior to seaming.
- 43 4. Restrain membrane at the roof perimeter, at higher walls and around all curbed penetrations
- 44 using perimeter securement strip.
- 45 5. Prior to seaming, thoroughly clean membrane of excess dirt, dust, talc, etc. Scrub sheets with
- 46 warm soapy water and rinse with clean water to insure clean surfaces.
- 47 6. When using primers and adhesives, mix all materials by stirring proper lengths of time as
- 48 recommended by the manufacturer. Consult manufacturer's literature for application
- 49 techniques regarding use of rollers or brushes.
- 50 7. All field seams shall be minimum 3". Seams may be made using either adhesives or tapes.
- 51 After seaming, roll seams with a 2" wide steel roller, using positive pressure. ROLL
- 52 PERPENDICULAR TO SEAM ONLY.

- 1 8. Termination Bar: Restrain membrane at the roof perimeter, at higher walls and around all
2 curbed and other penetrations base flashing using mechanically fastened continuous perimeter
3 securement strip/metal termination bar, per manufacturer's instructions.
4 9. Cold Weather Application: Contact membrane supplier for written adhesive application
5 temperature restrictions.
6

7 D. Install flashing as follows:

- 8 1. Apply flashing to seal membrane to vertical elements, at all T-seams and at other appropriate
9 locations in accordance with the manufacturer's recommendations and the following:
10 a. Cured flashing shall be used over the waterdam portion of the roof edge/fascia at all roof
11 perimeters.
12 b. Uncured flashing shall be used on mechanical equipment curbs, other penetrations and T-
13 seams. (Cured flashing may be substituted for uncured flashing where a minimum of
14 95% adhesion is obtained.)
15 c. Totally bond (95 to 100%) all flashing to its substrate and round all exposed corners.
16 d. Use a minimum 6" x 6" patch of uncured flashing over T-seams. (A T-seam is defined as
17 two field seams which cross to form a "T".)
18 e. Forming of uncured flashing may be assisted with use of a hot air blower; take care not to
19 overheat or "burn" material.
20 f. Mechanically fasten top edge of flashings as detailed.
21 g. Thoroughly clean and apply sealant to all field fabricated seams in the membrane and
22 flashing systems in accordance with the manufacturer's detailed specifications. Sealant
23 shall be applied at the end of each day.
24 h. Flash plumbing vents as detailed. Extend standard plumbing vent stacks as necessary to
25 provide heights of 8" to 12" above the finished roof surface. No extensions shall be
26 shorter than 4" (consult Project Representative for approved methods).
27

28 E. Roof drain installation:

- 29 1. Complete installation of roof drains on a daily basis. Temporary installation at drain bowl
30 assemble shall not be allowed. Clamping rings and sealant shall be applied to assure a water
31 tight installation at the end of each work day.
32

33 3.05 CLEANING

- 34
35 A. Repair or replace defaced or disfigured finishes caused by work of this Section. In areas where
36 finished surfaces are soiled by asphalt or any other source of soiling caused by work of this
37 Section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
38
39 B. Rod and Clean Drain: When complete and roof is free of debris, Contractor shall rod and clean all
40 drain bodies and piping to the first elbow to be clean and free of previous asphalt and coal tar
41 system seepage, re-roofing debris and all other debris that may impede proper drainage.
42
43 C. All drains shall be made to be fully operable and free flowing and maintained in such condition
44 throughout construction and after final drain bowl strainer re-installation.
45
46
47
48

END OF SECTION 07 53 23

SECTION 07 61 00

SHEET METAL ROOFING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

1.02 SUMMARY

- A. Section Includes:

1. Standing-seam metal roof panels, shop-fabricated.

1.03 RELATED SECTIONS:

- A. Division 7 Section "Joint Sealants" for field-applied sealants adjoining sheet metal roofing.

1.04 PERFORMANCE REQUIREMENTS

- A. General Performance: Sheet metal roofing system including, but not limited to, metal roof panels, cleats, clips, anchors and fasteners, sheet metal flashing integral with sheet metal roofing, fascia panels, trim, underlayment, and accessories shall comply with requirements indicated without failure due to defective manufacture, fabrication, installation, or other defects in construction. Sheet metal roofing shall remain watertight.

- B. Thermal Movements: Provide sheet metal roofing that allows for thermal movements from ambient and surface temperature changes. 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. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

- B. Shop Drawings: Show fabrication and installation layouts of sheet metal roofing, including plans, elevations, expansion joint locations, and keyed details. Distinguish between shop- and field-assembled work. Include the following:

1. Details for forming sheet metal roofing, including seams and dimensions.
2. Details for joining and securing sheet metal roofing, including layout of fasteners, cleats, clips, and other attachments. Include pattern of seams.
3. Details of termination points and assemblies, including fixed points.
4. Details of expansion joints, including showing direction of expansion and contraction.
5. Details of roof penetrations.
6. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings. Include details of all shims to provide continuous 1/4" vented system.
7. Details of special conditions.
8. Details of connections to adjoining work.
9. Detail the following accessory items, at a scale of not less than 1-1/2 inches per 12 inches:
 - a. Flashing and trim.

- 1 C. Color Samples for Initial Selection: For each type of sheet metal roofing indicated, with factory-
2 applied color finishes.
3
4 D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size
5 indicated below:
6 1. Color samples on metal substrate.
7 2. Snow Guards: Full-size Sample.
8
9 E. Warranties: Sample of special warranties.

10
11 1.06 QUALITY ASSURANCE

- 12 A. Installer Qualifications: Installer of sheet metal roofing for a minimum of 10 years.
13
14 B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Minimum of 10 years factory
forming experience.
15
16 C. Source Limitations: Obtain each type of metal roof panels through one source from a single
17 manufacturer.

18 1.07 DELIVERY, STORAGE, AND HANDLING

- 19
20 A. Do not store sheet metal roofing materials in contact with other materials that might cause
21 staining, denting, or other surface damage. Store sheet metal roofing materials away from
22 uncured concrete and masonry.
23
24 B. Protect strippable protective covering on sheet metal roofing from exposure to sunlight and high
25 humidity, except to the extent necessary for the period of sheet metal roofing installation.
26

27 1.08 COORDINATION

- 28
29 A. Coordinate installation of roof curbs, equipment supports, and roof penetrations, which are
30 specified in other Sections.
31
32 B. Coordinate sheet metal roofing with rain drainage work, flashing, trim, and construction of
33 sheathing, walls, and other adjoining work to provide a leakproof, secure, and noncorrosive
34 installation.
35

36 1.09 WARRANTY

- 37
38 A. Special Weathertight Warranty: Manufacturer's Standard warranty in which manufacturer
39 agrees to repair or replace roof panel assemblies that fail to remain weather tight within the
40 specified warranty period.
41 1. Warranty Period: (20) years from date of Substantial Completion.
42
43 B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to
44 repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-
45 applied finishes within specified warranty period.
46 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
47 a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
48 b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
49 c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
50 2. Finish Warranty Period: (30) years from date of Substantial Completion.
51

52 PART 2 - PRODUCTS

- 1 2.01 ROOFING SHEET METALS
2
3 A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying a
4 strippable, temporary protective film before shipping.
5 B. Manufacturer's Qualifications:
6 All panels are to be factory formed and packaged per job requirements.
7 All panels are to be precision leveled during roll forming process.
8
9 C. Roll-formed .040 Aluminum
10 1. Surface: Smooth, flat.
11 2. Panel Width: 19 1/2", stiffening ribs standard
12 3. Seam Height: 2"
13 4. Vertical Rib, Seamed-Joint with mechanically seaming panels together with approved
14 seaming equipment
15 5. Color and finish: As selected by Architect from manufacturer's full range of standard
16 colors to match Atas Charcoal Grey (62) or approved equal.
17
18 6. KYNAR 500 PVDF or HYLAR 5000 PVDF finish.
19 a. Dry Film Thickness: ASTM D 1005, ASTM D 1400, ASTM D 4138 or ASTM D
20 5796 Specular Gloss: ASTM D 523 Pencil Hardness: ASTM D 3363 T-Bend
21 Flexibility: ASTM D 4145 Mandrel Bend Flexibility: ASTM D 522 Impact
22 Resistance: ASTM D 2794 Adhesion: ASTM D 3359 Water Immersion
23 Resistance: ASTM D 870 Abrasion Resistance: ASTM D 968 Acid Resistance:
24 ASTM D 1308 Acid Rain Resistance (Kesternich): ASTM G 87 or DIN 50018
25 Salt Spray: ASTM B 117 Cyclic Salt Spray: ASTM D 5894 Humidity Resistance:
26 ASTM D 2247 Accelerated Weathering: ASTM D 822 and ASTM G 155, ASTM
27 G 151 or ASTM G 153 Color Retention, Florida Exposure: ASTM D 2244
28 Chalking Resistance – ASTM D 4214 Cleveland Condensing Cabinet: ASTM D
29 4585 Cure Test, MEK Resistance: ASTM D 5402 Alkali Resistance, Sodium
30 Hydroxide: ASTM D 1308, Procedure 7.2 Organic coatings meet requirements of
31 AAMA 2605 when applied to aluminum. Panel testing/ratings: Structural: ASTM
32 E 330 (Modified) Uplift/Load: ASTM E 1592 UL580 Class 90 (UL File R12113)
33 TAS 125 Air Infiltration: ASTM E 283 Water Penetration: ASTM E 331 Wind
34 Driven Rain: TAS 100 AAMA 501.1 Fire Resistance: UL790/ASTM E 108
35 Impact Resistance: UL 2218 Penetration (Foot Traffic): ICC ES AC166, Par. 4.2
36 Florida Product Approval: FL 3556 R4 Load tables available upon request
37 Galvanized Steel: ASTM A 653 55% Al-Zn alloy coated Steel: ASTM A 792
38 Aluminum: ASTM B 209 Copper: ASTM B 370 Coil Coating: ASTM A 755
39 Field Tested and Approved.
40
41 D. Provide all related components and trim accessories for a complete installation including flat
42 sheet and/or coil stock in matching color and gauge no less than roof panel in finish matching
43 roof panel.
44
45 E. Metal Roof Panels:
46 1. Basis of design: ATAS International, Inc. Field Lok Structural Standing Seam Roof Panel
47 2. Contact Information: Johanna Welsh, jwelsh@atas.com, ph: 312.859.2066
48 3. Approved equal by:
49 a. Firestone/Uni-Clad
50 b. Pac-Clad.
51 c. Centria
52 d. Or approved manufacturer. Substitution requests must meet specifications and
53 must be submitted a minimum of ten (10) days prior to date of bid.
54

55 2.02 UNDERLAYMENT MATERIALS
56

- 1
2 A. Self-Adhering, High-Temperature Sheet: Minimum 45 mil thick, consisting of slip-resisting
3 polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with
4 release-paper backing; cold applied. Provide primer when recommended by underlayment
5 manufacturer.
6 1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
7 2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
8 3. Products: Basis of design: ATAS ATA Shield at all flashing points. Subject to
9 compliance with requirements, other products are available but must be pre-approved by
10 the roof panel manufacturer.

11
12 2.03 MISCELLANEOUS MATERIALS

- 13
14 A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings,
15 separators, sealants, and other miscellaneous items as required for a complete roofing system
16 and as recommended by primary sheet metal manufacturer unless otherwise indicated.
17
18 B. Fasteners: Wood screws, annular-threaded nails, self-tapping screws, self-locking rivets and
19 bolts, and other suitable fasteners designed to withstand design loads.
20 1. General:
21 a. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic
22 caps or factory-applied coating.
23 b. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed,
24 with hex-washer head.
25 c. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for
26 metal being fastened.
27
28 C. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant
29 tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining
30 tape 1/2 inch wide and 1/8 inch thick.
31
32 D. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant;
33 polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited
34 movement.
35
36 E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

37
38 2.04 ACCESSORIES

- 39
40 A. Clip and ASV Clip Spacer for Above-Sheathing Ventilation system. Provide 16 ga. Galv. Steel
41 clip base with 22 ga. Galv. steel clip stem with ASV Clip Spacer and shims to lift all roof edge
42 areas (ridges, valleys, eaves, gables, etc.) and trim to provide a minimum 3/8" continuous air
43 flow between the roof sheathing and the metal panel system.
44 B. Sheet Metal Accessories: Provide components required for a complete sheet metal roofing
45 assembly including trim, copings, fasciae, corner units, clips, flashings, sealants, gaskets, fillers,
46 metal closures, closure strips, and similar items. Match material and finish of sheet metal
47 roofing unless otherwise indicated.
48 1. Cleats: For mechanically seaming into joints and formed from the following materials:
49 a. Metallic-Coated Steel Roofing: 0.025-inch thick stainless steel.
50 2. Backing Plates: Plates at roofing splices, fabricated from material recommended by
51 SMACNA.
52 3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin foam or
53 closed-cell laminated polyethylene; minimum 1-inch- thick, flexible-closure strips; cut or
54 premolded to match sheet metal roofing profile. Provide closure strips where indicated or
55 necessary to ensure weathertight construction.

- 1 4. Flashing and Trim: Formed from same material and with same finish as sheet metal
2 roofing, minimum thickness matching the sheet metal roofing with a minimum of 12'
3 lengths
4 a. Vented ridge flashing with perforated "Z" closures.
5
6 C. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.
7
8 2.05 GUTTERS AND DOWNSPOUTS
9
10 A. Rectangular, plain.
11 1. Minimum Size: 4" x 6", .040 Aluminum.
12 2. Support straps: 1/16" x 1".
13 a. 10' on center vertically.
14 3. Provide elbows, offsets and extensions.
15 4. Minimum gutter length: 20'
16
17 B. Material: Pre-finished metal to match roof color and material thickness.
18 C. Size to meet SMACNA recommendation for proper rainfall. Coordinate with civil drawings for
19 connections to underground discharge piping.
20
21 2.06 SNOW GUARDS
22 A. Snow Guards, General: Prefabricated, noncorrosive units designed to be installed without
23 penetrating sheet metal roofing; complete with predrilled holes, clamps, or hooks for anchoring.
24 Bar/Rail -Type Snow Retention Systems for Standing Seam Metal Roofs
25
26 B. Bar/Rail-Type Snow Retention System: Non-Penetrating attachment system to utilizing aluminum
27 extruded clamps, brackets, and brackets.
28 1. Products: Basis of Design: ColorGard manufactured by S-5! Metal Roof Innovations, Ltd.
29 Components of ColorGard to include clamps, brackets, cross members, color strips, snow
30 and ice clips, and all related accessories for each component. Subject to compliance with
31 requirements, available products that may be incorporated into the Work include, but are not
32 limited to, the following:
33 ATAS International, Inc., or approved equal.
34 2. Finish – Color Strips: To be selected by architect from manufacturer's full range including
35 premium colors.
36
37 2.07 FABRICATION
38
39 A. General: Custom fabricate sheet metal roofing to comply with details shown and
40 recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to the design,
41 dimensions (panel width and seam height), geometry, metal thickness, and other characteristics
42 of installation indicated. Fabricate sheet metal roofing and accessories at the shop to greatest
43 extent possible.
44 1. Standing-Seam Roofing: Form standing-seam panels with finished seam height of 1-1/2
45 inches.
46
47 B. Fabrication Tolerances: Fabricate sheet metal roofing that is capable of installation to a tolerance
48 of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of
49 adjoining faces and of alignment of matching profiles.
50
51 C. Form exposed sheet metal work to fit substrates without excessive oil canning, buckling, and
52 tool marks; true to line and levels indicated; and with exposed edges folded back to form hems.
53 1. Lay out sheet metal roofing so transverse seams, if required, are made in direction of
54 flow with higher panels overlapping lower panels.
55 2. Offset transverse seams from each other 12 inches minimum.
56 3. Fold and cleat eaves and transverse seams in the shop.

- 1 4. Form and fabricate sheets, seams, strips, cleats, valleys, ridges, edge treatments, integral
2 flashings, and other components of metal roofing to profiles, patterns, and drainage
3 arrangements shown on Drawings and as required for leakproof construction.
4
- 5 D. Expansion Provisions: Fabricate sheet metal roofing to allow for expansion in running work
6 sufficient to prevent leakage, damage, and deterioration of the Work. Where lapped expansion
7 provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1
8 inch deep, filled with butyl sealant concealed within joints.
9
- 10 E. Sealant Joints: Where movable, non-expansion-type joints are indicated or required to produce
11 weathertight seams, form metal to provide for proper installation of elastomeric sealant in
12 compliance with SMACNA standards.
13
- 14 F. Metal Protection: Where dissimilar metals will contact each other, protect against galvanic
15 action by painting contact surfaces with bituminous coating, by applying self-adhering sheet
16 underlayment to each contact surface, or by other permanent separation as recommended by
17 fabricator of sheet metal roofing or manufacturers of the metals in contact.
18
- 19 G. Sheet Metal Accessories: Custom fabricate flashings and trim to comply with recommendations
20 in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and
21 other characteristics of item indicated. Obtain field measurements for accurate fit before shop
22 fabrication.
23 1. Form exposed sheet metal accessories without excessive oil canning, buckling, and tool
24 marks and true to line and levels indicated, with exposed edges folded back to form
25 hems.
26 2. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not
27 allowed on faces of accessories exposed to view.
28 3. Fabricate cleats and attachment devices of sizes as recommended by SMACNA's
29 "Architectural Sheet Metal Manual" for application, but not less than thickness of metal
30 being secured.
31
- 32 H. Do not use graphite pencils to mark metal surfaces.
33

34 PART 3 - EXECUTION

35 3.01 EXAMINATION

- 36 A. Examine substrates, areas, and conditions, with Installer present, for compliance with
37 requirements for installation tolerances, substrate, and other conditions affecting performance of
38 the Work.
39 1. Examine solid roof sheathing to verify that sheathing joints are supported by framing or
40 blocking, that tops of fasteners are flush with surface, and that installation is within
41 flatness tolerances required for finished roofing installation.
42 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely
43 anchored, and that provision has been made for drainage, flashings, and penetrations
44 through sheet metal roofing.
45
46
47
- 48 B. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to
49 performance of the Work.
50
- 51 C. Examine roughing-in for components and systems penetrating sheet metal roofing to verify
52 actual locations of penetrations relative to seam locations of sheet metal roofing before
53 installation.
54
- 55 D. Proceed with installation only after unsatisfactory conditions have been corrected.
56

- 1 3.02 UNDERLAYMENT INSTALLATION
2
3 A. Install breathable ice and water shield over the entire roof. ATA-Guard or approved equal.
4
5 B. Underlayment: Install breathable ice and water shield underlayment on roof sheathing under
6 sheet metal roofing. Mechanically attached, coated woven synthetic roofing underlayment for
7 sloped roofs. ATA-Guard is 100% asphalt free, reinforced underlayment. Advanced polymers
8 are combined to produce a film that is unaffected by water and resistant to UV for up to 6
9 months. ATA-Guard, 30 mil thickness.
10
11 C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free, on
12 roof sheathing under sheet metal roofing. Apply primer if required by underlayment
13 manufacturer. Comply with temperature restrictions of underlayment manufacturer for
14 installation; use primer rather than nails for installing underlayment at low temperatures. Apply
15 in shingle fashion to shed water, with end laps and overlap edges in accordance with the
16 underlayment manufacturers requirements. ATA-Shield, 45 mil.
17
18 D. Install flashings to cover underlayment to comply with requirements in Division 7 Section
19 "Sheet Metal Flashing and Trim."
20
21 3.03 INSTALLATION, GENERAL
22
23 A. Structural continuous standing seam panel with an integral seam.
24 B. General: Anchor sheet metal roofing and other components of the Work securely in place, with
25 provisions for thermal and structural movement. Install fasteners, solder, welding rods,
26 protective coatings, separators, sealants, and other miscellaneous items as required for a
27 complete roofing system and as recommended by fabricator for sheet metal roofing.
28 1. Field cutting of sheet metal roofing by torch is not permitted.
29 2. Provide metal closures at peaks, rake edges, rake walls, eaves and each side of ridge caps.
30 3. Flash and seal sheet metal roofing with closure strips at eaves, rakes, and perimeter of all
31 openings. Fasten with self-tapping screws.
32 4. Locate and space fastenings in uniform vertical and horizontal alignment. Pre-drill panels
33 for fasteners.
34 5. Install ridge caps as sheet metal roofing work proceeds.
35 6. Locate roofing splices over, but not attached to, structural supports. Stagger roofing
36 splices and end laps to avoid a four-panel lap splice condition. Install backing plates at
37 roofing splices.
38 7. Install sealant tape where indicated.
39 8. Lap metal flashing over sheet metal roofing to allow moisture to run over and off the
40 material.
41 9. Do not use graphite pencils to mark metal surfaces.
42
43 C. Thermal Movement. Rigidly fasten metal roof panels to structure at only one location for each
44 panel. Allow remainder of panel to move freely for thermal expansion and contraction.
45 1. Point of Fixity: Fasten each panel along a single line of fixing located at ridge.
46 2. Avoid attaching accessories through roof panels in a manner that will inhibit thermal
47 movement.
48
49 D. Fasteners: Use fasteners of sizes that will penetrate wood sheathing not less than 1-1/4 inches
50 for nails and not less than 3/4 inch for wood screws.
51 1. Fasteners at eaves shall be sized to not penetrate the exposed face of the cedar, T&G
52 sheathing.
53
54 E. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect
55 against galvanic action by painting contact surfaces with bituminous coating, by applying self-

1 adhering sheet underlayment to each contact surface, or by other permanent separation as
2 recommended by SMACNA.

3
4 F. Conceal fasteners and expansion provisions where possible in exposed work and locate to
5 minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight
6 installation.

7
8 G. Fascia: Align bottom of sheet metal roofing and fasten with blind rivets, bolts, or self-tapping
9 screws. Flash and seal sheet metal roofing with closure strips where fasciae meet soffits, along
10 lower panel edges, and at perimeter of all openings.

11 12 3.04 CUSTOM-FABRICATED SHEET METAL ROOFING INSTALLATION

13
14 A. Fabricate and install work with lines and corners of exposed units true and accurate. Form
15 exposed faces flat and free of buckles, excessive waves, and avoidable tool marks, considering
16 temper and reflectivity of metal. Provide uniform, neat seams with minimum exposure of solder,
17 welds, and sealant. Fold back sheet metal to form a hem on concealed side of exposed edges
18 unless otherwise indicated.

- 19 1. Install cleats to hold sheet metal panels in position. Attach each cleat with two fasteners
20 to prevent rotation.
- 21 2. Fasten cleats not more than 12 inches o.c. Bend tabs over fastener head.
- 22 3. Provide expansion-type cleats and clips for roof panels that exceed 30 feet in length.

23
24 B. Seal joints as shown and as required for watertight construction. For roofing with 3:12 slopes or
25 less, use cleats at transverse seams.

- 26 1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than
27 1 inch into sealant. Form joints to completely conceal sealant.
 - 28 a. When ambient temperature at time of installation is moderate, between 40 and
29 70 deg F, set joint members for 50 percent movement each way. Adjust setting
30 proportionately for installation at higher ambient temperatures.
 - 31 b. Do not install sealant-type joints at temperatures below 40 deg F.
- 32 2. Prepare joints and apply sealants to comply with requirements in Division 7 Section
33 "Joint Sealants."

34
35 C. Standing-Seam Roofing: Attach standing-seam metal panels to substrate with clips, double
36 fastened in accordance with the roof panel manufacturers requirements. Install panels reaching
37 from eave to ridge before moving to adjacent panels. Before panels are interlocked, apply
38 continuous bead of sealant to top of flange of lower panel. Lock standing seams by folding over
39 twice so cleat and panel edges are completely engaged.

40 41 3.05 ACCESSORY INSTALLATION

42
43 A. General: Install accessories with positive anchorage to building and weathertight mounting and
44 provide for thermal expansion. Coordinate installation with flashings and other components.

- 45 1. Install components required for a complete sheet metal roofing assembly including trim,
46 copings, seam covers, flashings, sealants, gaskets, fillers, metal closures, closure strips,
47 and similar items.
- 48 2. Install accessories integral to sheet metal roofing that are specified in Division 7 Section
49 "Sheet Metal Flashing and Trim" to comply with that Section's requirements.

50
51 B. Flashing and Trim: Comply with performance requirements, manufacturer's written installation
52 instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners
53 where possible, and set units true to line and level as indicated. Install work with laps, joints,
54 and seams that will be permanently watertight and weather resistant.

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1. Install flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
 2. Install continuous strip of self-adhering underlayment at edge of continuous flashing overlapping self-adhering underlayment, where "continuous seal strip" is indicated in SMACNA's "Architectural Sheet Metal Manual," and where indicated on Drawings.
 3. Install exposed flashing and trim without excessive oil canning, buckling, and tool marks and 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.
 4. 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, and filled with butyl sealant concealed within joints.
- C. Pipe Flashing: Form flashing around pipe penetration and sheet metal roofing. Fasten and seal to sheet metal roofing as recommended by SMACNA.
- D. Stop-Type Snow Guards: Attach snow guards to sheet metal roofing with adhesive or adhesive tape, as recommended by manufacturer. Do not use fasteners that will penetrate sheet metal roofing.
1. Provide snow guards on downward slopes, up from roof edge beginning at location of bearing wall below.
 2. Rows staggered 4" horizontally between sheet metal roofing ribs.
- 3.06 ERECTION TOLERANCES
- A. Installation Tolerances: Shim and align sheet metal roofing within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- 3.07 CLEANING AND PROTECTION
- A. Clean off excess sealants.
- B. Remove temporary protective coverings and strippable films as sheet metal roofing is installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal roofing installation, clean finished surfaces as recommended by sheet metal roofing manufacturer. Maintain sheet metal roofing in a clean condition during construction.

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SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern all work under this section.

1.02 WORK INCLUDED

- A. Metal Counter Flashing.
- B. Miscellaneous Sheet Metal Accessories.

1.03 RELATED WORK

- A. Flashing at Masonry: Section 04 05 19.
- B. Sheet Metal Roofing: Section 07 61 00 for exposed metal trim.
- C. Plumbing and HVAC Vents.

1.04 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 and made a part of this work.
 1. AISI – American Iron and Steel Institute.
 2. ASTM A653 - Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 3. ASTM B32 - Solder Metal.
 4. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
 5. ASTM C920 – Elastomeric Joint Sealants.
 6. ASTM D2244 – Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 7. ASTM D4214 – Test Methods for Evaluating Degree of Chalking of Exterior Paint Films.
 8. NRCA - Roofing and Waterproofing Manual.
 9. SMACNA - Architectural Sheet Metal Manual.

1.05 SUBMITTALS

- A. Submit in accordance with the General Conditions of the Contract.
- B. Sustainable Design Documentation: Submit documentation from the manufacturer highlighting requirements for materials and products of this Section.
- C. Shop Drawings showing profiles, joint treatment, fastening methods, gauge and finish of materials.
- D. Color Samples for Initial Selection: Samples of pre-finished sheet metal showing the exact color(s) and texture(s) available for selection.
 1. Provide range of a minimum of (3) custom color samples of slightly varying color and shade.

- 1 E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size
2 indicated below:
3 1. Color samples on metal substrate.
4
- 5 1.06 GUARANTEE
6 A. Manufacturer's Warranty: Provide the sheet metal manufacturer's standard twenty (20) year
7 warranty stating at a minimum that the metal finish will not chalk in excess of an eight (8) rating, or
8 fade in excess of a five (5) rating, when tested in accordance with ASTM D2244 and ASTM D4214.
9
- 10 1.07 SUSTAINABLE DESIGN REQUIREMENTS
11
- 12 A. Recycled content: Provide products manufactured from recycled content as specified.
13 1. Sheet metal: Minimum 30% post-consumer recycled content.
14
- 15 B. Regional Materials: Provide materials or products that have been extracted, harvested, or recovered,
16 as well as manufactured, within 500 miles of the project site.
17 1. Sheet metal: 100%.
18
- 19 C. Low-Emitting Materials, Adhesives, and Sealants: Materials used on the interior of the building
20 (defined as inside the weatherproofing system and applied on site) must not exceed the following
21 requirements.
22 1. Adhesives, Sealants and Sealant Primers: South Coast Air Quality Management (SCAQMD)
23 Rule # 1168, requirements in effect on July 1, 2005, and rule amendment date January 7,
24 2005.
25 2. Aerosol Adhesives: Green Seal Standard for Commercial Adhesives GS-36, requirements in
26 effect on October 19, 2000.
27

28 PART 2 - PRODUCTS 29

- 30 2.01 SHEET METAL
31 A. Galvanized Metal Flashing: ASTM A653, G-90; 20 gauge galvanized steel.
32
- 33 2.02 ACCESSORIES
34
- 35 A. Fasteners: Where not specified, size fasteners to suit conditions.
36
- 37 1. Metal to Wood (exposed locations): #10 x 1-1/2" stainless steel screws with metal capped
38 neoprene or PVC washers.
39
- 40 2. Other Metal to Wood (concealed locations): 1-3/4" hot-dipped galvanized roofing nails.
41
- 42 3. Metal to Metal: #10 x 3/4" stainless steel sheet metal screws with pan or hex heads or 1/8"
43 diameter color-matched pop rivets.
44
- 45 4. Metal to Concrete or Masonry: Zinc-alloy expansion shields with hardened steel pins.
46
- 47 B. Solder: ASTM B32; 50% pig lead - 50% block tin.
48
- 49 C. Flux: Muriatic acid killed with zinc, or an approved brand of commercial soldering flux.
50
- 51 D. Sealant: ASTM C920, Type M, Grade NS, Class 50, Use T, NT, M, A or O; multi-part polyurethane
52 base, elastomeric joint sealing compound:
53 1. Sika Chemicals "Sikaflex 2c NS"
54 2. Degussa Sonneborn "Sonolastic NP2"
55 3. Pecora "Dynatred"

- 1 4. Tremco "Vulkem 227" or "Dymeric"
2 5. Color: Selected by A/E from manufacturer's full range of colors.
3
4 E. Rosin Paper: Unsaturated rosin sized building paper, minimum 4 lbs. /square.
5
6 F. Flexible Flashing: 0.045" EPDM.
7
8 G. Other products, not specifically described, but required for a complete and proper installation of the
9 work in this section shall be selected by the Contractor subject to the approval of the A/E.
10
11 2.03 METAL COUNTER/CAP FLASHING
12
13 A. 24-gauge pre-finished galvanized steel.
14
15 B. Formed in 8-foot sections, lap end joints 3 inches.
16 1. Do not seal joints; make continuous at angles; overlap base flashing minimum of 3 inches.
17
18 PART 3 - EXECUTION
19
20 3.01 EXAMINATION
21
22 A. Examine surfaces to be covered by sheet metal. Report any improper defective surfaces to
23 Contractor in writing. Beginning of sheet metal work over surfaces: Presumed as acceptance of
24 surfaces as satisfactory by sheet metal sub-contractor.
25
26 3.02 FABRICATION
27
28 A. Fabricate new sections as detailed. Form sections true to shape, accurate in size, square and free
29 from distortion or defects. Do not "punch" metal at brake points.
30
31 B. Form all pieces in lengths of 8'-0" or 10'-0" where practical. Sections less than 3' long are
32 unacceptable unless that section comprises the entire run.
33
34 C. Unless detailed otherwise, hem exposed edges on underside 1/2"; fabricate vertical faces with
35 bottom edge formed outward 1/2" at 45 degrees and hemmed to form drip.
36
37 D. Miter and seam inside and outside corners using rivets and polyurethane sealant. Outside corners
38 shall be prefabricated with outside face of section broken at corner; seam at corner is unacceptable.
39 Pieces shall be a minimum of 18" in length, in both directions from the corner.
40
41 3.03 WORKMANSHIP
42
43 A. Make all work weather and watertight throughout; provide allowances for material expansion and
44 contraction.
45
46 B. Sections shall be uniform, accurately fitted so as to line up straight and true and rigidly secured in
47 place, without kinks or buckles. Joints at corners and angles shall be smooth, tight and neatly
48 mitered and seamed.
49
50 C. Unless detailed otherwise, lap all vertical joints between adjacent sections a minimum of 2".
51
52 D. Where metal is hooked to a continuous cleat, crimp metal to cleat along entire length.
53
54 E. Soldering:
55

- 1 1. Rivet pieces prior to soldering.
- 2
- 3 2. Soldering shall be done with heavy soldering coppers of blunt design, properly tinned before
- 4 using. Coppers shall weigh not less than 10 pounds per pair. Use of a gas torch is not
- 5 allowed.
- 6
- 7 3. Follow manufacturer's recommendations for cleaning, tinning and soldering metal.
- 8
- 9 4. Soldering shall be done slowly to heat sheet metal thoroughly and to sweat solder completely
- 10 through full width of seam. Whenever possible, soldering shall be done in flat position;
- 11 seams on slopes shall be soldered a second time.
- 12
- 13 5. Clean all flux from metal after soldering is completed.
- 14

15 3.04 INSTALLATION

- 16
- 17 A. Junctures where sheet metal abuts into adjacent dissimilar materials: Executed in manner that will
- 18 prevent electrolysis between the two materials.
- 19
- 20 B. Insure that all work is precisely done, true to line, and free from over bending, burning, deforming,
- 21 stretching, distortion, waves and buckles.
- 22
- 23 C. Repair or replace all damaged or defective work.
- 24

25 3.05 COUNTERFLASHING RECEIVER:

- 26
- 27 A. Install new receiver as detailed or where required.
- 28
- 29 B. Notch and lap joints 3" between sections.
- 30
- 31 C. Apply sealant at the joint between the receiver and the masonry wall where receiver is not part of a
- 32 thru-wall flashing; DO NOT APPLY SEALANT between masonry and thru-wall flashings.
- 33

34 3.06 COUNTERFLASHING:

- 35
- 36 A. Fasten counterflashing to receiver with stainless steel sheet metal screws @ 24" O.C.
- 37
- 38 B. Notch and lap joints 3" between sections; bayonet joints are unacceptable. Do not fasten joints
- 39 between sections.
- 40
- 41 C. Counterflashing shall be creased longitudinally just enough to provide a spring action that will hold
- 42 bottom edge firmly against flashing.
- 43

44 3.07 WALL FLASHING: (FLASHINGS AT MASONRY WALLS.)

- 45
- 46 A. Install flashings in accordance with Section 04 05 19.
- 47

48 3.08 MISCELLANEOUS FLASHINGS:

- 49
- 50 A. Install appropriate flashings at all exhausts, vents and penetrations not specifically called out but
- 51 required.
- 52
- 53 B. Remount and secure all rooftop equipment. Use threaded fasteners.
- 54

55 3.09 CLEANING

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A. Clean exposed sheet metal of roofing materials, mortar, hand marks, other foreign materials.

END OF SECTION

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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. Wall Joints (exterior).

1.03 RELATED WORK

- A. Section 07 62 00, Sheet Metal Flashing and Trim.
- B. Section 08 11 13, Steel Doors and Frames.

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. 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.

- E. Field-Adhesion Test Reports: For each sealant application tested.

- F. 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. Notify A/E seven days in advance of dates and times when test joints will be erected.
3. 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.
4. 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.
5. 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.

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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. 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.

- 1 b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
2 c. May National Associates, Inc.; Bondaflex Sil 290.
3 d. Pecora Corporation; 301 NS.
4 e. Sika Corporation, Construction Products Division; SikaSil-C990.
5 f. Tremco Incorporated; Spectrem 1.
6
7 B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920,
8 Type S, Grade NS, Class 100/50, for Use T.
9 1. Products: Subject to compliance with requirements, available products that may be
10 incorporated into the Work include, but are not limited to, the following:
11 a. Dow Corning Corporation; NS Parking Structure Sealant.
12 b. May National Associates, Inc.; Bondaflex Sil 728 NS.
13 c. Pecora Corporation; 311 NS.
14 d. Tremco Incorporated; Spectrem 800.
15
16 C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade
17 NS, Class 25, for Use NT.
18 1. Products: Subject to compliance with requirements, available products that may be
19 incorporated into the Work include, but are not limited to, the following:
20 a. Dow Corning Corporation; 799.
21 b. GE Advanced Materials - Silicones; UltraGlaze SSG4000 or UltraGlaze
22 SSG4000AC.
23 c. May National Associates, Inc.; Bondaflex Sil 200 GPN or Bondaflex Sil 201 FC.
24 d. Polymeric Systems, Inc.; PSI-631.
25 e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
26 f. Tremco Incorporated; Proglaze SSG or Tremsil 600.
27
28 D. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS,
29 Class 50, for Use NT.
30 1. Products: Subject to compliance with requirements, available products that may be
31 incorporated into the Work include, but are not limited to, the following:
32 a. Tremco Incorporated; Spectrem 4TS.
33
34 E. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920,
35 Type S, Grade NS, Class 25, for Use NT.
36 1. Products: Subject to compliance with requirements, available products that may be
37 incorporated into the Work include, but are not limited to, the following:
38 a. Pecora Corporation; 898.
39
40 2.03 LATEX JOINT SEALANTS
41
42 A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP,
43 Grade NF.
44
45 1. Products: Subject to compliance with requirements, available products that may be
46 incorporated into the Work include, but are not limited to, the following:
47 a. BASF Building Systems; Sonolac.
48 b. Bostik, Inc. Chem-Chal 600.
49 c. Pecora Corporation; AC-20+.
50 d. Tremco Incorporated; Tremflex 834.
51
52 2.04 PREFORMED JOINT SEALANTS
53

1 A. A. Preformed Silicone Joint Sealants: Manufacturer's standard sealant consisting of precured
2 lowmodulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-
3 curing silicone sealant for bonding extrusions to substrates.
4

5 2.05 SEALANT ACCESSORIES
6

7 A. Primer: When required, as recommended by the Sealant Manufacturer.
8

9 B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants
10 and sealant backing materials, free of oily residues or other substances capable of staining or
11 harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote
12 optimum adhesion of sealants to joint substrates.
13

14 C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces
15 adjacent to joints.
16

17 D. Joint Sealant Backing:
18

19 1. General: Provide sealant backings of material that are nonstaining; are compatible with joint
20 substrates, sealants, primers, and other joint fillers; and are approved for applications
21 indicated by sealant manufacturer based on field experience and laboratory testing.
22

23 2. Closed Cell Back-up (Backer Rod): ASTM C 1330, Type C.

24 a. Tremco "Closed Cell Backer Rod".

25 b. Sonneborn "Sonofam".

26 c. W.R. Meadows "Kool-Rod".
27

28 3. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant
29 manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or
30 joint surfaces at back of joint. Provide self-adhesive tape where applicable.
31

32 PART 3 - EXECUTION
33

34 3.01 EXAMINATION
35

36 A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with
37 requirements for joint configuration, installation tolerances, and other conditions affecting joint-
38 sealant performance.

39 B. Proceed with installation only after unsatisfactory conditions have been corrected.
40

41 3.02 JOINT PREPARATION
42

43 A. Clean joint surfaces immediately before installation of sealant. Remove dirt, insecure coatings,
44 moisture and other substances which would interfere with bond of sealant. Etch concrete and
45 masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous or glazed
46 joint surfaces as recommended by sealant manufacturer.
47

48 B. Prime or seal the joint surfaces wherever shown or recommended by the sealant manufacturer.
49 Do not allow primer/sealer to spill or migrate onto adjoining surfaces.
50

51 3.03 SEALANT APPLICATION, GENERAL
52

53 A. General: Comply with joint-sealant manufacturer's written installation instructions for products
54 and applications indicated, unless more stringent requirements apply.

- 1 B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint
2 sealants as applicable to materials, applications, and conditions indicated.
3
- 4 C. Set joint filler units at proper depth or position in the joint to coordinate with other work,
5 including the installation of bond breakers, backer rods and sealants.
6
- 7 1. Do not leave voids or gaps between the ends of joint filler units.
8 2. Do not stretch, twist, puncture, or tear sealant backings.
9 3. Remove absorbent sealant backings that have become wet before sealant application and
10 replace them with dry materials.
11
- 12 D. Install bond breaker tape wherever shown and wherever required by manufacturer's
13 recommendations to ensure that elastomeric sealants will perform properly.
14
- 15 E. Apply compound with a gun having proper size nozzle or with a knife, as required. Use
16 sufficient pressure to fill all voids and joints solid. Remove excess sealant and leave surfaces
17 smooth, neat and clean. Upon completion sealant shall have a smooth, even finish and all joints
18 shall be weathertight. All work shall be in accordance with manufacturer's printed instructions.
19
- 20 F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing
21 begins, tool sealants according to requirements specified in subparagraphs below to form
22 smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact
23 and adhesion of sealant with sides of joint.
24
- 25 1. Remove excess sealant from surfaces adjacent to joints.
26 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not
27 discolor sealants or adjacent surfaces.
28 3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
29 4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
30 5. Provide recessed joint configuration of recess depth and at locations indicated per
31 Figure 8C in ASTM C 1193.
32 a. Use masking tape to protect surfaces adjacent to recessed tooled joints.
33
- 34 G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal
35 construction at perimeters, behind control joints, and at openings and penetrations with a
36 continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at
37 perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's
38 written recommendations. Refer to Section 09 29 00 for product.
39
- 40 H. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate
41 into the voids of adjoining surfaces. Clean the adjoining surfaces by whatever means may be
42 necessary to eliminate evidence of spillage.
43

44 3.04 FIELD QUALITY CONTROL

45

- 46 A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
47 1. Extent of Testing: Test completed and cured sealant joints as follows:
48 a. Perform 5 tests for the first 1000 feet of joint length for each kind of exterior
49 sealant and joint substrate.
50 b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor
51 per elevation.
52
- 53 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint
54 Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in
55 ASTM C 1521.

- 1 a. For joints with dissimilar substrates, verify adhesion to each substrate separately;
2 extend cut along one side, verifying adhesion to opposite side. Repeat procedure
3 for opposite side.
4
- 5 3. Inspect tested joints and report on the following:
6 a. Whether sealants filled joint cavities and are free of voids.
7 b. Whether sealant dimensions and configurations comply with specified
8 requirements.
9 c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint
10 substrates or tore cohesively. Include data on pull distance used to test each kind
11 of product and joint substrate. Compare these results to determine if adhesion
12 passes sealant manufacturer's field-adhesion hand-pull test criteria.
13
- 14 4. Record test results in a field-adhesion-test log. Include dates when sealants were
15 installed, names of persons who installed sealants, test dates, test locations, whether joints
16 were primed, adhesion results and percent elongations, sealant fill, sealant configuration,
17 and sealant dimensions.
- 18 5. Repair sealants pulled from test area by applying new sealants following same procedures
19 used originally to seal joints. Ensure that original sealant surfaces are clean and that new
20 sealant contacts original sealant.
21
- 22 B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from
23 testing or noncompliance with other indicated requirements will be considered satisfactory.
24 Remove sealants that fail to adhere to joint substrates during testing or to comply with other
25 requirements. Retest failed applications until test results prove sealants comply with indicated
26 requirements.
27
- 28 3.05 PROTECTION
- 29
- 30 A. Cure sealants in compliance with manufacturer's instructions and recommendations. Advise the
31 Contractor of procedures required for the cure and protection of joint sealers during the
32 construction period, so that they will be without deterioration or damage (other than normal wear
33 and weathering) at the time of Substantial Completion.
34
- 35 3.06 JOINT-SEALANT COLOR SCHEDULE
- 36
- 37 1. Provide different sealant colors, as selected by A/E from manufacturer's full range of colors,
38 at the following joint locations, and as specified in related Sections:
39 a. Cast-in-place concrete.
40 b. HM Doors and Frames.
41
42
43

END OF SECTION 07 92 00

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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 Doors.
- B. Hollow Metal Frames.

1.03 RELATED WORK

- A. Joint Sealants: Section 07 92 00.
- B. Door Hardware: Section 08 71 00.
- C. Painting: Section 09 90 00.

1.04 REFERENCES

- A. Comply with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.
- B. ANSI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
- C. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings
- D. ANSI A250.5 Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors
- E. ANSI A250.6 Hardware on Steel Doors (Reinforcement --Application)
- F. ANSI A250.8 Nomenclature for Standard Steel Doors and Steel Door Frames
- G. ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames
- H. ANSI/DHI A115 Specifications for Hardware Preparations in Standard Steel Doors and Frames
- I. ANSI/DHI A115.1G Installation Guide for Doors and Hardware
- J. SDI-Steel Door Institute
- K. ASTM E119 Methods for Fire Tests of Building Construction and Materials.

- 1 L. ASTM A240/A240M Standard Specification for Heat-Resisting Chromium and Chromium-
2 Nickel Stainless Steel
- 3
- 4 M. ASTM A366 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality
- 5
- 6 N. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy,
7 Hot-Rolled and Cold-Rolled, General Requirements
- 8
- 9 O. ASTM A569 Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled
10 Sheet and Strip Commercial Quality
- 11
- 12 P. ASTM A591 Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for light Coating
13 Mass Applications
- 14
- 15 Q. ASTM A620 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Drawing Quality,
16 Special Killed
- 17
- 18 R. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron
19 Alloy-Coated (Galvanealed) by the Hot-Dip Process
- 20
- 21 S. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated
22 by the Hot-Dip Process
- 23
- 24 T. NFPA-101-94: Life Safety Code.
- 25
- 26 U. American Welding Society
- 27

28 1.05 SUBMITTALS

- 29
- 30 A. Submit in accordance with the General Conditions of the Contract.
- 31 1. Manufacturer's technical product data substantiating that products comply with
32 requirements.
- 33 2. Shop Drawings for fabrication and installation of steel doors and frames. Include details
34 of each frame type, elevations of door design types, conditions at openings, details of
35 construction, location and installation requirements of finish hardware and
36 reinforcements, and details of joints and connections. Show anchorage and accessory
37 items.
- 38 a. Provide schedule of doors and frames using same reference numbers for details
39 and openings as those on contract drawings.
- 40 b. Indicate coordination of glazing frames and stops with glass and glazing
41 requirements.
- 42
- 43 3. Oversize Construction Certification: For assemblies required to be fire rated and exceeding
44 limitations of labeled assemblies.
- 45
- 46 4. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified
47 testing agency, for each type of hollow metal door and frame assembly.
- 48

49 1.06 QUALITY ASSURANCE

- 50
- 51 A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.
- 52

53 1.07 DELIVERY, STORAGE, AND HANDLING

54

- 1 A. Deliver hollow metal work cartoned or crated to provide protection during transit and job
2 storage.
3 1. Provide additional protection to prevent damage to finish of factory-finished units.
4
5 B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to
6 jambs and mullions.
7
8 C. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided
9 refinished items are equal in all respects to new work and acceptable to Construction Manager;
10 otherwise, remove and replace damaged items as directed.
11
12 D. Store doors and frames at building site under cover. Place units on minimum 4 inch high wood
13 blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity
14 chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4
15 inch spaces between stacked doors to promote air circulation.
16

17 1.08 PROJECT CONDITIONS

- 18
19 A. Examine the openings and conditions under which hollow metal work is to be installed. Do not
20 proceed with the work until unsatisfactory conditions have been corrected.
21

22 PART 2 - PRODUCTS

23
24 2.01 MANUFACTURERS, HOLLOW METAL

- 25
26 A. Amweld Building Products
27
28 B. Ceco Door Products
29
30 C. Curries Company
31
32 D. Kewaunee Corporation
33
34 E. Mesker Door, Inc.
35
36 F. Steelcraft
37
38 G. Or approved equal.
39

40 2.02 MATERIALS

- 41
42 A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for
43 exposed applications.
44
45 B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale,
46 pitting, or surface defects; pickled and oiled.
47
48 C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill
49 phosphatized.
50 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008 or
51 ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
52
53 D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
54

- 1 E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated,
2 fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching
3 hollow metal frames of type indicated.
4
- 5 F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C
6 143/C 143M.
7
- 8 G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of
9 fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum
10 flamespread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for
11 combustion characteristics.
12
- 13 H. Glazing: Comply with requirements in Division 08 Section "Glazing."
14
- 15 I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film
16 thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur
17 components, and other deleterious impurities.
18
- 19 J. Steel: Commercial quality, level, cold-rolled steel conforming to ASTM A366, free of scale and
20 surface defects. Commercial quality hot rolled and pickled steel conforming to ASTM A569
21 may be used as option for interior frames. Standard hollow metal frame gauges are as follows
22 (Bullet Resistant must meet specified resistance level):
23 1. Interior Frames: 16-gage.
24 2. Exterior Frames: 14-gage.
25 3. Flush Doors: 16-gage (exterior), 18-gage (interior).
26 4. Rough Bucks and Stiffeners: 12-gage.
27 5. Miscellaneous Trim: 16 gage.
28

29 2.03 FABRICATION, GENERAL
30

- 31 A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal
32 to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and
33 assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify
34 work that cannot be permanently factory assembled before shipment.
35
- 36 B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
37
- 38 C. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-
39 rolled steel sheet.
40
- 41 D. Fabricate doors to a maximum tolerance of 1/16 inch from a straight edge when laid on face of
42 door in any direction, including diagonal.
43
- 44 E. Provide proper Underwriters' Laboratory (UL) labels. Labeled doors shall have equal labeled
45 frames.
46
- 47 F. Clearances
48 1. Edge clearances shall be provided as follows:
49 a. Between doors and frame, at head and jambs - 1/8 inch.
50 b. At door sills:
51 1) Where no threshold is used - 3/8 minimum.
52 2) Where threshold is used - 1/4 inch maximum between door & threshold.
53

- 1 G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware;
2 include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware
3 Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
4 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
5 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door
6 hardware.
7 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series
8 specifications for preparation of hollow metal work for hardware.
9 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26
10 Sections.
11
12 H. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners
13 of stops and moldings with butted or mitered hairline joints.
14 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal
15 work. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each
16 glazed lite is capable of being removed independently.
17 2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and
18 frames.
19 3. Provide loose stops and moldings on inside of hollow metal work. Coordinate rabbet width
20 between fixed and removable stops with type of glazing and type installation indicated.
21
22 2.04 HOLLOW METAL FRAME FABRICATION
23
24 A. Provide metal frames of the types and styles indicated on the drawings or schedules and
25 complying with SDI for materials and construction requirements.
26
27 B. Provide metal frames for doors, transoms, sidelights, borrowed lites, and other openings, as
28 shown on drawings.
29
30 C. Provide integral channel frames, sub frames and stiffeners to structure where indicated or
31 required for fastening and stiffening frames.
32
33 D. Provide steel spreader temporarily attached to feet of both jambs for welded frames.
34
35 E. Completely clean all frames by degreasing process, followed by one coat rust inhibitive primer
36 equal to withstand a salt spray test (5% solution) of 70 hours. Thoroughly prime all surfaces
37 without runs, smears, or bare spots, and under and inside all removable stops.
38
39 F. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment
40 plates or angles at each joint, fabricated of same thickness metal as frames.
41
42 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth,
43 flush, and invisible.
44 2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints,
45 fabricated from same material as door frame. Fasten members at crossings and to jambs by
46 butt welding.
47 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners
48 unless otherwise indicated.
49 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
50 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds
51 per anchor.
52 6. Jamb Anchors: Provide number and spacing of anchors as follows:
53 a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of
54 frame. Space anchors not more than 32 inches o.c. and as follows:
55 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. Compression Type: Not less than two anchors in each jamb.
 - c. 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 HOLLOW METAL DOOR FABRICATION

- A. Top and bottom edges of all doors shall be closed with a continuous recessed steel channel not less than 16-gauge, full width spot welded to both faces.
- B. All doors to be flush with seamless edges i.e., provide continuous flush end closures, continuously welded in place and ground smooth.
- C. Hardware location per manufacturer recommended heights to meet ADA requirements.
- D. Completely clean all doors of impurities and pressure sand to a smooth surface and correct all irregularities with metallic putty sanded smooth. Provide one spray coat of primer, baked on. Thoroughly paint unexposed inside surfaces of exterior doors, fire doors, and other doors occurring in excessive moisture area.
- E. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- F. Glazed Lites: Factory cut openings in doors.

2.06 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
 1. Design: As indicated.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
 - a. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 6.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
 - 1) Locations: Exterior doors and doors that connect the main (office and Medical Examiner Suite) portion of the building to Garage, 150.
 3. Vertical Edges for Single-Acting Doors: Beveled edge.
 - a. Beveled Edge: 1/8 inch in 2 inches.
 4. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- thick, end closures or channels of same material as face sheets.
 5. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Door and Frames."

- 1 B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying
2 with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and
3 ANSI/SDI A250.4 for physical performance level:
4 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).
5
6 C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from
7 same material as door face sheets.
8
9 D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
10
11 2.07 STANDARD HOLLOW METAL FRAMES
12
13 A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
14
15 B. Exterior Frames: Fabricated from metallic-coated steel sheet.
16 1. Fabricate frames with mitered or coped corners.
17 2. Fabricate frames as face welded unless otherwise indicated.
18 Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.
19
20 C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from
21 same material as frames.
22
23 2.08 FRAME ANCHORS
24
25 A. Jamb Anchors:
26 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less
27 than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10
28 inches long; or wire anchors not less than 0.177 inch thick.
29 2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
30 3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch diameter
31 bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat
32 reinforcement plate, welded to frame at each anchor location.
33
34 B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
35 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
36 2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not
37 less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
38
39 2.09 STOPS AND MOLDINGS
40
41 A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as
42 door face sheet in which they are installed.
43
44 B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high
45 unless otherwise indicated.
46
47 C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material
48 as frames in which they are installed.
49
50 D. Cut-Off Stops:
51 1. Angled stop terminates 6-inches above the floor, closed at a 45 degree angle.
52 2. See Door Schedule for locations.
53
54 2.010 STEEL FINISHES
55

- 1 A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
- 2 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying
- 3 with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for
- 4 substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- 5 2. Ensure primer is compatible with finish coats scheduled.

6
7 PART 3 - EXECUTION

8
9 3.01 EXAMINATION

- 10 A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements
- 11 for installation tolerances and other conditions affecting performance of the Work.
- 12
- 13 B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame
- 14 installation.
- 15
- 16 C. Proceed with installation only after unsatisfactory conditions have been corrected.
- 17
- 18

19 3.02 PREPARATION

- 20 A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding,
- 21 filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- 22
- 23 B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness,
- 24 alignment, twist, and plumbness to the following tolerances:
- 25 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb
- 26 perpendicular to frame head.
- 27 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane
- 28 of wall.
- 29 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines,
- 30 and perpendicular to plane of wall.
- 31 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to
- 32 floor.
- 33
- 34 C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door
- 35 hardware.
- 36
- 37

38 3.03 INSTALLATION

- 39 A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place;
- 40 comply with Drawings and manufacturer's written instructions.
- 41
- 42 B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with
- 43 ANSI/SDI A250.11.
- 44 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent
- 45 anchors are set. After wall construction is complete, remove temporary braces, leaving
- 46 surfaces smooth and undamaged.
- 47 a. Where frames are fabricated in sections because of shipping or handling limitations,
- 48 field splice at approved locations by welding face joint continuously; grind, fill, dress,
- 49 and make splice smooth, flush, and invisible on exposed faces.
- 50 b. Install frames with removable glazing stops located on secure side of opening.
- 51 c. Install door silencers in frames before grouting.
- 52 d. Remove temporary braces necessary for installation only after frames have been
- 53 properly set and secured.
- 54

- 1 e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as
- 2 necessary to comply with installation tolerances.
- 3 f. Field apply bituminous coating to backs of frames that are filled with grout containing
- 4 antifreezing agents.
- 5
- 6 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and
- 7 secure with postinstalled expansion anchors.
- 8 a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled
- 9 expansion anchors if so indicated and approved on Shop Drawings.
- 10
- 11 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
- 12 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between
- 13 frames and masonry with grout.
- 14 5. Completely fill jambs and head of hollow metal door frames in masonry walls with grout.
- 15 6. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions,
- 16 including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
- 17 7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled
- 18 expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on
- 19 exposed faces.
- 20 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural
- 21 supports or substrates above frame unless frame is anchored to masonry or to other structural
- 22 support at each jamb. Bend top of struts to provide flush contact for securing to supporting
- 23 construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
- 24 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist,
- 25 and plumb to the following tolerances:
- 26 a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees
- 27 from jamb perpendicular to frame head.
- 28 b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to
- 29 plane of wall.
- 30 c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on
- 31 parallel lines, and perpendicular to plane of wall.
- 32 d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- 33
- 34 C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified
- 35 below. Shim as necessary.
- 36 1. Non-Fire-Rated Standard Steel Doors:
- 37 a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
- 38 b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
- 39 c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
- 40 d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
- 41
- 42 D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow
- 43 metal manufacturer's written instructions\.
- 44 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more
- 45 than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 46
- 47 E. Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames",
- 48 unless otherwise indicated.
- 49 1. Except for frames located at in-place concrete or masonry and at drywall installations,
- 50 place frames prior to construction of enclosing walls and ceilings. Set frames accurately
- 51 in position, plumbed, aligned, and braced securely until permanent anchors are set. After
- 52 wall construction is completed, remove temporary braces and spreaders leaving surfaces
- 53 smooth and undamaged.
- 54 2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.

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. 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. Other as needed.
 - 5. Hinges:
 - a. Spring-loaded concealed pin type.
 - 6. Latch:
 - a. Screwdriver-operated cam latch.

- 1 b. Key operated security lock.
2
- 3 2.05 FABRICATION
4
- 5 A. General: Provide access door assemblies manufactured as integral units ready for installation.
6
- 7 B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials
8 with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam
9 marks, roller marks, rolled trade names, or roughness.
10
- 11 C. Steel Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces.
12 Furnish attachment devices and fasteners of type required to secure access panels to types of
13 supports indicated.
14
- 15 D. For trimless frames with drywall bead for installation in gypsum board assembly, provide edge
16 trim for gypsum board securely attached to perimeter of frames.
17
- 18 E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when
19 closed.
20
- 21 F. All access doors to be fabricated and properly installed in such a manner as to maintain the fire
22 rating of the assembly into which it is placed.
23
- 24 2.06 FINISHES, GENERAL
25
- 26 A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for
27 recommendations for applying and designating finishes.
28
- 29 B. Finish metal fabrications after assembly.
30
- 31 2.07 METALLIC-COATED STEEL FINISHES
32
- 33 A. Galvanizing of Steel Shapes and Plates: Hot-dip galvanize items indicated to comply with
34 applicable standard listed below:
35 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
36 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
37
- 38 B. Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and
39 other contaminants. For galvanized surfaces, apply, after cleaning, a conversion coating suited
40 to the organic coating to be applied over it. For metallic-coated surfaces, clean welds,
41 mechanical connections, and abraded areas, and apply galvanizing repair paint specified below
42 to comply with ASTM A 780.
43 1. Galvanizing Repair Paint: High-zinc-dust-content paint for re-galvanizing welds in steel,
44 complying with SSPC-Paint 20.
45
- 46 C. Factory Priming for Field-Painted Finish: Apply shop primer immediately after cleaning and
47 pre-treating.
48
- 49 PART 3 - EXECUTION
50
- 51 3.01 INSTALLATION
52
- 53 A. Install according to manufacturer's instructions.
54 1. Doors to be installed plumb/level/square as surfaces require.
55 2. Maintain even gap between frame and door.
56

1 3.02 ADJUSTING AND CLEANING

2

3 A. Adjust doors and hardware after installation for proper operation.

4

5 B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

6

7 C. Remove all packaging material upon completion.

8

9

10

END OF SECTION 08 31 13

SECTION 08 52 00

WOOD WINDOWS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern the work under this section.

1.02 WORK INCLUDED

- A. This Section includes operable and fixed wood-framed windows of the following type:
 - 1. Wood windows.

1.03 DEFINITIONS

- A. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
 - 1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
- B. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- C. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

1.04 PERFORMANCE REQUIREMENTS

- A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified, and that are of test size indicated below:
 - 1. Size required by AAMA/WDMA 101/I.S.2/NAFS for gateway performance.
 - 2. Size indicated on Drawings.
- B. Structural Performance: Provide wood windows capable of withstanding the effects of the following loads based on testing units representative of those indicated for Project that pass AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Structural Test:
 - 1. Design Wind Loads: Determine design wind loads applicable to Project from basic wind speed indicated in miles per hour at 33 feet above grade, according to ASCE 7, Section 6.5, "Method 2- Analytical Procedure," based on mean roof heights above grade indicated on Drawings.
 - 2. Deflection: Design glass framing system to limit lateral deflections of glass edges to less than 1/175 of glass-edge length or 3/4 inch, whichever is less, at design pressure based on testing performed according to AAMA/WDMA 101/I.S.2/NAFS, Uniform Load Deflection Test or structural computations.
- C. Windborne-Debris Resistance: Provide glazed windows capable of resisting impact from windborne debris, based on the pass/fail criteria as determined from testing glazed windows identical to those specified, according to ASTM E 1886 and testing information in ASTM E 1996 or AAMA 506 and requirements of authorities having jurisdiction.

1.05 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.

- B. Shop Drawings: Include plans, elevations, sections, details, hardware, attachments to other work, operational clearances, installation details, and the following:
 - 1. Joinery details.
 - 2. Expansion provisions.
 - 3. Flashing and drainage details.
 - 4. Weather-stripping details.
 - 5. Thermal-break details.
 - 6. Glazing details.
 - 7. Window cleaning provisions.

C. Qualification Data: For installer and manufacturer.

D. Warranty

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.

B. Manufacturer Qualifications: A manufacturer capable of fabricating wood windows that meet or exceed performance requirements indicated and of documenting this performance by inclusion in lists and by labels, test reports, and calculations.

C. Source Limitations: Obtain wood windows through one source from a single manufacturer.

D. Product Options: Information on Drawings and in Specifications establishes requirements for wood windows' aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

E. Product Options: Drawings indicate size, profiles, and dimensional requirements of wood windows and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements." Do not modify size and dimensional requirements.

- 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

F. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

- 1. Provide AAMA or WDMA-certified wood windows with an attached label.

G. Glazing Publications: Comply with published recommendations of glass manufacturers and with GANA's "Glazing Manual" unless more stringent requirements are indicated.

1.07 PROJECT CONDITIONS

A. Field Measurements: Verify wood window openings by field measurements before fabrication and indicate measurements on Shop Drawings.

- 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating wood windows without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure to meet performance requirements.
 - b. Structural failures including excessive deflection, water leakage, air infiltration, or condensation.
 - c. Faulty operation of movable sash and hardware.
 - d. Deterioration of wood, metals, other materials, and finishes beyond normal weathering.
 - e. Failure of insulating glass.
 - 2. Warranty Period:
 - a. Window: Ten years from date of Substantial Completion.
 - b. Glazing: Insulating glass shall be warranted against visible obstruction thru the glass caused by a failure of the insulating glass air seal for a period of twenty (20) years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Archispec LLC, River Hills, WI ph: 414.628.6000, archispecllc.com
 - a. Or approved equal

2.02 WOOD WINDOWS

- A. Material: Sipo mahogany (Entandrophragma Utile)
quartered/ straight grain dried to 8%
clear grade
free of any checks, knots, defects
- B. Window Type: Inward Tilt and fixed as indicated on Drawings.
- C. Air Infiltration: Air leakage shall not exceed the following when tested at 6.24 psf according to ASTM E 283: 0.30 cfm per square foot of frame.
- D. Water Resistance: No water penetration when tested at the following pressure according to ASTM E 547: C-R40-6.0 psf, C-C50-7.5 psf, C-C65-9.75 psf.
- E. Test Pressure: Assembly shall withstand a positive or negative uniform static air pressure difference of C-R40-60 psf, C-C50-75 psf, C-C65-97.5 psf. without damage when tested according to ASTM E 330.
- F. Operating Force and Auxiliary (Durability) Tests: Comply with AAMA/WDMA 101/I.S.2/NAFS for operating window types indicated.

2.03 FINISH

- A. All units sanded to 180 grit
- B. Stain
provided by "Sikkens" AkzoNobel www.sikkens.com
one coat of cetol one color stain
two coats of "door/window" elastic top coat

2.04 GLAZING

- A. Cardinal IG Company, Spring Green WI
1" overall thickness, 3/16" clear over 3/16" low e 3 with argon fill
20 yr warranty
1/4" glass on larger units per glass manufacturer requirements
www.cardinalcorp.com
Tempered at all locations.

- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

2.05 HARDWARE

- A. Hardware: manual operation, coordinate mounting of controls with owner below bottom of sill, removable level if possible. Operable window locking hardware by GU hardware (Gretch Unitas) made in Germany, 10 year warranty on parts www.g-u.com
- B. Hardware finish: Provide bronze or oil-rubbed bronze at crank handles and lock levers.

2.06 ACCESSORIES

- A. Insect Screens at all operable windows: oversize, custom. Charcoal aluminum wire. Aluminum frame finish: Bronze.
- B. Mullion covers:
 - 1. Wood to match windows

2.07 FABRICATION

- A. Fabricate wood windows in sizes indicated. Include a complete system for assembling components and anchoring windows.
- B. Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
- D. Factory machine windows for openings and for hardware that is not surface applied.
- E. Factory-Glazed Fabrication: Except for light sizes in excess of 100 united inches, glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 8 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
- F. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing windows, hardware, accessories, and other components.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.

3.03 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.
- E. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.

END OF SECTION 08 52 00

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SECTION 08 58 00

ALUMINUM SLIDING SERVICE WINDOW

PART 1 - GENERAL

1.01 SUMMARY

- A. This section includes:
 - 1. Aluminum, heavy-duty commercial sliding service windows as indicated in drawings.

1.02 SUBMITTALS

- A. Product Data: Submit Manufacturer's technical product data substantiating that products comply.
- B. Shop drawings: Submit for fabrication and installation of windows. Include details, elevations and installation requirement of finish hardware and cleaning.
- C. Certification: Provide printed data in sufficient detail to indicate compliance with the contract documents.

1.03 DELIVERY, STORAGE, AND HANDLING

- A. Deliver windows crated to provide protection during transit and job storage
- B. Inspect windows upon delivery for damage. Unless minor defects can be made to meet the Architect's specifications and satisfaction, damaged parts should be removed and replaced.
- C. Store windows at building site under cover in dry location.

1.04 PROJECT CONDITIONS

- A. Field measurements: Check opening by accurate field measurement before fabrication. Show recorded measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.05 WARRANTY

- A. All material and workmanship shall be warranted against defects for a period of one (1) year from the original date of purchase.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER'S

- A. Basis of design: Design is based on aluminum (DW) series, deluxe sliding service window manufactured by C.R. Laurence Co., Inc. (800) 421-6144 or equal by:
 - 1. Ready-Access, Chicago, IL.
 - 2. Creative Industries, Indianapolis, IN.
 - 3. Nissen & Company, South El Monte, CA.

2.02 MATERIALS

- 1 A. Frames: 4" Aluminum frame modules shall be constructed of 6063-T5 extruded aluminum.
2 Replacement and servicing of glass shall be from the clerk side of the window by means of an access
3 panel in the top header and does not require the removal of the frame from the opening. Window
4 glides on top-hung heavy-duty ball bearing slides. Poly-pile weather stripping and self-latching
5 handle. Overall frame sizes are to be in accordance with the drawings.
6
7 B. Finish: All aluminum to be custom color KYNAR Painted.
8
9 C. Glazing: The glazing is 1/4" in thickness. Provide tempered, insulating glazing.
10
11 D. Screens
12
13 E. Options: Stainless steel shelf, keyed lock, full bottom track.
14

15 PART 3 - EXECUTION

16
17 3.01 INSTALLATION

- 18
19 A. Install window in accordance with manufacturer's printed instructions and recommendations.
20

21 3.02 CLEANING

- 22
23 A. Clean frame and glazing surfaces after installation, complying with requirements contained in the
24 manufacturer's instructions. Remove excess glazing sealant compounds, dirt or other substances.
25

26 3.03 PROTECTION

- 27
28 A. Institute protective measures required throughout the remainder of the construction period to ensure
29 that all the windows do not incur any damage or deterioration, other than normal weathering, at the
30 time of acceptance.
31

32
33
END OF SECTION 08 58 00

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. Hollow Metal Doors and Frames: Section 08 11 13.

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. Reinstalled salvaged hardware is included in the scope of the work.
 - 2. Samples of hardware items as may be required. Identify each sample and indicate the location of subsequent installation in the project.
 - 3. 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 approval 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: Company specializing in the builders' hardware industry.
- 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 Owner Installed hardware.

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. Manufacturers

1. Hinges	Hager Hinge Co.	HAG
a. Approved Equals:	Stanley	STA
	McKinney	MCK
2. Lockset	Marshall Best	MBS
a. Approved Equals:	No substitutions. Provide 7-pin interchangeable core cylinders to match existing. New cylinders shall be keyed into existing masterkey system.	
3. Door Closers	LCN	LCN
a. Approved Equals:	No substitutions.	
4. Kickplate	Rockwood Mfg. Co	ROC
6. Electric Strikes	Security Door Controls	SDC
a. Approved Equals:	HES	HES

B. Hardware Sets:

SET 01

Opening(s): 100

3 EA HINGES

BB1191 – 4.5 X 4.5 X NRP 630 HAGER

1	EA	CLASSROOM LOCK	MB1A-3-03-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4111-SHCUSH X SRI	689	LCN
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP
1	EA	DRIP STRIP	16A	AL	NGP

SET 02

Opening(s): 101, 200C, 600A

3	EA	HINGES	BB1279 – 4.5 X 4.5 X NRP	652	HAGER
1	EA	STOREROOM LOCK	MB1A-3-05-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4111 X SCUSH	689	LCN

SET 03

Opening(s): 200

6	EA	HINGES	BB1191 – 5 X 5	630	HAGER
1	EA	CLASSROOM LOCK	MB1A-3-03-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4011H	689	LCN
1	EA	CLOSER	4011H X ST1495	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	EA	FLOOR STOP	440	626	ROCKWOOD
1	SET	AUTO FLUSHBOLTS	FB31P	630	IVES
1	EA	DUSTPROOF STRIKE	DP1	630	IVES
1	EA	COORDINATOR	COR X FL	628	IVES
1	SET	SEALS	5050C	BLK	NGP
1	EA	THRESHOLD	896	AL	NGP

**PROVIDE SPECIAL TEMPLATE TO ALLOW FOR 180 DEGREE SWING WHERE SHOWN ON PLANS.

SET 04

Opening(s): 500

6	EA	HINGES	BB1279 – 5 X 5	652	HAGER
1	EA	CLASSROOM LOCK	MB1A-3-03-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4011H	689	LCN
1	EA	CLOSER	4011H X ST1495	689	LCN
2	EA	WALL STOP	409	630	ROCKWOOD
1	SET	AUTO FLUSHBOLTS	FB31P	630	IVES
1	EA	DUSTPROOF STRIKE	DP1	630	IVES
1	EA	COORDINATOR	COR X FL	628	IVES
1	SET	SEALS	5050C	BLK	NGP
1	EA	THRESHOLD	896	AL	NGP

**PROVIDE SPECIAL TEMPLATE TO ALLOW FOR 180 DEGREE SWING WHERE SHOWN ON PLANS.

SET 05

Opening(s): 200A, 200B, 500A, 500B

3	EA	HINGES	BB1279 – 4.5 X 4.5	652	HAGER
1	EA	DEADBOLT	MBT-3-S	626	MARSHALL BEST
1	EA	PUSH	70C X C/C	630	ROCKWOOD
1	EA	PULL	BF111 X 70C X C/C	630	ROCKWOOD

1	EA	CLOSER	4011	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD

SET 06

Opening(s): 500C, 600B

3	EA	HINGES	BB1191 – 4.5 X 4.5 X NRP	630	HAGER
1	EA	STOREROOM LOCK	MB1A-3-05-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4111-SCUSH	689	LCN
1	SET	WEATHERSTRIP	160S	AL	NGP
1	EA	SWEEP	200N	AL	NGP
1	EA	THRESHOLD	8425	AL	NGP
1	EA	DRIP STRIP	16A	AL	NGP

SET 07

Opening(s): 600C

3	EA	HINGES	BB1279 – 4.5 X 4.5	652	HAGER
1	EA	STOREROOM LOCK	MB1A-3-05-15-S1	626	MARSHALL BEST
1	EA	CLOSER	4011 X ST1544 X 4020-18	689	LCN
1	EA	OVERHEAD STOP	GJ100 SERIES	630	GLYNN-JOHNSON

SET 08

Opening(s): 300, 400

3	EA	HINGES	BB1279 – 4.5 X 4.5	652	HAGER
1	EA	DORMITORY LOCK	RS-TD-S	626	MARSHALL BEST
1	EA	INDICATOR	RS-21-S-O-626	626	MARSHALL BEST
1	EA	CLOSER	4011	689	LCN
1	EA	WALL STOP	409	630	ROCKWOOD
1	EA	KEYPAD	920	630	SDC
1	EA	POWER SUPPLY	602RF X FB4	GRY	SDC
1	EA	ELECTRIC STRIKE	55-D	630	SDC
1	EA	RELEASE BUTTON	DTMA-2	BEI	SDC
1	SET	SEALS	5050C	BLK	NGP
1	EA	THRESHOLD	896	AL	NGP

**PROVIDE ONE RELEASE BUTTON TO OPERATE BOTH DOORS. RELEASE BUTTON TO BE LOCATED IN CONCESSIONS AREA.

OPERATION: DOOR NORMALLY LOCKED AND CLOSED. ENTRY VIA KEYPAD, VIA REMOTE RELEASE, OR VIA MAINTAINED RELEASE THROUGH KEYPAD OR RELEASE BUTTON. THROWING DEADBOLT ON LOCK PROJECTS DEADBOLT AND INDICATES WHETHER ROOM IS OCCUPIED/UNOCCUPIED. KEYPAD AND RELEASE BUTTON WILL NOT ALLOW ACCESS WHILE DEADBOLT IS THROWN TO PROVIDE PRIVACY TO USER (KEY WILL RETRACT DEADBOLT IN EMERGENCY SITUATIONS). FREE EGRESS IS ALWAYS ALLOWED.

SET 09

Opening(s): Furnace Enclosure access above chase in Room 200

3	EA	HINGES	BB1279 – 4.5 X 4.5	652	HAGER
1	EA	DEADBOLT	MBT-3-S	626	MARSHALL BEST

DOOR AND FRAME SCHEDULE

DOOR NO.	QNTY	DOOR						FRAME				FIRE LABEL	HDWR GROUP	REMARKS
		SIZE		MATERIAL	ELEV	GLASS	LOUVER OR UNDERCUT	MATL	ELEV	DETAILS				
		W	H							T	HEAD			
100	1	3-0	7-0	-	HM	A	-	-	HM			-	1	
101	1	3-0	7-0	-	HM	A	-	-	HM			-	2	
200	2	3-0	7-0	-	HM	A	-	-	HM			-	3	
200A	1	4-0	6-4	-	STEEL	A	-	-	STEEL			-	5	1
200B	1	4-0	6-4	-	STEEL	A	-	-	STEEL			-	5	1
200C	1	3-0	7-0	-	HM	A	-	-	HM			-	2	
300	1	3-0	7-0	-	HM	A	-	-	HM			-	8	
400	1	3-0	7-0	-	HM	A	-	-	HM			-	8	
500	2	3-0	7-0	-	HM	A	-	-	HM			-	4	
500A	1	3-8	6-4	-	STEEL	A	-	-	STEEL			-	5	1
500B	1	3-8	6-4	-	STEEL	A	-	-	STEEL			-	5	1
500C	1	3-0	7-0	-	HM	A	-	-	HM			-	6	
600A	1	3-0	7-0	-	HM	A	-	-	HM			-	2	
600B	1	3-0	7-0	-	HM	A	-	-	HM			-	6	
600C	1	3-0	7-0	-	HM	A	-	-	HM			-	7	

GENERAL NOTES:

1. PAINT ALL HM FRAMES/DOORS TO MATCH ARCHITECT'S SAMPLE
2. 4" HEAD TYPICAL ALL HM FRAMES, COORDINATE WITH MASONRY COURSING

LEGEND

- | | |
|----|--------------|
| HM | HOLLOW METAL |
| UC | UNDERCUT |

REMARKS:

1. SEE PLAN FOR CONFIGURATION. PROVIDE CUSTOM STEEL JAMBS WITH STOPS. STOPS REQUIRED AT BOTH CLOSED AND OPEN POSITION TO ALLOW DEADBOLT TO LOCK IN THE OPEN POSITION. PROVIDE 2" MINIMUM FRAME DIMENSION WITH PROFILE COORDINATED WITH ALL HARDWARE. BENT METAL ACCEPTABLE AT STOPS IN CLOSED POSITION IF FULLY COORDINATED TO PROVIDE STOPS AND ACCOMMODATE DEADBOLT. DOOR FRAME TO BE 1 3/4" STEEL FRAME PERIMETER FOR ATTACHMENT OF FIBER CEMENT PANELS. FIELD VERIFY ALL MASONRY DIMENSIONS PRIOR TO FABRICATION OF DOOR OR JAMBS.

1 SECTION 09 29 00

2
3 GYPSUM BOARD

4
5 PART 1 - GENERAL

6
7 1.01 RELATED DOCUMENTS

- 8
9 A. Conditions of the Contract and portions of Division One of this Project Manual apply to this Section
10 as though repeated herein.

11
12 1.02 WORK INCLUDED

- 13
14 A. Gypsum Board and Gypsum Board Assemblies (Metal Studs)
15
16 B. Trim and Accessories.

17
18 1.03 RELATED WORK

- 19
20 A. Section 06 10 00, Rough Carpentry
21
22 B. Section 09 90 00, Painting

23
24 1.04 REFERENCES

- 25
26 A. Referenced Specifications: The more stringent requirement of this section or referenced
27 specification applies.
28 1. "Using Gypsum Board for Walls and Ceilings", The Gypsum Association - GA-201-85.
29 2. "Recommended Specifications for the Application and Finishing Gypsum Boards", The
30 Gypsum Association - GA-216.

31
32 1.05 SUBMITTALS

- 33
34 A. Submit in accordance with the General Conditions of the Contract.
35 1. Manufacturer's product data including acoustic sealant.
36 2. Texture finish sample.

37
38 1.06 DELIVERY, STORAGE AND HANDLING

- 39
40 A. Deliver materials to the project site with manufacturer's labels intact and legible.
41
42 B. Handle materials with care to prevent damage.
43
44 C. Storage
45 1. Store materials inside under cover, stack flat, off floor.
46 2. Stack wallboard so that long lengths are not over short lengths.
47 3. Avoid overloading floor system.
48 4. Store adhesives in dry area, provide protection against freezing at all times.

49
50 1.07 PROJECT CONDITIONS

- 51
52 A. During cold weather, maintain temperature range between 55 degrees F. to 70 degrees F. for 24
53 hours before, during, and after gypsum board and joint treatment applications.
54
55 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. Suspension System

- 1 1. Chicago Metallic 640 system.
2 a. Hanger Wire: 8-gage, annealed.
3 b. Carrying Channels: 1-1/2 inch cold rolled steel.
4 c. Screws: USG 1-inch type S.
5 d. Furring Channels: USG metal furring channel, attached with USG furring channel
6 clips.
7
8 D. Accessories
9 1. Metal Trim: USG No. 200-A or approved equal.
10 2. L-shaped Metal Trim USG No. 801-B.
11 3. Metal Reveal Molding: Fry Reglet DRM-625-75.
12 4. Metal Reveal Molding: Fry Reglet DRM-625-200.
13 5. Metal "Z" Reveal Molding, 1/4" wide: Fry Reglet DRMZ-625-25.
14 6. Metal "Z" Reveal Molding, 1/2" deep X 1/2" wide: Fry Reglet DRMZ-50-50
15 7. Metal "Z" Reveal Molding 5/8" wide X 1/2" deep Fry-Reglet DRMZ- 625-50.
16 8. Metal "Z" Reveal Molding, 1" wide: Fry Reglet DRMZ-100-100.
17 9. Metal "Z" Reveal Molding 2" wide: Fry Reglet DRMZ-625-200
18 10. Expansion Joints: USG No. 093.
19 11. Drywall Screws for Metal Framing: 1" Type S-12 or Type S bugle head.
20 12. Outside Corner Reinforcement: USG No. 104, 1-1/8" x 1-1/8" corner bead.
21 13. Acoustical Sealant: Equal to Tremco "Tremflex 834" or Pecora "Acoustic and Insulation
22 Sealant", low VOC formulation.
23 a. VOC content less than 50 g/l.
24 14. Sound Attenuation Blanket: U.S. Gypsum Thermafiber, 3" for an STC of 49
25 15. Or approved equals.
26
27 E. Drywall Finishing Accessories
28 1. Joint Compounds: Ready mixed type, or approved equal.
29 2. Joint Reinforcement: USG Perf-A-Tape, or approved equal.
30
31 F. Texture Finish Materials
32 1. Ceilings: USG Spray Fine Sand Texture Finish, or approved equal.
33 2. Walls (Painted Only): "Orange Peel".
34

35 PART 3 - EXECUTION

36 3.01 METAL STUDS

- 37
38
39 A. Attach metal runners at floor and at ceiling or structural elements above with suitable fasteners
40 located 2 inches from each end, spaced 16 inches on center.
41
42 B. Position studs vertically, engaging floor and ceiling runners. Splice studs with 8-inch nested lap,
43 one positive attachment per stud flange. Place studs in direct contact with all door frame jambs,
44 abutting partitions, partition corners, existing construction elements.
45
46 C. Anchor studs adjacent to door frames, partition intersections, and corners to ceiling and floor runner
47 flanges with USG metal lock fastener tool.
48
49 D. Provide double studs at jambs and head of each door frame. Securely anchor studs to jamb and head
50 anchor clips at metal door frames by bolt or screw attachment. Over metal frames, place a
51 cut-to-length section of runner horizontally with web-flange bent at each end; secure with one
52 positive attachment per flange. Position a cut-to length stud (extend to ceiling runner) at vertical
53 board joints over door frame header. Place an additional track-to-track stud 6 inches from double
54 jamb studs on both sides of framed openings.
55

1 3.02 INSTALLATION OF VAPOR BARRIER

- 2
- 3 A. General: Extend vapor barrier to extremities of areas to be protected from vapor transmission.
- 4 Secure in place with adhesives or other anchorage system as indicated. Extend vapor barrier to
- 5 cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- 6
- 7 B. Firmly attach vapor barrier to metal framing and solid substrates with vapor- barrier fasteners.
- 8
- 9 C. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor barrier
- 10 with vapor- barrier tape to create an airtight seal between penetrating objects and vapor barrier.
- 11
- 12 D. Repair tears or punctures in vapor barrier immediately before concealment by other work. Cover
- 13 with vapor- barrier tape or another layer of vapor barrier.
- 14
- 15 E. Vapor barrier shall be installed in maximum material sizes so as eliminate intermediate horizontal
- 16 joints and to achieve a minimum vertical joint spacing of 90-feet. The vertical joints shall have 12-
- 17 inch overlaps and shall include two continuous runs of specified tape. The tape shall be used at the
- 18 top and bottom seals.
- 19

20 3.03 GYPSUM BOARD

- 21
- 22 A. Follow Gypsum Association's recommendations for installation procedures.
- 23
- 24 B. Cut wallboards by scoring and breaking or sawing; scribe neatly at wall projections.
- 25
- 26 C. Apply first to ceilings then to walls.
- 27
- 28 D. Maintain a 5/8" space between floor and bottom edge of gypsum board.
- 29
- 30 E. Locate wallboard joints at openings so that no end joint aligns with edge of opening.
- 31
- 32 F. Set fasteners with heads slightly below surface of wallboard. Avoid breaking face paper.
- 33
- 34 G. Provide water resistant wallboard at rooms/areas with high humidity.
- 35

36 3.04 CEILING SUSPENSION SYSTEM

- 37
- 38 A. Suspend carrying channels with 8-gage hanger wires spaced 48 inches on center, within 6 inches of
- 39 ends.
- 40
- 41 B. Install carrying channels 48 inches on center and within 6 inches of walls. Provide 1 inch clearance
- 42 between channel ends and abutting walls, partitions.
- 43
- 44 C. At splices, interlock flanges, overlap ends 12 inches, and secure with 16-gage double standard tie
- 45 wire at each end.
- 46
- 47 D. Erect furring channels at right angles to carrying channels, spaced 24 inches on center and within 6
- 48 inches of walls. Provide 1-inch clearance between channel ends and abutting walls, partitions.
- 49
- 50 E. Secure to carrying channels with clips, or, saddle tie with 16-gage double standard tie wire. At
- 51 splices nest channels at least 8 inches, securely wire tie at each end.
- 52
- 53 F. Install additional cross reinforcing to restore lateral stability of suspension system at openings that
- 54 interrupt carrying or furring channels.
- 55

- 1 G. Apply wallboard of maximum practical length with long dimension at right angles to furring
2 channels. Position and stagger end joints over channel web. Fit ends and edges closely, but not
3 forced together.
4
- 5 H. Fasten board to channels with 1-inch Type S screws spaced 12 inches on center in field of board,
6 along abutting ends, edges.
7
- 8 I. Comply with UL Design No. D502 requirements at fire rated assembly.
9
- 10 3.05 EXPANSION JOINTS
- 11
- 12 A. At Ceilings: 50'-0" on center each way maximum.
13
- 14 B. At Walls: 30'-0" on center maximum.
15
- 16 C. Provide continuous from each door jamb to top of partition.
17
- 18 D. Provide at intersections with exposed masonry construction.
19
- 20 3.06 SINGLE LAYER/ERECTION
- 21
- 22 A. Position all ends, edges over framing members, except when edge joints are at right angles to
23 framing members, or when end joints are back-blocked. Apply wallboard horizontally or vertically
24 on walls to minimize the number of joints.
25
- 26 B. Attach wallboard to metal framing supports by power driven screws. For vertical application space
27 screws 12 inches on center in field of board, 8 inches on center staggered along vertical abutting
28 edges. For horizontal application space screws 12 inches on center in field, along abutting end
29 joints.
30
- 31 3.07 JOINT TREATMENT APPLICATION
- 32
- 33 A. Mix joint compound in accordance with manufacturer's recommendations.
34
- 35 B. Apply compound in thin uniform layer to all joints, angles to be reinforced. Apply reinforcing tape
36 centered over joint, seated into compound. Follow immediately with thin skim coat or embed tape.
37 Fold and embed tape in interior angles to provide true angle.
38
- 39 C. When embedding coat is thoroughly dry, apply second coat of compound, filling board taper flush
40 with surface. Cover tape, feather out slightly beyond tape.
41
- 42 D. On joints with no taper, cover tape, feather out at least 10 inches on either side of tape.
43
- 44 E. When second coat is thoroughly dry, spread finish coat evenly over and extend slightly beyond
45 second coat. Feather to a smooth, uniform finish.
46
- 47 F. Over taped edges, do not allow finish coat to protrude beyond plane of surface. Apply finish coat to
48 cover tape, taping compound at taped angles to provide true angle.
49
- 50 G. Do not abrade adjacent face-paper surfaces.
51
- 52 3.08 FINISHING FASTENERS
- 53
- 54 A. Apply compound to fastener depressions. Follow with minimum of two additional coats leaving
55 depressions level with surface.

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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 30 00

TILING

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. Wall Tile
- B. Floor Tile
- C. Base Tile
- D. Transition Strips

1.03 RELATED WORK

- A. Unit Masonry: Section 04 20 00.

1.04 REFERENCES

- A. The following specifications and standards are incorporated by reference:
 - 1. Tile Council of America, Inc. - "Handbook for Ceramic Tile Installation".

1.05 SUBMITTALS

- A. Submit in accordance with the General Conditions of the Contract.
 - 1. Samples for colors on 12 inch by 12 inch panels in duplicate for tile specified.
 - 2. Samples in duplicate for each different trim piece required.
 - 3. Grout samples in duplicate indicating color range anticipated, texture.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, handle, deliver and store at the job site in original unbroken containers in a manner that will avoid damage or contamination.
- B. All containers shall bear grade seals, manufacturer's name, size, color and quantities.

1.07 PROJECT CONDITIONS

- A. Set and grout tile when ambient temperature is at least 50 degrees F. and rising.

1.08 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
2 PART 2 - PRODUCTS

3
4 2.01 TILE

5
6 A. Wall tile.

7 1. WT-1: Porcelain Tile

- 8 a. Dal-Tile Colorbody Imagica
9 b. Color: Cosmo Unpolished
10 c. Sizes: 4"x48", 6"x48" and 8"x48"
11 d. Installation: Random staggered brickwork pattern.
12

13 B. Floor tile.

14 1. FT-1: Porcelain Tile

- 15 a. Dal-Tile Colorbody Imagica
16 b. Color: Cosmo Unpolished
17 c. Sizes 4"x48", 6"x48" and 8"x48"
18 d. Installation: Random staggered brickwork pattern.
19

20 C. Base tile.

21 1. BT-1: Porcelain Tile

- 22 a. Dal-Tile Colorbody Imagica
23 b. Color: Cosmo Unpolished
24 c. ***Size: 6" cut tile to match floor tile lengths.***
25 d. Installation: continuous over exposed steel columns
26

- 27 D. Dal-Tile is used as the basis of design. Approved equal by Atlas Concorde, Ceasar Ceramics USA or
28 approved equal.
29

30 2.02 SETTING MATERIALS

31 A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4, consisting of the following:

- 32 1. Prepackaged dry-mortar mix containing dry, re-dispersible, ethylene vinyl acetate additive to which
33 only water must be added at Project site.
34 2. Prepackaged dry-mortar mix combined with acrylic resin liquid-latex additive.
35 a. For wall applications, provide non-sagging mortar that complies with Paragraph F-4.6.1 in
36 addition to the other requirements in ANSI A118.4.
37
38

39 2.03 ACCESSORIES

- 40 A. Portland Cement: ASTM C 150, type 1.
41

- 42 B. Sand: ASTM C-144.
43

- 44 C. Water: Clean and potable.
45

- 46 D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces,
47 specifically approved for materials and installations indicated by tile and grout manufacturers.
48

- 49 E. Grout:
50

51 1. Non-sanded (Selected as per tile manufacturer's recommendation)

- 52 a. Color: To be selected by AE from manufacturer's full range of colors.
53
54

2. Sanded (Selected as per tile manufacturer's recommendation)
 - a. LATICRETE "Tri-Poly Fortified Sanded Grout (1500 Series)"; Bostik Findley "Hydroment Ceramic Tile Grout (sanded)"; or approved equal.
 - b. Color: To be selected by AE from manufacturer's full range of colors.
 - 1) Acrylic Additive: LATICRETE "1776 Grout Admix Plus"; Chargar Corporation "Acryl 60" or approved equal.
- F. Acrylic Additive: LATICRETE "1776 Grout Admix Plus"; Chargar Corporation "Acryl 60" or approved equal.
- G. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- H.** Provide other materials not specifically described but required for a complete and proper installation. ***Provide Schluter Schiene at cut tile edges. Review on site with architect.***
- I. Transition Strips:
 1. Tile to sealed concrete
 - a. Manufacturer: Schluter
 - b. Profile: Schluter -Reno-U,
 - c. Material: Stainless steel
 - d. Size according to materials used with approval of A/E.
 2. Or approved equal.
- J. Sealer
 1. Product: Dupont Stonetech Professional Heavy Duty Grout Sealer

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces where tile is to be applied and notify the Contractor of any defects.

3.02 INSTALLATION

A. General

1. Provide all proper installation methods for freezing climate.
2. Installation and workmanship shall be in accordance with ANSI A108.1 and as specified herein. The printed instructions of the tile manufacturer and the manufacturer of proprietary mortars and grouts shall be followed where applicable.
3. Before commencing work, establish field pattern and border line locations.
4. Center the work symmetrically so that no tile need be cut to less than half size.
5. Joints in wall tile shall be aligned vertically and horizontally; staggered joints will not be accepted.
6. Align joints when adjoining tiles on floor, base and trim are the same size.
7. Rub exposed edges smooth.

- B. Interior Wall Tile Setting Bed: TCA W202/Tile backer board substrates - acrylic modified latex-cement mortar.

- C. Handle, store, mix and apply proprietary setting and grouting materials in compliance with the manufacturer's instructions.

- 1
2 D. Extend tile work into recesses and under equipment and fixtures to form a complete covering without
3 interruptions, except as otherwise shown.
4
5 E. Terminate work neatly at obstructions, edges, and corners without disruption of pattern or joint alignments.
6
7 F. Comply with manufacturer's instructions for mixing and installation of proprietary materials.
8
9 G. Neutralize and seal substrates in accordance with setting bed manufacturer's instructions, where required.
10
11 H. Jointing Pattern: Grid pattern.
12
13 I. Expansion, Control Joints
14 1. Extend completely through tile mortar bed. Insert preformed back-up material to provide correct
15 cavity depth for sealant.
16 2. Width of expansion, control joints: Same as tile joints.
17 3. Prior to grouting, keep expansion and control joints open and clean.
18 4. After tile is grouted and completely dry, remove temporary filler material. Brush joints clean, fill
19 expansion and control joints.
20
21 J. Seal as per manufacturers requirements.
22

23 3.03 CLEANING

- 24
25 A. After completion, clean all work, point open joints and replace defective work.
26

27 3.04 PROTECTION

- 28
29 A. Close off work spaces to traffic during installation and at least 48 hours after completion of work.
30
31 B. Tiled vertical outside corners shall be protected with board corner strips in areas used as passageways.
32
33

34 END OF SECTION 09 30 00
35

SECTION 09 90 00

PAINTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern the work under this section.

1.02 WORK INCLUDED

- A. Painting and finishing of interior and exterior exposed items and surfaces throughout Project.
- B. 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.
- C. "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.
- D. 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.
- E. 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. Section 03 30 00, Cast-in-Place Concrete for sealing of exposed concrete floors.
- B. Section 06 20 00, Finish Carpentry for backpriming of exterior wood.
- C. 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.
- D. 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.

- 1 2. If manufacturer to be used is different from that of color chips furnished, prepare and submit
2 two approximately 6 inch square, properly labeled samples of each color and sheen required
3 on properly prepared paint-out cards or hardboard.
4
5 3. Stain: Two, 6 inch square properly labeled samples of each color and sheen required on
6 actual wood for project.
7
8 4. Oil: Two, 6 inch square properly labeled samples of each color and sheen required on actual
9 wood for project.

10
11 1.05 QUALITY ASSURANCE

- 12
13 A. MPI Standards:
14 1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products
15 List."
16
17 2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting
18 Specification Manual" for products and paint systems indicated.
19

20 1.06 DELIVERY, STORAGE AND HANDLING

- 21
22 A. Do not deliver materials to site until having received all written approvals of submitted information
23 and samples.
24
25 B. Deliver materials to job site in original, new and unopened packages and containers bearing
26 manufacturer's name and label.
27
28 C. Store materials not in actual use in tightly covered containers.
29
30 D. Take all precautions to ensure that workers and work areas are adequately protected from fire
31 hazards and health hazards resulting from handling, mixing and application of paints.
32
33 E. Remove rags and waste from storage areas daily.
34

35 1.07 PROJECT CONDITIONS

- 36
37 A. Apply water-base paints only when temperatures of surfaces to be painted and surrounding air
38 temperatures are between 50 and 95 degrees F.
39
40 B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air
41 temperatures are between 45 degrees F. and 95 degrees F.
42
43 C. Do not apply paint when relative humidity exceeds 85%; at temperatures less than 5 degrees F.
44 above the dew point; or to damp or wet surfaces.
45

46 1.08 SEQUENCING AND SCHEDULING

- 47
48 A. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto
49 newly-painted surfaces.
50

51 1.09 EXTRA MATERIALS

- 52
53 A. Furnish extra materials described below that are from same production run (batch mix) as materials
54 applied and that are packaged for storage and identified with labels describing contents.
55

1 1. Quantity: Furnish an additional 5 percent, but not less than 1 new and unopened gal. of each
2 material and color applied.

3
4 1.010 SUSTAINABLE DESIGN REQUIREMENTS

5
6 A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-
7 site must meet the limitations and restrictions concerning chemical components set by the following
8 standards:

- 9 1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.
10 2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints",
11 Second Edition, January 7, 1997. For applications on ferrous metal substrates.
12 3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality
13 Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on
14 January 1, 2004.

15
16 PART 2 - PRODUCTS

17
18 2.01 MANUFACTURERS

19
20 A. Provide products from the following manufacturers:

- 21
22 1. AFM Safecoat
23
24 2. Benjamin Moore & Co.
25
26 3. Cabot
27
28 4. ICI/Dulux.
29
30 5. Mythic Paint, Southern Diversified Products
31
32 6. PPG Architectural Finishes, Inc.
33
34 7. Rymar, LLC
35
36 8. Sherwin-Williams Company
37
38 9. Sikkens
39
40 10. Target Coatings

41
42 2.02 MATERIALS

43
44 A. Use the materials of the same manufacturer for each system.

45
46 B. Sherwin-Williams systems are called out in the system schedules to establish quality and dry mil
47 thickness of finished installation for all systems. A different manufacturer may be used for color
48 selection. Any manufacturer noted above may be used as long as quality and color requirements are
49 met.

- 50
51 1. Proprietary names used to designate colors or materials are not intended to imply that
52 products of named manufacturers are required to exclusion of equivalent products of other
53 manufacturers.
54

- 1 C. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint
2 materials manufacturers.
3
- 4 D. Material Compatibility:
5
- 6 1. Provide materials for use within each paint system that are compatible with one another and
7 substrates indicated, under conditions of service and application as demonstrated by
8 manufacturer, based on testing and field experience.
9
- 10 2. For each coat in a paint system, provide products recommended in writing by manufacturers
11 of topcoat for use in paint system and on substrate indicated.
12
- 13 E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply
14 with the following limits for VOC content, exclusive of colorants added to a tint base, when
15 calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical
16 restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or
17 finishing shop:
18
- 19 1. Primer or Undercoat: VOC content of not more than 100 g/L (150 g/L with colorant added at
20 point-of-sale).
21
- 22 2. Flat Paints and Coatings: VOC content of not more than 50 g/L (100 g/L with colorant
23 added at point-of-sale).
24
- 25 3. Non-flat Paints and Coatings: VOC content of not more than 100 g/L (150 g/L with colorant
26 added at point-of-sale).
27
- 28 4. Floor Paint: VOC content of not more than 100 g/L (150 g/L with colorant added at point-of-
29 sale).
30
- 31 5. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight
32 of total aromatic compounds (hydrocarbon compounds containing one or more benzene
33 rings).
34
- 35 6. Restricted Components: Paints and coatings shall not contain any of the following:
36
- 37 a. Acrolein.
38 b. Acrylonitrile.
39 c. Antimony.
40 d. Benzene.
41 e. Butyl benzyl phthalate.
42 f. Cadmium.
43 g. Di (2-ethylhexyl) phthalate.
44 h. Di-n-butyl phthalate.
45 i. Di-n-octyl phthalate.
46 j. 1,2-dichlorobenzene.
47 k. Diethyl phthalate.
48 l. Dimethyl phthalate.
49 m. Ethylbenzene.
50 n. Formaldehyde.
51 o. Hexavalent chromium.
52 p. Isophorone.
53 q. Lead.
54 r. Mercury.
55 s. Methyl ethyl ketone.
t. Methyl isobutyl ketone.
u. Methylene chloride.
v. Naphthalene.
w. Toluene (methylbenzene).
x. 1,1,1-trichloroethane.

- 1 y. Vinyl chloride.
- 2
- 3 F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.
- 4
- 5 2.03 PRIMERS/SEALERS
- 6
- 7 A. Interior Latex Primer/Sealer: MPI #50.
- 8
- 9 2.04 METAL PRIMERS
- 10
- 11 A. Rust-Inhibitive Primer (Water Based): MPI #107.
- 12
- 13 2.05 LATEX PAINTS
- 14
- 15 A. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).
- 16
- 17 B. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).
- 18
- 19 C. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).
- 20
- 21 D. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).
- 22
- 23 2.06 EQUIPMENT
- 24
- 25 A. Provide all brushes, rollers, ladders, scaffolding, and other equipment of any kind to properly
- 26 execute each type of work.
- 27
- 28 PART 3 - EXECUTION
- 29
- 30 3.01 EXAMINATION
- 31
- 32 A. Examine substrates and conditions, with Applicator present, for compliance with requirements for
- 33 maximum moisture content and other conditions affecting performance of work.
- 34
- 35 B. Maximum Moisture Content of Substrates:
- 36 1. Concrete: Must be cured a minimum of 45 days.
- 37
- 38 C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes
- 39 and primers.
- 40
- 41 D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are
- 42 dry.
- 43 1. Beginning coating application constitutes Contractor's acceptance of substrates and
- 44 conditions.
- 45
- 46 3.02 PREPARATION
- 47
- 48 A. Perform preparation and cleaning procedures in accord with paint manufacturer's instructions and as
- 49 specified for each particular substrate condition.
- 50
- 51 1. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and
- 52 similar items in place and not to be finish-painted, or provide surface-applied protection prior
- 53 to surface preparation and painting operations.
- 54 a. After completing painting operations, use workers skilled in the trades involved to
- 55 reinstall items that were removed. Remove surface-applied protection if any.

- 1 b. Do not paint over labels of independent testing agencies or equipment name,
2 identification, performance rating, or nomenclature plates.
- 3
- 4 2. All paint removal work performed on-site must use a non-caustic, citrus-based stripping
5 product. The Owner will only accept a citrus-based product for stripping the paint. The use of
6 sodium hydroxide or methylene chloride removers will NOT be permitted. Dry scraping,
7 sanding or other abrading of the existing paint that would create dust or chips is not
8 permitted.
- 9 a. Use of a drop cloth below the work area and disposal of paint debris at the end of
10 each day will be mandatory.
- 11
- 12 3. Follow manufacturer's instructions for use of stripping solutions to avoid raising grain of
13 wood.
- 14 4. Do not dip fabricated units (doors, etc.) in stripping solution to avoid saturating wood or
15 damaging glued connections.
- 16 5. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and
17 grease prior to mechanical cleaning.
- 18 6. Remove dirt, rust, scale, moisture, scuffed surfaces, or conditions otherwise detrimental to
19 formation of a durable paint film.
- 20
- 21 B. Wood: Prepare substrate and apply finish according to manufacturer's recommendations. Apply to
22 smooth clean surfaces only.
- 23
- 24 C. Ferrous Metal
- 25
- 26 1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer
27 and clean cloths.
- 28 2. Where not galvanized, shop coat of primer will exist on surface. If prime coat is not smooth,
29 sand to bare metal and re-prime.
- 30
- 31 D. Exterior Concrete
- 32 1. Surfaces must be clean and free of grease, wax, and mildew. Remove any chalk and loose
33 scaling. Wash with a detergent and rinse with water from a hose.
- 34
- 35 3.03 APPLICATION
- 36
- 37 A. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse
38 humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- 39
- 40 B. Do no interior work until building is properly enclosed.
- 41
- 42 C. Do work under adequate illumination and dust-free conditions.
- 43
- 44 D. Apply paints according to manufacturer's written instructions.
- 45 1. Use applicators and techniques suited for paint and substrate indicated.
- 46 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
47 Before final installation, paint surfaces behind permanently fixed equipment or furniture with
48 prime coat only.
- 49 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged
50 items to match exposed surfaces.
- 51
- 52 E. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same
53 material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient
54 difference in shade of undercoats to distinguish each separate coat.
- 55

- 1 F. Materials
2 1. Do not open containers until required for use.
3 2. Stir materials thoroughly and keep at uniform consistency during application.
4
- 5 G. Coats
6 1. Number specified is minimum.
7 2. Touch up suction spots between coats.
8 3. If undercoats or other conditions show through topcoat, apply additional coats until cured
9 film has a uniform paint finish, color, and appearance.
10 4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush
11 marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines
12 and color breaks.
13 5. Refinish surfaces affected by refitting work.
14
- 15 3.04 COLOR SEPARATION
16
- 17 A. An average of one or two wall colors will be used per room. Ceilings generally will be a different
18 color than walls. Finished closets will usually be same as adjoining rooms.
19
- 20 B. Job painted metal items such as diffusers, grilles and registers will generally be same color as
21 adjacent surface.
22
- 23 C. Hardwood generally will be the same color stain throughout.
24
- 25 3.05 CLEANING
26
- 27 A. During the progress of this work, remove from the site all discarded paint materials, rubbish, cans
28 and rags at the end of each work day.
29
- 30 B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove
31 spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise
32 damage finished surfaces.
33
- 34 3.06 PROTECTION
35
- 36 A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing
37 work. Correct damage by cleaning, repairing or replacing.
38
- 39 B. Provide "wet paint" signs to protect newly-painted finishes. Remove temporary protective
40 wrappings, after completion of painting operations.
41
- 42 C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted
43 surfaces.
44
- 45 3.07 SCHEDULE OF INTERIOR WORK
46
- 47 A. In addition to obvious surfaces, the following do not require painting or finishing.
48 1. Do not include painting when factory-finishing or installer-finishing is specified for such
49 items as (but not limited to) acoustic materials, finished mechanical and electrical equipment
50 including light fixtures and distribution cabinets.
51 2. Painting is not required on surfaces such as walls or ceilings in concealed areas and generally
52 inaccessible areas, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
53 3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and
54 similar finished materials will not require finish painting, unless otherwise indicated.

- 1 4. Moving parts of operating units, mechanical and electrical parts, such as valve and damper
- 2 operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish
- 3 painting, unless otherwise indicated.
- 4 5. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory
- 5 Mutual, or any equipment identification, performance rating, name or nomenclature plate.
- 6 6. N/A indicates system not applicable to this Project.

7
8 B. Walls and Ceilings

- 9 1. Paint all rooms. Paint patched walls from 90 degree corner and patched ceilings complete.
- 10 2. Do not apply next coat until previous is thoroughly dry.
- 11 3. Provide final coat which is solid and even in color, free from runs, laps, sags, brush marks,
- 12 air bubbles and excessive roller stipple and worked into crevices, joints and similar areas.

13
14 C. Wood Trim:

- 15 1. Apply finishes to all areas as shown on drawings.
- 16 2. Apply per manufacturer's instructions.

17
18 D. Electrical Panel Box Covers and Doors

- 19 1. Remove, paint and reinstall after paint is dry.

20
21 E. Other Unfinished and Primed Surfaces

- 22 1. Provide specified finish on exposed surfaces. This includes prime coated mechanical units,
- 23 piping, pipe covering, conduit, and interior duct surfaces visible behind grilles.

24
25
26 F. Interior Paint Schedule

System	Material	Type/Sheen	Number and Type of Coating
IPS-4	Wood	Water-based Stain, Transparent/Satin	One coat "Wood Classics 250"; Two coats "Target Coatings 9000 Series 'Clear Coat' Polyurethane Ultra-Low VOC"; Custom colors to match A/E's finish control sample
IPS-6	Gypsum Board	Epoxy-Gloss	One coat "ProMar Primer" Two coats "Water based Catalyzed Epoxy"
IPS-9	Concrete Masonry	Latex/Eggshell	One coat "Loxon Block Surfacer"; Two coats "Pro Industrial Zero VOC Acrylic Gloss finish B66W611"
IPS-13	Ferrous Metal (Unprimed)	Latex/Semi-gloss	One coat "Pro-Cryl Universal Primer"; Two coats "ProClassic Waterborne"
IPS-14	Ferrous Metal (Primed)	Latex/Semi-gloss	One coat "Pro-Cryl Universal Primer"; Two coats "ProClassic Waterborne"
IPS-15	Copper/Aluminum (finished rooms only)	Latex/Flat	One coat "DTM Acrylic Primer; Finish"; Two coats "ProMar 200 Interior Latex Flat"
IPS-16	Galvanized Metal (finished rooms only)	Latex/Flat	One coat "DTM Acrylic Primer Finish"; Two coats "ProMar 200 Interior Latex Flat"

27
28
29
30 3.08 SCHEDULE OF EXTERIOR WORK

31
32 A. General

- 33 1. Paint or finish other new, unfinished and primed surfaces noted on drawings.

1
2
3
4
5

- 2. Provide aggregate in quantity as recommended by manufacturer and mix according to manufacturer's written instructions.

B. Exterior Paint Schedule

System	Material	Type/Sheen	Number and Type of Coating
EPS-1	Ferrous Metal (hollow metal, exposed plates, angles, bolts, etc.)	Latex /Semi-Gloss	One coat "Kem-Kromik Universal" primer; Two coats "DTM Acrylic"
EPS-2	Galvanized Metal (hollow metal, equipment housings, steel, etc.)	Latex /Semi-Gloss	One coat "Pro-Cryl Univeral" primer; Two coats "DTM Acrylic"
EPS-4	Wood (exposed wood framing)	Oil Stain, semi-transparent/Flat	One coat Rymar "Xtreme Weather Wood Sealer" at all concealed and cut surfaces prior to installation; Two coats Rymar "Xtreme Weather Wood Sealer" at exposed surfaces

6
7
8
9
10
11
12
13
14
15
16

3.09 PAINT COLOR SCHEDULE (GENERIC)

- A. Color 1: GWB ceilings/soffit
- B. Color 2: CMU
- C. Color 3: Hollow Metal/Steel Doors and Frames, Structural Steel
- D. Color 4: Wood Deck/Ceiling, transparent stain

END OF SECTION

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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.

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: Graphics with text, 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. Exterior Signs
 - 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.
 - 3. Size: Approximately 6" x 10".
 - 4. Material: Plastic for exterior use.
 - 5. Color: As selected by Architect from manufacturer's full range.
- C. Manufacturers
 - 1. ASI Sign Systems.
 - 2. Poblocki Sign Company
 - 3. Best Sign Systems Inc.
 - 4. 2/90 Sign Systems

SECTION 10 21 13

TOILET COMPARTMENTS

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 WORK INCLUDED

- A. Solid Surface Toilet Partition Doors and Urinal Screens – all components are wall mounted to masonry
- B. Attachment hardware.

1.03 RELATED WORK

- A. Metal Fabrications: Section 05 50 00.
- B. Rough Carpentry: Section 06 10 00 Wall Blocking.
- C. Toilet, Bath and Laundry Accessories: Section 10 28 00.

1.04 REFERENCES

- A. All work shall be in strict accord with Wisconsin Enrolled Commercial Building Code.
- B. ANSI A117.1 – Accessible and Usable Buildings and Facilities.
- C. ADAAG – Americans with Disabilities Act for Accessibility Guidelines.
- D. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

1.05 SUBMITTALS

- A. Submit in accordance with the General Conditions of the Contract.
 - 1. Shop drawings showing scale, drawings of plan, all elevations of all compartments, indicate clearly the hardware, and accessories to be furnished.
 - 2. Verify field dimensions.
 - 3. Part of the submittal may consist of standard brochures.
 - 4. Shop drawings that clearly show attachment locations for all blocking and anchorages.
 - 5. Shop drawings that show locations and drilling dimensions.
 - 6. Two sets of color samples.
 - 7. Minimum warranty: 15 year solid surface warranty against material defect, 10 year hardware manufacturer product guarantee. 3 year warranty against fabrications defects including labor to remove or re-install replacements.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver compartments in suitable crating or packaging to prevent damage in transit and storage.

1 B. Coordinate delivery with progress schedule to reduce period of on-site storage. Store under cover in
2 a dry area.

3
4 1.07 FIELD MEASUREMENTS

5
6 A. Verify field measurements are as shown on Drawings, shop drawings and as instructed by the
7 manufacturer.

8
9 PART 2 - PRODUCTS

10
11 2.01 TOILET PARTITIONS

- 12
13 A. Solid Surface Toilet Partitions
14 1. Champion Partitions
15 2. Ampco Products, Inc.
16 3. American Building Specialties Corp.
17 4. Or approved equal.

18
19 2.02 FEATURES

- 20
21 A. Material: Solid Surface:
22 1. Color: Formica Bianco Mineral.
23
24 B. Fasteners, Anchorages: Manufacturer's standard stainless steel to accommodate solid surface.
25 1. Through bolts and nuts, stainless steel with tamperproof heads.
26
27 C. Hardware: Material: Stainless steel, complying with ADA standards.
28 1. Hinges: Bathroom Stall Full Length Stainless Steel Continuous self closing hinges that can
29 be adjusted to hold door open in any position. 54 ½" ¼" Pin. 14 Gauge.
30 2. Coat Hook: Combination hook and rubber tipped bumper, sized to prevent door from hitting
31 accessories or wall.
32 3. Latch and keeper: Toilet Partition Stainless Steel ADA Throw Latch 3 ½" Screws. 4 ½" x 1
33 ½" x 3/16" base. Provide keeper with stops for throw latch coordinated with each stall
34 configuration.
35 4. Stainless steel pulls where required for operation.
36 5. Door bumper: Rubber tipped as needed at out swinging doors.

37
38 2.03 FABRICATION

- 39
40 A. Doors and urinal screens: Custom 1/2 inch thick constructed of solid surface material.

41
42 2.04 FINISHES

- 43
44 A. Finish color and pattern selected by A/E from manufacturer's full range to match Formica Bianco
45 Mineral.
46
47 B. Stainless Steel: No. 4 polished finish on all exposed hardware.

48
49 PART 3 - EXECUTION

50
51 3.01 INSTALLATION

- 52
53 A. Installation of all doors and screens shall be done in compliance with manufacturer's instructions and
54 approved shop drawings.

55

- 1 B. Evidence of drilling in walls shall be concealed in the finished work.
- 2
- 3 C. Install partition components secure, plumb and level.
- 4
- 5 D. Attach panels and pilasters to brackets with through bolts and nuts.
- 6
- 7 E. Anchor urinal screens to walls with continuous brackets.
- 8
- 9 F. Provide 1/2 inch space between wall surface and panels.
- 10
- 11 3.02 CLEANING
- 12
- 13 A. Remove all protective maskings and clean surfaces. Leave them free of soil and imperfections.
- 14
- 15 3.03 PROTECTION
- 16
- 17 A. Field touch-up of finished surfaces will not be permitted. Replace damaged components.
- 18
- 19
- 20
- 21

END OF SECTION 10 21 13

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SECTION 10 28 00

TOILET, BATH AND LAUNDRY ACCESSORIES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern the work under this section.

1.02 WORK INCLUDED

- A. Commercial Toilet and Bath Accessories

1.03 REFERENCES

- A. All work of this section 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 product data.

1.05 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.

1.06 SUSTAINABLE DESIGN 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 MANUFACTURED COMMERCIAL UNITS

- A. Grab Bars:
1. Bradley Model 812
1. Or approved equal
2. 1-1/2" diameter, 18 gauge, type 304 stainless steel
3. Concealed-mounting
4. Lengths as indicated on drawings

- 1 B. Toilet Tissue (Roll) Dispenser:
2 1. Owner Provided Contractor Installed at each water closet
3
4 C. Soap Dispenser:
5 1. Bradley Model 6542
6 1. Or approved equal
7 2. Stainless steel
8 3. Surface-mounted
9 4. Minimum soap capacity of 40oz.
10 5. Install at each Lav Faucet or where indicated on drawings
11
12 D. Warm-Air Dryers (DRYER):
13 1. Xlerator Hand Dryer
14 1. Or approved equal
15 2. Noise Reduction Nozzle
16 3. ADA Compliant Projection
17 4. Surface recessed
18 5. Operation: Electronic-sensor activated with timed power cut-off switch
19 1. Operation Time: 10 to 15 seconds
20 6. Cover Material and Finish: Steel, with black graphite epoxy finish
21 7. Electrical Requirements
22 1. 120 V, 13 A, 1500 W
23 2. Each hand dryer shall have a dedicated 20amp circuit
24
25 E. Waste Receptacle (WASTE):
26 1. Bobrick B-43644 with liner/mate or
27 2. Contura Series Recessed Waste Receptacle with liner
28
29 F. Mirrors:
30 1. Bradley Model 740
31 1. Or approved equal
32 2. Tilt type
33 3. Stainless steel framed
34 4. Size: 18" x 36" or as indicated on drawings
35

36 2.02 SEALANT

- 37
38 A. "G-E silicone sealant", General Electric Company.
39
40 B. "Dow Corning 780", Dow Corning Corporation.
41
42 C. "Pecora 826", Pecora Chemical Corporation.
43

44 2.03 FASTENERS

- 45
46 A. Provide all fastening devices including screws, bolts, anchors, and backplates.
47
48 B. Exposed fasteners shall match finish of accessories.
49

50 2.04 FABRICATION

- 51
52 A. Fabricate all toilet and bath accessories of type 302 or 304 stainless steel with satin finish, unless
53 otherwise specified or approved.
54
55 B. All accessories shall be by one manufacturer unless otherwise specified or approved.
56
57 C. Manufacturer's labels or imprinted name shall not be visible.
58

59 PART 3 - EXECUTION

Bid No. 316048

Toilet, Bath and Laundry Accessories
09 30 00-2

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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.
- C. Set all recessed and semi-recessed accessories with continuous seal of sealant, around entire perimeter of all accessories to prevent moisture from reaching substrate.

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 accessory keys, service, and parts manual in accordance with the General Conditions of the Contract Closeout.

3.04 SCHEDULE

- A. Provide accessories as indicated on the drawings or specification.

END OF SECTION

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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

- 1
- 2 A. Basis of Design: Larsen Manufacturing, Architectural Series, Vertical Duo, clear acrylic door, #4
- 3 stainless steel.
- 4 1. FX-1: Recessed
- 5 2. FX-2: Semi-recessed.
- 6 3. FX-3: Surface mounted.
- 7
- 8 B. Products: Subject to compliance with requirements products by additional manufacturers that may be
- 9 incorporated into the Work include the following; submit for approval:
- 10 1. J. L. Industries, Inc., a division of Activar Construction Products Group.
- 11 2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
- 12 3. Potter Roemer LLC.
- 13
- 14 C. Cabinet Construction: Nonrated and rated same as adjacent structure.
- 15 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-
- 16 inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch- thick, fire-barrier material.
- 17 Provide factory-drilled mounting holes.
- 18
- 19 D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim
- 20 indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall
- 21 surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of
- 22 insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed
- 23 cabinet installation.
- 24 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
- 25
- 26 E. Cabinet Trim Material: Same material and finish as door.
- 27
- 28 F. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type,
- 29 trim style, and door material and style indicated.
- 30 1. Provide continuous hinge, of same material and finish as trim, permitting door to open 180
- 31 degrees.
- 32
- 33 G. Accessories
- 34 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire
- 35 protection cabinet, of sizes required for types and capacities of fire extinguishers indicated,
- 36 with plated or baked-enamel finish.
- 37 a. For FX-3: Kidde Fire Extinguisher Wall Hanger, model to accommodate extinguisher
- 38 2. Lettered Door Handle: One-piece, cast-iron door handle with the word "FIRE" embossed into
- 39 face.
- 40 3. Identification: Lettering complying with authorities having jurisdiction for letter style, size,
- 41 spacing, and location.
- 42 a. Identify fire extinguisher in fire protection cabinet with the words "FIRE
- 43 EXTINGUISHER."
- 44 1) Location: Applied to cabinet glazing.
- 45 2) Application Process: Decals.
- 46 3) Lettering Color: Red.
- 47 4) Orientation: Vertical
- 48
- 49 4. Alarm: Manufacturer's standard alarm that actuates when fire protection cabinet door is
- 50 opened and that is powered by batteries.

51 2.03 FABRICATION

- 52
- 53
- 54 A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and
- 55 hardware to suit cabinet type, trim style, and door style indicated.

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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.

- 1 B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 1-A:10-B:C, 2.5-lb, 2-A:10-B:C, 5-
2 lb and 3-A:40-B:C, 5-lb nominal capacity, with monoammonium phosphate-based dry chemical in
3 enameled-steel container.

4

5 PART 3 - EXECUTION

6

7 3.01 EXAMINATION

8

- 9 A. Examine fire extinguishers for proper charging and tagging.
10 1. Remove and replace damaged, defective, or undercharged fire extinguishers.

11

- 12 B. Proceed with installation only after unsatisfactory conditions have been corrected.

13

14 3.02 INSTALLATION

15

- 16 A. Install all items in conformance with manufacturer's directions.

17

- 18 B. Prepare recesses in wall for fire extinguisher cabinets.

19

- 20 C. Securely fasten mounting brackets and fire extinguisher cabinets to structure, square and plumb. No
21 gaps are allowed between cabinet edge and wall surface.

22

- 23 D. Mount fire extinguishers in cabinets or on wall brackets so the top of the extinguisher is not more
24 than 4 feet above the floor.

25

- 26 E. Clean fire extinguisher cabinet and extinguisher of all dirt, residue, or smudges.

27

- 28 F. Replace any damaged components; touch-up is not acceptable.

29

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31

END OF SECTION 10 44 13

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

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
- Related Work
- Regulatory Requirements
- Reference Standards
- Quality Assurance
- Abbreviations and Symbols
- Definitions
- Coordination
- Electronic Drawings
- Continuity of Existing Services
- Protection of Finished Surfaces
- Sealing and Firestopping
- Equipment Furnished by Others
- Off Site Storage
- Submittals
- Specified Materials and Equipment
- Equipment Installation
- Operating and Maintenance Manuals
- Record Drawings
- Training of Owner Personnel
- Testing
- Cleaning
- Warranty
- Certified Startup Reports

PART 2 - PRODUCTS

- Electrical Requirements
- Access Panels and Doors
- Pipe Penetrations
- Equipment, Piping, and Valve Identification
- Equipment Accessories
- Thermometers and Gauges
- Bedding and Backfill

PART 3 - EXECUTION

- General
- Demolition
- Excavation and Backfill
- Dewatering
- Rock Excavation
- Surface Restoration
- Concrete Work
- Openings, Cutting and Patching
- Building Access

- 1 Equipment Access
- 2 Coordination of Work
- 3 Piping Installation
- 4 Lubrication and Maintenance
- 5 Sleeves
- 6 Pipe Penetrations
- 7 Escutcheon Plates
- 8 Flashing of Roof and Wall Penetrations
- 9 Painting
- 10 Identification

11
12 **RELATED WORK**

13 Applicable provisions of Division 01 govern work under this Section.

14
15 This section applies to all Division 22 sections of plumbing.

16
17 **REGULATORY REQUIREMENTS**

18 **Codes and Standards:**

19 All plumbing work shall conform to the requirements of Wisconsin Administrative Code SPS 382 and SPS
20 384, Wisconsin Uniform Plumbing Code.

21
22 All materials and workmanship shall comply with applicable Codes, local ordinances, industry standards
23 and utility regulations. In case of differences between such Codes, and the Contract Documents, the most
24 stringent shall govern. Promptly notify the A/E in writing of any such difference.

25
26 **Non-Compliance:**

27 Should the Contractor perform any work that does not comply with the above requirements, without having
28 notified the A/E, he shall bear all costs necessary to correct the deficiencies.

29
30 **Permits, Inspections and Fees:**

31 All required, permits, and inspections shall be requested and obtained by the Contractor.

32
33 All fees and charges for approvals, reviews, or other inspections shall be paid by the Contractor.

34
35 All fees and charges assessed by local utilities for water, sewer, gas or other services shall be included in
36 the bid and shall be paid by the Contractor(s).

37
38 **REFERENCE STANDARDS**

39 Standards cited in the Specifications shall be the most recent editions.

40
41 Abbreviations of standards organizations referenced in this and other sections are as follows:

- 42 ABMA American Boiler Manufacturers Association
- 43 AGA American Gas Association
- 44 AMCA Air Movement and Control Association
- 45 ANSI American National Standards Institute
- 46 ASME American Society of Mechanical Engineers
- 47 ASPE American society of Plumbing Engineers
- 48 ASSE American Society of Sanitary Engineering
- 49 ASTM American Society for Testing and Materials
- 50 AWWA American Water Works Association
- 51 AWS American Welding Society
- 52 CISPI Cast Iron Soil Pipe Institute
- 53 CS Commercial Standards, Products Standards Sections, Office of Eng. Standards Service, NBS
- 54 EPA Environmental Protection Agency
- 55 FS Federal Specifications, Superintendent of Documents, U.S. Government Printing Office
- 56 GAMA Gas Appliance Manufacturers Association

- 1 IAPMO International Association of Plumbing & Mechanical Officials
- 2 IEEE Institute of Electrical and Electronics Engineers
- 3 ISA Instrument Society of America
- 4 MCA Mechanical Contractors Association
- 5 MICA Midwest Insulation Contractors Association
- 6 MSS Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
- 7 NBS National Bureau of Standards
- 8 NEC National Electric Code
- 9 NEMA National Electrical Manufacturers Association
- 10 NFPA National Fire Protection Association
- 11 NSF National Sanitation Foundation
- 12 PDI Plumbing and Drainage Institute
- 13 UL Underwriters Laboratories Inc.

14
15 Standards referenced in this section:

- 16 ACI 614 Recommended Practice for Measuring, Mixing and Placing of Concrete
- 17 ASTM D1557 Standard Test Method for Moisture-Density Relations of Soils
- 18 ASTM E814 Standard Test Method for Fire Tests of Through-Penetration Fire Stops
- 19 ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
- 20 UL1479 Fire Tests of Through-Penetration Firestops
- 21 UL723 Surface Burning Characteristics of Building Materials

22 23 **QUALITY ASSURANCE**

24 Substitution of Materials: Refer to Division 01 of the Project Manual.

25
26 All products and materials used are to be new, undamaged, clean and in good condition. Existing products
27 and materials are not to be reused unless specifically indicated.

28
29 Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings,
30 or engineering parameters from those indicated on the contract documents, the contractor is responsible for
31 all costs involved in integrating the equipment or accessories into the system and for obtaining the intended
32 performance from the system into which these items are placed.

33 34 **ABBREVIATIONS AND SYMBOLS**

35 Key to abbreviations and symbols shall be on the Drawings.

36
37 The following are additional abbreviations used in the Specifications:

- 38 A/E Architect/Engineer
- 39 GC General Contractor
- 40 PC Plumbing Contractor
- 41 HC Heating Ventilating and Air Conditioning Contractor
- 42 EC Electrical Contractor

43 44 **DEFINITIONS**

45 **Furnish:**

46 Supply and deliver to Project site ready for unpacking, assembly and installation.

47 48 **Install:**

49 Operations at Site including unpacking, assembling, erecting, placing, anchoring, applying, finishing,
50 cleaning, and connecting related devices required for product fully functional for intended use after
51 installation.

52 53 **Provide:**

54 Furnish and install, such that product is fully functional for intended use.

55

1 **COORDINATION**

2 The Drawings show the general arrangement of piping and equipment and shall be followed as closely as
3 actual building construction and the work of other trades permits. Architectural and Structural Drawings
4 shall take precedence. Because of the scale of the Drawings, it is not possible to indicate all offsets, fittings,
5 and accessories which may be required. Investigate conditions affecting the Work and arrange accordingly,
6 providing offsets, fittings and accessories as may be required to meet conditions.
7

8 **ELECTRONIC DRAWINGS**

9 Drawings in electronic format will be made available to successful Plumbing contractor at a non-refundable
10 cost specified under Division 01 of Specifications. If no cost is specified in Division 01, default cost shall
11 be \$75 per drawing. Drawings provided may or may not be updated to reflect Addenda items. Use of
12 Drawings is limited to this Project and may not be forwarded to any other party for any purpose. Use of
13 files will be at Contractor's sole risk and without liability or legal exposure to JDR Engineering, Inc or its
14 employees. Architectural drawings or any other drawings not produced by JDR Engineering will not be
15 provided.
16

17 **CONTINUITY OF EXISTING SERVICES**

18 Refer to Division 01 of the Project Manual.
19

20 Do not interrupt or change existing services without prior approval from Owner, Architect, Engineer or
21 Construction Manager. When interruption is required, coordinate down-time with Owner to reduce
22 disruption to activities. Scope of Work is indicated on Contract Documents or described herein. Unless
23 specifically stated, any work involved in interrupting or changing existing services is to be done during
24 normal working hours.
25

26 **PROTECTION OF FINISHED SURFACES**

27 Refer to Division 01 of the Project Manual.
28

29 Furnish one can of touch-up paint for each different color factory finish to be finished surface of product.
30 Deliver touch-up paint with other "loose and detachable parts" as covered in General Requirements.
31

32 **SEALING AND FIRESTOPPING**

33 Sealing and firestopping of sleeves/openings between piping, etc. and the sleeve or structural opening shall
34 be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall
35 hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall
36 normally and routinely be employed in the sealing and fireproofing occupation.
37

38 **EQUIPMENT FURNISHED BY OTHERS**

39 Drawings indicate equipment to be furnished or installed by Others. When providing utility connections,
40 coordinate exact requirements, including quantity, location, elevation size, material, flow and pressure.
41

42 **OFF SITE STORAGE**

43 Refer to Division 01 of the Project Manual.
44

45 **SUBMITTALS**

46 Refer to Division 01, of the Project Manual.
47

48 Submit shop drawings with space for approval stamps of GC and A/E.
49

50 Submit the following plumbing system data sheet for approval by the GC and A/E. List piping material
51 type for each piping service on the project, ASTM number, schedule or pressure class, joint type,
52 manufacturer and model number where appropriate. List valves and specialties for each piping service,
53 fixture and equipment with manufacturer and model number.
54

1 PLUMBING SYSTEM DATA SHEET

2 Item	Pipe Service/Sizes	Manufacturer/Model No.	Remarks
3	Pipe		
4	Fittings		
5	Unions		
6	Valves:		
7	Ball		
8	Butterfly		
9	Balancing		
10	Check		
11	Other		
12	Pipe Specialties:		
13	Thermometers		
14	Press Gauges		
15	Strainers		
16	Building Penetrations		
17	Hangers & Supports		
18	Insulation		
19	Plbg. Specialties:		
20	Floor/Roof Drains		
21	Cleanouts		
22	Water Hammer Arrestors		
23	Backflow Preventers		
24	Wall/Yard Hydrants		
25	Hose Bibbs		
26	Plbg. Fixtures:		
27	Lavatory		
28	Faucet		
29	Stop/Supplies		
30	Waste/Trap		
31	Plbg. Equipment:		
32	Water Softener		
33	Water Heater		
34	Circulation Pump		

36 Submit manufacturer's color charts where finish color is specified to be selected by Architect/Engineer.

37
 38 Shop drawing submittals are to be bound, labeled, contain the project manual cover page and a material
 39 index list page showing item designation, manufacturer and additional items supplied with the installation.
 40 Submit for all equipment and systems as indicated in the respective specification sections, marking each
 41 submittal with that specification section number. Mark general catalog sheets and drawings to indicate
 42 specific items being submitted and proper identification of equipment by name and/or number, as indicated
 43 in the contract documents. Include wiring diagrams of electrically powered equipment.

44
 45 Submit sufficient quantities of data sheets and shop drawings to allow the following distribution:

- 46 • Operating and Maintenance Manuals 2 copies
- 47 • Architect/Engineer 2 copies
- 48 • Local Fire Chief or Marshal 1 copy

49
 50 **Firestop Systems:**

51 Contractor shall submit product data for each firestop system. Submittals shall include product
 52 characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and
 53 procedures for each method of installation applicable to this project. For non-standard conditions where no
 54 UL tested system exists, submit manufacturer's drawings for UL system with known performance for which
 55 an engineering judgement can be based upon.

56

1 **SPECIFIED MATERIALS AND EQUIPMENT**

2 Design is based on equipment specified by manufacturer and model number as specified on Drawing
3 Schedules. Where certain items are specified by manufacturer or trade name, Contractor's bid shall be
4 based on use of named item. Where one (1) make is described and other makes are listed, comparable
5 models of other named equipment may also be used, provided they meet requirements of Specifications.
6

7 When equipment or accessories used differ in arrangement, configuration, dimensions, ratings, or
8 engineering parameters from those on Drawing schedules, Contractor shall be responsible for costs involved in
9 integrating equipment or accessories into system. Contractor shall be responsible for obtaining original
10 design performance from system into which items are placed, regardless of whether manufacturer/model is
11 specified equivalent or substitute.
12

13 If Contractor wishes to use items other than those named in Specifications in base bid, request for approval
14 of substitution must be made in writing to A/E at least 14 days prior to opening of bids. Include complete
15 technical and descriptive data with request. If approved, an Addendum will be issued notifying bidders of
16 approval. Request for approval will be considered only if requested by prime bidding Contractor.
17

18 **EQUIPMENT INSTALLATION**

19 Drawings show general arrangement and location of equipment and appurtenances. It is Contractor's
20 responsibility to install equipment in a location and manner that allows for proper service and maintenance
21 access to equipment. Work shall generally conform to requirements shown on Drawings. However,
22 location of equipment may require field adjustments to obtain required service space. **DO NOT SCALE**
23 **OFF PLANS** to determine proper location of equipment. Because of scale of Drawings, it is not possible to
24 indicate exact routing of piping, and offsets, fittings and accessories required to provide proper service
25 access to equipment. Contractor shall route and install ductwork and piping to provide required service
26 access to equipment.
27

28 If, during construction phase of Project, contractor feels inadequate space exists, or equipment locations
29 must be substantially modified to provide proper service and maintenance access, prior to installing
30 equipment, contractor shall notify engineer in writing, outlining general concerns and proposed
31 modifications. Equipment installed without providing manufacturer's required maintenance and service
32 clearance shall be considered defective. Contractor shall remove and relocate piping, ductwork and
33 equipment, to provide required service clearances at contractor's expense.
34

35 **OPERATING AND MAINTENANCE INSTRUCTIONS**

36 Refer to Division 01 of the Project Manual.
37

38 Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for
39 each system or type of equipment. In addition to the data indicated in the General Requirements, include
40 the following information:

- 41 • Copies of all approved shop drawings.
- 42 • Manufacturer's wiring diagrams for electrically powered equipment
- 43 • Records of tests performed to certify compliance with system requirements
- 44 • Certificates of inspection by regulatory agencies
- 45 • Parts lists for fixtures, equipment, valves and specialties.
- 46 • Manufacturer's installation, operation and maintenance recommendations for fixtures,
47 equipment, valves and specialties.
- 48 • Valve schedules
- 49 • Lubrication instructions, including list/frequency of lubrication
- 50 • Warranties
- 51 • Additional information as indicated in the technical specification sections
52

53 **RECORD DRAWINGS**

54 Refer to Division 01 of the Project Manual.
55

1 Maintain Record Drawings on daily basis to be turned over at completion of Project.
2
3 **TRAINING OF OWNER PERSONNEL**
4 Instruct Owner’s personnel in proper operation and maintenance of systems and equipment provided as part
5 of Project, using Operating and Maintenance manuals during instruction. Demonstrate startup and
6 shutdown procedures for equipment. Training shall be during normal working hours.
7
8 Provide a total of 2 hours of training (minimum) over a total of 1 training session. Coordinate with Owner
9 at least 2 weeks prior to scheduling training systems.
10
11 **TESTING**
12 Provide materials, labor, and equipment required for testing.
13
14 Notify Inspector(s) one day prior to the time when the test is ready to be performed.
15
16 After testing, submit in writing the time, date, name and title of the person approving the test. This shall also
17 include the description and what portion of the system has been tested. The person approving the test shall sign the
18 submittal.
19
20 Records shall be maintained of testing that has been completed, and shall be made available at the job site.
21
22 Upon completion of the work, records and certifications approving testing requirements shall be submitted.
23
24 Defective work or material shall be replaced or repaired, and the test repeated. Repairs shall be made with new
25 materials.
26
27 **CLEANING**
28 Keep the premises broom clean and free of surplus materials, rubbish and debris.
29
30 After fixtures and equipment have been installed, remove stickers, rust stains, labels, and temporary covers.
31
32 Foreign matter shall be blown out, or flushed out, of pipes, tanks, pumps, strainers, motors, devices,
33 switches, fixtures, and panels.
34
35 Boilers and water heaters shall be cleaned, drained, flushed and recleaned until free of oil and debris.
36
37 Identification plates on equipment shall be free of paint and dirt.
38
39 Leave the work in a condition ready for operation.
40
41 **WARRANTY**
42 Warrant that work shall function for one year immediately following acceptance of the system(s).
43
44 Keep the system in good working order at no expense, unless defects are clearly the result of improper or abnormal
45 usage.
46
47 Submit for acceptance of the work, written certification that the entire system has been installed and
48 adjusted for operation in accordance with the Contract Documents.
49
50
51
52
53
54

1 **CERTIFIED STARTUP REPORTS**

2 The Contractor shall obtain from the manufacturer of equipment in the following systems, four (4) copies of certified
3 startup reports prepared and signed by the manufacturer's representative in responsible charge. The four
4 copies of the startup reports shall be submitted to the A/E along with or prior to the Contractor's certification
5 of completion. The following systems require manufacturer's startup reports:

- 6 • Pumps
- 7 • Water Treatment Systems
- 8 • Water Heaters

9
10
11 **PART 2 – PRODUCTS**

12
13 **ELECTRICAL REQUIREMENTS**

14 **General:**

15 Work shall conform to requirements of Division 26.

16
17 Power wiring shall be provided by the EC. Control wiring shall be provided by the PC. Plumbing
18 Contractor shall provide wiring diagrams for use by the Electrical Contractor.

19
20 **Motors:**

21 Motors smaller than ½ HP shall be NEMA standard motors rated for 120 volts, AC, single phase, 60 Hz.
22 Motors shall be capacitor start and capacitor run type and shall have internal overload protection.

23
24 Motors ½ HP and larger shall be NEMA standard motors rated for specified voltage, AC, three phase and
25 60 Hz.

26
27 Motors shall be Design B, squirrel cage, open drip-proof construction with standard T frame, ball bearings,
28 Class B insulation, single winding, continuous duty rated and 1.15 service factor unless noted otherwise.

29
30 Minimum power factor for motors one HP and larger is 85% at rated capacity. Capacitors for power factor
31 correction are not acceptable.

32
33 Provide devices for motor overload protection unless integral with equipment. Devices shall be sized
34 according to actual measured current draw with motor operating under normal load conditions. Provide
35 temporary protective devices where installation is not complete.

36
37 **Motor Starters:**

38 Motor starters shall be provided by the PC.

39
40 Provide a combination starter for each motor.

41
42 Starter shall conform to Allen-Bradley Co. Bulletin 512, consisting of a Bulletin 509 full voltage starter and
43 non-fusible disconnect switch mounted in a NEMA Type 1 general purpose enclosure.

44
45 Starter shall be equipped as standard with block type overload relays and external reset buttons.

46
47 Starter shall be equipped as standard with a transformer to provide a 120V, 60 Hz., secondary control
48 circuit.

49
50 Provide a three position Hand-Off-Auto selector switch for field installation in the enclosure flange: A-B
51 Catalog No. 1481-N51A or 1481-N51B.

52
53 **ACCESS PANELS AND DOORS**

54 Provide access panels at locations requiring access to mechanical equipment. Locations include, but are not
55 limited to areas above drywall ceilings, shaft enclosures and other furred-in spaces concealing valves, ducts
56 or equipment. Provide UL listed, fire rated access panels when penetrating fire rated chase or shaft areas.

1
2 Access panels shall be of size required to provide adequate access to equipment. Minimum size shall be 12
3 inch by 12 inch for hand access and 24 inch by 24 inch for body access.
4
5 Panels shall be Milcor brand or equivalent.
6
7 Panels shall include concealed hinges, cam type locking devices, and have frame/border type necessary for
8 particular wall or ceiling construction they are installed. Access panels shall be flush mounted, recessed
9 frame type units. Access panels shall be prime coated steel, able to accept field painting for general
10 applications and stainless steel for use in toilet rooms, shower rooms and similar wet areas.
11
12 Refer to Architectural Room Finish Schedule for wall and ceiling surfaces and finishes.
13
14 For non-security applications, panel construction shall utilize 16 gauge frame with not less than 18 gauge
15 hinged door panel. Door locks shall be screwdriver operated for panels in general location applications and
16 shall be key locked for public area applications.
17
18 For security area applications, panel construction shall utilize 16 gauge frame with not less than 14 gauge
19 hinged door panel. Door locks shall be locking type. Furnish and install locking devices in accordance with
20 types specified in Division 11.
21
22 **PIPE PENETRATIONS**
23 Refer to Division 01 requirements as well as the following.
24
25 **Fire, Smoke And Fire/Smoke Rated Surfaces:**
26 3M CP 25N/S or CP 25S/L caulk, 3M FS 195 wrap/strip with restricting collar, 3M CS 195 composite
27 sheet, Pipe Shields Inc. Series F fire barrier kits, Proset Systems fire rated floor and wall penetrations,
28 Insta-Foam Products Insta-Fire Seal Firestop Foam or Dow Corning Fire Stop System.
29
30 All fire stopping systems shall be provided by the same manufacturer.
31
32 UL listed or tested by independent testing laboratory, approved by State and Local Code jurisdictions.
33
34 Use product that has a rating not less than rating of wall or floor being penetrated. Reference architectural
35 drawings for identification of fire and/or smoke rated walls and floors.
36
37 Sleeves in concrete to be Schedule 40 steel pipe with integral water stop unless fire stop material used
38 includes a sleeve that is an integral part of rated assembly.
39
40 Use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks,
41 firestop mortar or a combination of these products to provide a UL listed system for each application
42 required for this project. Provide mineral wool backing where specified in manufacturer's application detail.
43
44 **Non-Rated Surfaces:**
45 Stamped steel, chrome plated, hinged, split ring escutcheons or floor/ceiling plates for covering openings in
46 occupied spaces.
47
48 In exterior wall openings below grade, use modular mechanical type seal consisting of interlocking
49 synthetic rubber links shaped to continuously fill the annular space between the un-insulated pipe and cored
50 opening or a water-stop type wall sleeve.
51
52 At interior partitions where pipe penetrations are sealed, use Tremco Dymonic, Sika Corp. Sikaflex 1a,
53 Sonneborn Sonolastic NPI, or Mameco Vulkan 116 urethane caulk to effect seal. Use galvanized sheet
54 metal sleeves in hollow wall penetrations.
55

1 **EQUIPMENT, PIPING AND VALVE IDENTIFICATION**

2 **Equipment Labels:**

3 After painting and covering, identify equipment, including pumps, tanks, compressors, and control panels.
4 Locate identification conspicuously.

5
6 Identification of equipment shall be by engraved white letters on a black 1/16 inch thick plastic laminate
7 panel, beveled edges, screw mounting, permanently attached to the equipment.

8
9 Minimum size:
10 3/4" x 2 1/2" with 3/8" letters.

11
12 Manufacturers:
13 Setonply ® Style 2060 by Seton Name Plate Company or Emedolite Style EIP by EMED Co., or equal by
14 W. H. Brady.

15
16 **Pipe Identification:**

17 Pipe identification shall conform to ANSI A13.1 "Scheme for Identification of Piping Systems".

18
19 Printed labels identifying the fluid conveyed and direction of flow shall be attached to pipes in accessible
20 locations, at intervals not to exceed 20 feet, not less than once in each room, at each branch, adjacent to
21 each access door or panel, at each valve and where exposed piping passes through walls and floors.

Outside Diameter of Pipe Covering	Minimum Size of Letters
up to 1 1/4"	1/2"
1 1/2" to 2"	3/4"
2 1/2" to 6"	1 1/2"

22
23
24 Manufacturers:
25 EMED Co., Seton Name Plate Company, or W. H. Brady.

26
27 Stencils:
28 Not less than 1 inch high letters/numbers for marking pipe and equipment.

29
30 **Valve Tags:**

31 Identify each valve by means of 1 1/2" diameter brass tag fastened to body of valve with copper or brass
32 chain. Identification number shall be stamped thereon with letters a minimum of 1/2" high. System
33 identification abbreviation shall be stamped with letters a minimum of 1/4" high.

34
35 The following prefixes shall be used:
36 PLBG - Plumbing

37
38 Manufacturers:
39 EMED Co., Seton Name Plate Company, or W. H. Brady.

40
41 **Valve Charts:**

42 Furnish three charts listing each valve. Two charts shall be delivered to A/E. An additional chart shall be
43 framed behind glass and hung in location selected by Owner. Charts shall show the following:

44
45 Valve number Size
46 Manufacturer Type of valve
47 Type of service Location

48
49 Furnish a typewritten chart indicating equipment or areas served by each numbered valve and incorporate
50 in Operating and Maintenance Manuals.

1 **EQUIPMENT ACCESSORIES**

2 Provide equipment accessories, connections, and incidental items.
3 Install piping connecting to pumps and other equipment without strain at the piping connection. If
4 requested by the A/E, remove the bolts in these flanged connections, or disconnect piping, to demonstrate
5 that piping has been properly connected.

6
7 **THERMOMETERS AND GAUGES**

8 **Acceptable Manufacturers:**

9 American, Taylor, Terlice, U.S. Gauge, Weiss, or Winters Instruments.

10
11 **Thermometers:**

12 Industrial type with separable sockets, adjustable angles, black cast aluminum 9" case, frame, glass front,
13 with red appearing mercury tube. Readable by person standing on floor. Provide extension necks for
14 equipment with 2" or thicker insulation.

15
16 Ranges shall be as follows:

17 Domestic Water: 30 to 200 degrees Fahrenheit.

18
19 **Pressure Gauges:**

20 Industrial quality with phosphor bronze bourdon tube, brass socket, 3½ inch dial face, bronze bushed
21 movement, aluminum case with black finish, white background, black figures readable by person standing
22 on floor.

23
24 Ranges shall be as follows:

25
26 Domestic Water:

27 0 to 150 psig

28
29 **BEDDING AND BACKFILL**

30 Bedding up to a point 12-inches above the top of the pipe shall be thoroughly compacted sand or crushed
31 stone chips meeting the following gradations:

Gradation for Bedding Sand	
Sieve Size	% Passing (by Wt)
1 inch	100
No. 16	45 - 80
No. 200	2 - 10

Gradation for Crushed Stone Chip Bedding	
Sieve Size	% Passing (by Wt)
1/2 inch	100
No. 4	75 - 100
No. 100	10 - 25

32
33
34 Backfill above the bedding in lawn areas shall be thoroughly compacted excavated material free of large
35 stones, organic, perishable, and frozen materials.

36
37 Backfill above the bedding under existing and future utilities, paving, sidewalks, curbs, roads and buildings
38 shall be granular materials, pit run sand, gravel, or crushed stone, free from large stones, organic,
39 perishable, and frozen materials.

40
41
42 **PART 3 – EXECUTION**

43
44 **GENERAL**

45 **Coordination Of Work:**

46 Review the complete set of Drawings and Specifications and report discrepancies to the A/E. Obtain
47 written instructions for changes necessary. Coordinate with each trade prior to beginning installation and
48 make provisions to avoid interferences. Changes required caused by neglect to coordinate shall be made
49 without expense to the project.

1
2 Piping shall not be located above electrical panels.
3

4 **Anchor Bolts, Sleeves, and Supports:**

5 These items required for the Work shall be furnished by the FPC for proper installation of his work. They
6 shall be installed (except as otherwise specified) by the trade furnishing and installing the material in which
7 they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade
8 requiring them. Expense resulting from the improper location or installation of anchor bolts, sleeves,
9 inserts and supports shall be paid for by the Contractor for the trade with responsibility for directing their
10 proper location.
11

12 **Adjustments In Locations:**

13 Locations of pipes and equipment, shall be adjusted to accommodate the work interferences anticipated and
14 encountered. Prior to fabrication determine the exact route and location of each pipe (subject to A/E's
15 approval).
16

17 **Right Of Way:**

18 New lines which pitch shall have the right-of-way over those which do not pitch. For example: Gravity
19 drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-
20 way over lines whose elevations can be changed. Notify A/E and other trades of conflicts.
21

22 Offsets, transitions and changes in direction of electrical raceways, pipes, and ducts shall be made to
23 maintain proper room and pitch of sloping lines whether or not indicated on the Drawings.
24

25 **DEMOLITION**

26 Demolition of existing building, plumbing fixtures, and plumbing equipment by others. PC shall be
27 available to assist in capping and abandoning existing plumbing utilities if requested by GC.
28

29 **EXCAVATION AND BACKFILL**

30 Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure no
31 disturbance of bearing soil.
32

33 Before burying piping, mark up Record Drawings and dimensionally locate piping. Deliver information to
34 A/E Field Representative.
35

36 Unless otherwise specifically indicated on Drawings, trenches for utilities shall be of depth that provides
37 the following minimum depths of cover from existing grade or from indicated finish grade, whichever is
38 lower:
39

40 Storm and sanitary sewers:

41 As described in DPS 382.30 (11) (b). Provide insulation for sewers installed at less than minimum
42 depth.
43

44 Water service and/or fire service piping:

45 The top of pipe shall be installed not less than six (6) feet below grade.
46

47 Existing utility lines to be retained shown on Drawings or locations of which are made known to Contractor
48 prior to excavation, as well as utility lines uncovered during excavation operations, shall be protected from
49 damage during excavation and backfilling and if damaged, shall be repaired by Contractor at his expense.
50

51 Perform excavation and backfill work to accomplish indicated mechanical systems installation in
52 accordance with Section 312000 – Earth Moving.
53
54

1 **DEWATERING**

2 Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation
3 pits, trenches and the entire subgrade area free from water under all circumstances. Obtain general permit
4 from the Wisconsin Department of Natural Resources district office for discharge of construction
5 dewatering effluent. Obtain well permit from the Wisconsin Department of Natural Resources district
6 office for dewatering wells discharging more than 70 GPM. Comply with permit requirements.

7
8 **ROCK EXCAVATION**

9 Remove rock encountered in the excavation to a minimum dimension of six (6) inches outside the pipe.
10 Rock excavation includes all hard, solid rock in ledges, bedded deposits and unstratified masses, all natural
11 conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; which material
12 is so hard or so firmly cemented that in the opinion of the Engineer it is not practical to excavate and
13 remove same with a power shovel except after thorough and continuous drilling and blasting. Rock
14 excavation includes rock boulders of 1/2 cubic yard or more in volume.

15
16 Rock excavation will be computed on the basis of the depth of rock removed and a trench width two (2)
17 feet larger than the outside diameter of the pipe where one (1) pipe is laid in the trench and three (3) feet
18 larger than the combined outside diameter where two (2) pipes are laid in the trench. Include 6 inch pipe
19 and structure bedding in rock excavation. Include rock excavation shown on the plans in the Base Bid.

20
21 **SURFACE RESTORATION**

22 Completely restore the surface of all disturbed areas to a like condition of the surface prior to the work.
23 Level off all waste disposal areas and clean up all areas used for the storage of materials or the temporary
24 deposit of excavated earth. Remove all surplus material, tools and equipment.

25
26 **CONCRETE WORK**

27 Provide all cast-in-place concrete pads per Division 03 specifications. Provide all, anchor bolts, metal
28 shapes, and/or templates required to be cast into concrete or used to form concrete for support or
29 installation of plumbing piping, fixtures, specialties and equipment. Coordinate locations of equipment,
30 pipe penetrations in wet areas, etc. with the Division 03 Contractor.

31
32 **OPENINGS, CUTTING AND PATCHING**

33 Refer to Division 01 of the Project Manual.

34
35 Provisions for openings including chases, holes and clearances through walls, floors, and roof, ceilings and
36 partitions shall be made in advance of construction of each part of the building. Openings shall be provided
37 by the GC for the respective materials in which openings occur, during the construction of the building
38 with the exception of pipe sleeves. The PC shall furnish to the GC opening dimensions and locations.

39
40 If the PC neglects to inform the GC of his opening requirements before that portion of the building
41 construction is complete, the PC shall cut the openings and provide framing and lintels. In the event holes
42 must be cut through reinforced concrete, avoid spalling and unnecessary damage or weakening of structural
43 members. No chopping or breaking out is permitted. Before cutting or drilling, obtain permission from the
44 A/E. Patch adjacent materials and repair damage resulting from the cutting.

45
46 The PC may perform core drilling for openings in existing walls and floors at the direction of the A/E.
47 Framed openings shall be by the GC.

48
49 Patch interior trench excavation to match existing slab-on-grade with concrete: 3500 PSI at 28 days, 3"
50 slump, 3/4" maximum aggregate size, 5.5 bags of cement per cubic yard.

51
52 **BUILDING ACCESS**

53 Arrange for necessary openings in building to allow for admittance of all apparatus. When building access
54 was not previously arranged and must be provided by Contractor, restore opening to original condition after
55 the apparatus has been brought into building. Coordinate with Architect/Engineer.

1 **EQUIPMENT ACCESS**

2 Install piping, conduit, fixtures, and accessories to permit access to equipment for maintenance. Coordinate
3 exact location of wall and ceiling access panels and doors with General Contractor, making sure access is
4 available for equipment and specialties. Where access is required in plaster walls or ceilings, furnish and
5 install access doors required. Coordinate for installation of access doors utilizing General Contractor and
6 other appropriate on-site subcontractor for access door installation.

7
8 Accessible ceilings, (i.e. lay-in ceilings) do not require access panels. Provide color coded thumb tacks or
9 screws, depending on surface, for use in accessible ceilings.

10
11 **COORDINATION OF WORK**

12 Install systems, equipment and piping in cooperation with other trades. Locations of pipes, equipment,
13 fixtures, etc., shall be adjusted to accommodate the work interferences anticipated and encountered. Prior
14 to fabrication determine the exact route and location of each pipe (subject to A/E's approval).

15
16 Any work that is not coordinated and that interferes with other contractor's work shall be removed or
17 relocated at the installing contractor's expense.

18
19 Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

20
21 Offsets, transitions and changes in direction of electrical raceways, pipes and ducts shall be made as
22 required to maintain proper room and pitch of sloping lines whether or not indicated on the Drawings.
23 Furnish and install all traps, air vents, sanitary vents, etc., as required to effect the offsets, transitions and
24 changes in direction.

25
26 New lines which pitch shall have the right-of-way over those which do not pitch. For example: Gravity
27 drains shall normally have right-of-way. Lines whose elevations cannot be changed shall have the right-of-
28 way over lines whose elevations can be changed. Notify A/E and other trades of any conflicts.

29
30 Provide appropriate sections of work with required wall, roof and floor opening locations and dimensions.
31 If Contractor neglects to coordinate information, openings shall be the responsibility of Contractor.

32
33 **PIPING INSTALLATION**

34 **General:**

35 Expansion and contraction of piping shall be provided for by expansion loops, bends, swing joints, or
36 expansion joints to prevent damage to connections, piping, equipment of the building.

37
38 Unions or flanges shall be installed on all by-passes, ahead of all traps, adjacent to screw connection
39 valves, and at all connections to equipment, whether or not shown on drawings.

40
41 **Installation Arrangement:**

42 Install all Work to permit removal (without damage to other parts) of all parts requiring periodic
43 replacement or maintenance. Arrange pipes and equipment to permit ready access to valves, cocks, traps,
44 starters, motors, control components and to clear the openings of swinging and overhead doors and of
45 access panels.

46
47 **Connections Different From Those Shown:**

48 Where equipment requiring different arrangement or connections from those shown is used, install the
49 equipment to operate properly and in harmony with the intent of the Drawings and Specifications. When
50 requested by the A/E, submit drawings showing the proposed installation.

51
52 If the proposed installation is approved, make all incidental changes in piping, ductwork, supports,
53 insulation, wiring, panelboards, etc. Provide any additional motors, controllers, valves, fittings and other
54 additional equipment required for the proper operation of the system resulting from the selection of
55 equipment, including all required changes in affected trades. The Contractor shall be responsible for the
56 proper location of rough-in and connections by other trades.

1
2 All changes shall be made at no increase in the Contract amount or additional cost to the other trades.
3

4 **LUBRICATION AND MAINTENANCE**

5 Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is
6 operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the
7 manufacturer's instructions until the work is accepted by the Owner. Maintain a log of all lubricants used
8 and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the
9 completion of the project.
10

11 **SLEEVES**

12 Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a
13 backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish.
14 Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall
15 is exposed to view, sheet metal sleeve shall be installed flush with face of wall. In existing poured concrete
16 walls where penetration is core drilled, pipe sleeve is not required.
17

18 Pipe sleeves are not required in existing poured concrete walls where penetrations are core drilled.
19

20 Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated
21 pipe to run through sleeve), cast in place.
22

23 In all piping floor penetrations, fire rated and non-fire rated, top of sleeve shall extend 1 inch above the
24 adjacent finished floor. In existing floor penetrations, core drill sleeve opening large enough to insert
25 schedule 40 sleeve and grout area around sleeve with hydraulic setting, non-shrink grout. If the pipe
26 penetrating the sleeve is supported by a pipe clamp resting on the sleeve, weld a collar or struts to the
27 sleeve that will transfer weight to existing floor structure.
28

29 For floor penetrations through existing floors in mechanical and wet locations listed below, core drill
30 opening and provide 1-1/2" x 1-1/2" x 1/8" galvanized steel angles fastened to floor surrounding the
31 penetration or group of penetrations to prevent water from entering the penetration. Provide urethane caulk
32 between angles and floor and fasten angles to floor a minimum of 8" on center. Seal corners water tight
33 with urethane caulk. Or, core drill sleeve openings large enough to insert schedule 40 sleeve and grout area
34 around sleeve with hydraulic setting non-shrink grout/cement.
35

36 For pipe penetrations through existing floors in food service areas, core drill sleeve opening large enough to
37 insert schedule 40 sleeve and grout area around sleeve with hydraulic setting non-shrink grout/cement. Size
38 sleeve to allow insulated pipe to pass through sleeve and paint the sleeve.
39

40 Pipe sleeves are not required in cored floor pipe penetrations through existing floors that are not located in
41 mechanical rooms, food service areas or wet locations listed above.
42

43 **PIPE PENETRATIONS**

44 **General:**

45 Coordinate location of building surface penetrations with appropriate contractors. Furnish sleeves, inserts,
46 and devices to be built into structure to contractor performing Work. Prepare Shop Drawings for approval
47 for penetrations of structural elements, including floor slabs, shear walls, and bearing walls. Do not allow
48 penetrations to be made until Shop Drawings are approved.
49

50 **Fire Rated Surfaces:**

51 Install products in accordance with the manufacturer's instructions where pipe penetrates a fire rated
52 surface. When pipe is insulated, use product that maintains integrity of insulation and vapor barrier. Where
53 sleeve must be installed in existing floor, grout area around sleeve to restore floor integrity. In wet area
54 floor penetration, top surface of penetration to be 2 inches above adjacent floor with additional height
55 obtained by means of concrete pad poured integral with floor.
56

1 **Non-Rated Surfaces:**

2 Install escutcheons or floor/ceiling plates where pipe penetrates non-fire rated surfaces in occupied spaces.
3 Size units to accommodate insulation, where applicable. Escutcheons are not required when insulation
4 completely covers wall opening and insulation end is trimmed in a neat manner. Occupied spaces for this
5 Paragraph include only those rooms with finished ceilings and penetration occurs below ceiling.

6
7 In exterior wall openings below grade, place water-stop type wall sleeve before concrete pour or core drill
8 opening after pour. Assemble rubber links to proper size for pipe and tighten in place in accordance with
9 manufacturer's instructions.

10
11 Install galvanized sheet metal sleeve in hollow wall penetrations to provide backing for sealant. Apply
12 sealant to both sides of penetration in a manner that annular space between pipe sleeve and pipe or
13 insulation is completely blocked.

14
15 Completely seal (or caulk) around pipe penetrations through non-rated, smoke tight corridor walls in
16 healthcare facilities. Refer to architectural drawings for additional information.

17
18 **ESCUTCHEON PLATES**

19 Provide plates on pipes passing through finished floors, walls and ceilings, with outside diameter to cover
20 sleeve opening and inside diameter to fit snugly around pipe. Set tight to building surface. Escutcheon
21 plates shall be chromium plated metal.

22
23 **FLASHING OF ROOF AND WALL PENETRATIONS**

24 Flashings on the roof shall be closely coordinated. Install flashings to insure proper vapor barrier.

25
26 Roof attachments, equipment supports, piping systems and other roof penetrations shall be waterproofed.

27
28 **PAINTING**

29 Refer to Division 09.

30
31 All exposed steel support structures (all metal surfaces located both inside and outside the building) shall
32 be painted after installation with one coat of a compatible metal primer coat and two coats of a finish coat
33 of paint for the application. Color shall be gray unless otherwise specified.

34
35 **IDENTIFICATION**

36 Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one
37 coat of black enamel against a light background or white enamel against a dark background. Use a primer
38 where necessary for proper paint adhesion.

39
40 Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

41
42 Identify interior piping not less than once every 30 feet, not less than once in each room, adjacent to each
43 access door or panel, and on both side of the partition where accessible piping passes through walls or
44 floors. Place flow directional arrows at each pipe identification location. Use one coat of black enamel
45 against a light background or white enamel against a dark background.

46
47 Identify all exterior buried piping for entire length with underground warning tape except for sewer piping
48 which is routed in straight lines between manholes or cleanouts. Place tape 6"-12" below finished grade
49 along entire length of pipe. Extend tape to surface at building entrances, meters, hydrants and valves.
50 Where existing underground warning tape is broken during excavation, replace with new tape identifying
51 appropriate service and securely spliced to ends of existing tape.

1 Identify valves with brass tags bearing a system identification and a valve sequence number. Identify
2 medical gas and vacuum valves with brass tags and wall or cabinet mounted color coded engraved
3 nameplate with the following "(Type of Gas) Shutoff Valve for (Location or Zone)". Valve tags are not
4 required at a terminal device unless the valves are greater than ten feet from the device, located in another
5 room or not visible from device. Provide a typewritten valve schedule and pipe identification schedule
6 indicating the valve number and the equipment or areas supplied by each valve and the symbols used for
7 pipe identification; locate schedules in mechanical room and in each Operating and Maintenance manual.
8 Schedule in mechanical room to be framed under clear plastic.
9
10
11

END OF SECTION

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SECTION 22 05 14
PLUMBING SPECIALTIES

PART 1 - GENERAL

SCOPE

This section includes specifications for backflow preventers, hose bibs, water hammer arrestors and other miscellaneous plumbing specialties. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Submittals

PART 2 - PRODUCTS

- General
- Backflow Prevention Devices
- Hose Bibbs/Wall Hydrants

PART 2 - EXECUTION

- Installation

RELATED WORK

Requirements of Division 01 shall govern work under this Section.

- Section 22 05 00 – Common Work Results for Plumbing
- Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- Section 22 07 00 – Plumbing Insulation
- Section 22 11 00 – Facility Water Distribution
- Section 22 13 00 – Facility Sanitary Sewerage
- Section 22 14 00 – Facility Storm Drainage
- Section 22 30 00 – Plumbing Equipment
- Section 22 40 00 – Plumbing Fixtures

REFERENCE STANDARDS

- ANSI A112.14.1 - Backwater Valves
- 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 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section 22 05 00 and Division 01 of the Project Manual.

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.

SUBMITTALS

Submit product data sheets in accordance with Division 01 and Section 22 05 00.

1 Submit and pay all fees to State of Wisconsin for reduced pressure zone backflow prevention device
2 review. Submit State approval of reduced pressure zone backflow prevention device with product data
3 sheets in accordance with Division 01 and Section 22 05 00.
4
5

6 **PART 2 - PRODUCTS**

7 **GENERAL**

8 Refer to Plumbing Equipment Schedule for specific model numbers and sizing information regarding the
9 plumbing fittings and specialties specified herein.
10

11 **BACKFLOW PREVENTION DEVICES**

12 **Acceptable Manufacturers:**

13 Cash-Acme, Chicago, Cla-Val, Conbraco, Febco, Nidel, Watts, Wilkins, or Woodford.
14
15

16 **Vacuum Breakers:**

17 For exposed piping in unfinished areas, brass construction, Watts series 288A.
18

19 Hose thread inlet and outlet, non-removable hose connection, vacuum breaker for use on service sink
20 faucets, Chicago Faucet No. E27, ¾ inch.
21

22 **Continuous Pressure Type:**

23 Bronze construction, stainless steel internal parts, primary and secondary checks with vent chamber, ASSE
24 1012, Watts No. 9D.
25

26 Satin chrome finish for finished areas, Watts Regulator No. 9DSC.
27

28 **Reduced Pressure Zone Type (RPBP):**

29 Bronze body, replaceable seats, ball valve shutoff valves, strainer, union connections, ball valve test ports,
30 ASSE 1013, Watts series 009, 909, or 919.
31

32 **General:**

33 All backflow preventers shall have ball valve shut-off.
34

35 **HOSE BIBBS/WALL HYDRANTS**

36 Hose bibbs and wall hydrants shall be manufactured by Chicago Faucet, MIFAB, Woodford, or Zurn.
37
38

39 **PART 3 - EXECUTION**

40 **INSTALLATION**

41 **Vacuum Breaker/Backflow Preventers:**

42 Install per Plumbing Code.
43
44

45 **Reduced Pressure Zone Backflow Preventers:**

46 Install in conformance with requirements of Wisconsin Plumbing Code, manufacturer's recommendations
47 and as shown. After installation and initial testing submit the proper paperwork to the Department of
48 Professional Services, Plumbing Bureau.
49

50 **Hose Bibbs/Wall Hydrants:**

51 Install 24 inches above finished grade or floor.
52
53

54 **END OF SECTION**

1
2 **DESIGN CRITERIA**

3 Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice
4 SP-58 and SP-69 unless noted otherwise.

5
6 Piping connected to pumps, compressors, or other rotating or reciprocating equipment is to have vibration
7 isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment,
8 whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the
9 100 pipe diameter/3 support distance.

10
11 Do not hang any mechanical item directly from a metal deck or run piping so its rests on the bottom chord
12 of any truss or joist.

13
14 **General:**

15 Secure pipe in place to prevent vibration, maintain proper slope and provide for expansion and contraction.

16
17 Design supports of strength and rigidity to suit loading, service, and manner which do not unduly stress the
18 building construction. Where support is from concrete construction, take care not to weaken concrete or
19 penetrate waterproofing. Fasten supports and hangers to building steel framing wherever practical. Do not
20 use another pipe for support. Do not use perforated iron, chain or wire as hangers.

21
22 Use inserts for suspending hangers from reinforced concrete slabs wherever practical. Where inserts are
23 not practical, provide channels or angles from which to suspend hangers/supports. Fasten structural steel
24 to concrete with expansion bolts.

25
26 Provide expansion anchors in concrete slabs for installation of threaded support rods.

27
28 Provide hangers capable of vertical adjustment after piping is erected. Do not pierce ductwork with hanger
29 rods. On threaded support rods and bolts, weld nuts to rods, peen threads, or provide double set of nuts
30 with lock washers to prevent loosening. Use beam clamps for attaching hangers to structural steel.

31
32 On piping insulated with vapor barrier covering, use protection shield to cover bottom one-half of insulated
33 pipe. Shield to be a minimum of 12" long and of 16 gauge galvanized steel.

34
35 **Exception:**

36 For insulated drain pipe, the pipe may rest on the hanger and the insulation to wrap around the
37 hanger and pipe.

38
39 Submit anchor drawings for approval upon request.

40
41 Hangers, supports, and support methods other than those specified shall not be used without obtaining
42 approval on method of support by the Structural Engineer prior to installing piping systems. Submit
43 support method arrangement, pipe weight and spacing scheme for approval.

44
45 **Hanger and Support Spacing:**

46 Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

47
48 Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

49
50 Use hangers with 1-1/2 inch minimum vertical adjustment.

51
52 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze
53 hangers.

54
55 Support riser piping independently of connected horizontal piping.

1
2 Adjust hangers to obtain the slope specified in the piping section of these specifications.

3
4 Space hangers for pipe as follows:
5

Pipe Material	Pipe Size	Max. Horiz. Spacing	Max. Vert. Spacing
Cast Iron	2" and larger	5'-0"	15'-0"
Copper	1/2" through 3/4"	5'-0"	10'-0"
Copper	1" through 1-1/4"	6'-0"	10'-0"
Copper	1-1/2" through 2-1/2"	8'-0"	10'-0"
Copper	3"	10'-0"	10'-0"
Ductile Iron	All	10'-0"	20'-0"
Plastic	Drain and Vent	4'-0"	10'-0"

6
7 **SUBMITTALS**
8 Submit data in accordance with Section 22 05 00 and Division 01 of the Project Manual.

9
10 Schedule of all hanger and support devices indicating attachment methods and type of device for each pipe
11 size and type of service.

12
13 Submit anchor drawings to the A/E for approval upon request.

14
15
16 **PART 2 - PRODUCTS**

17
18 **MANUFACTURERS**
19 B-Line, Fee and Mason, Grinnell, Michigan Hanger, Pate, PHD Manufacturing, Piping Technology,
20 Powers/Rawl, Proset, Roof Products & Systems, Unistrut, or Victaulic.

21
22 **PIPE HANGERS AND SUPPORTS**
23 **Overhead Supports:**
24 Adjustable clevis hanger, steel, Dura-Green epoxy coating or electro-plated, B-Line Figure B3100.
25
26 Adjustable J hook hanger, steel, Dura-Green epoxy coating or electro-plated, B-Line figure B3690.
27
28 Adjustable band hanger, steel, Dura-Green epoxy coating or electro-plated, B-Line Figure B3172.

29
30 **Multiple or Trapeze Hangers:**
31 Where several pipes are running parallel and pitching in the same direction, strut style support may be
32 used. Steel channel, 12-gauge thickness, Dura-Green epoxy coating or electro-plated, B-Line B11. Restrain
33 individual pipes with B-Line B2000 series or Vibraclamp series strut clamps.

34
35 **Wall Support:**
36 Carbon steel welded bracket with hanger. B-Line 3068 Series, Grinnell 194 Series.
37
38 Perforated, epoxy painted finish, 16-12 gauge, min., steel channels securely anchored to wall structure,
39 with interlocking, split-type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-
40 2000 series clamps, Grinnell type PS 200 H with PS 1200 clamps.

41
42 When copper piping is being supported, provide flexible elastomeric/thermoplastic isolation cushion
43 material to completely encircle the piping and avoid contact with the channel or clamp, equal to B-Line
44 B1999 Vibra Cushion or provide manufacturers clamp and cushion assemblies, B-Line BVT series,
45 Grinnell PS 1400 series.

1 **Vertical Support:**
2 Riser clamp, steel, Dura-Green epoxy coating or electro-plated, B-Line Figure B3373.

3
4 Riser clamp, flexible sleeve with stainless steel band, Proset PS #33.

5
6 **Floor Support:**
7 Carbon steel pipe saddle, stand and bolted floor flange. B-Line B3088T/B3093.

8
9 **Copper Pipe Supports:**
10 All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper plated or
11 polyvinylchloride coated. Where steel channels are used, provide isolation collar between
12 supports/clamps/fasteners and copper piping.

13
14 **PIPE HANGER RODS**

15 **Steel Hanger Rods:**
16 Steel, electro-plated, threaded both ends, threaded one end, or continuous threaded, complete with
17 adjusting and lock nuts. B-Line B3205.

18
19 Size rods for individual hangers and trapeze support as indicated in the following schedule:

20
21 Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed
22 the limits indicated.

23

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4

24
25 **BEAM CLAMPS**

26 MSS SP-69 Types 19 & 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick
27 with a retaining ring and threaded rod of 3/8, 1/2, and 5/8 inch diameter. Furnish with a hardened steel cup
28 point set screw. B-Line B3036L/B3034, Grinnell 86/92.

29
30 MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable
31 for rod sizes to 1-1/2 inch diameter. B-Line B3054, Grinnell 228.

32
33 **CONCRETE INSERTS**

34 **Poured in Place:**
35 MSS SP-69 Type 18 wedge type to be constructed of a black carbon steel body with a removable malleable
36 iron nut that accepts threaded rod to 7/8 inch diameter. Wedge design to allow the insert to be held by
37 concrete in compression to maximize the load carrying capacity. B-Line B2505, Grinnell 281.

38
39 MSS SP-69 Type 18 universal type to be constructed of black malleable iron body with a removable
40 malleable iron nut that accepts threaded rod to 7/8 inch diameter. B-Line B3014N, Grinnell 282.

41
42 **Drilled Fasteners:**

43 Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating, minimum tension load
44 of 3200 pounds. Use drill bit of same manufacturer as anchor.

45
46 Manufactured By:
47 Hilti, Powers/Rawl, Redhead.

1 **ANCHORS**

2 Use welding steel shapes, plates, and bars to secure piping to the structure.

3

4 **EQUIPMENT SUPPORT**

5 Examine Drawings, and manufacturer's data to determine how equipment, fixtures, and piping are to be
6 supported, mounted or suspended. Support all equipment plumb, rigid, and true to line. Provide rods,
7 bolts, inserts, pipe stands, brackets and accessories for proper support.

8

9 **Equipment Stands:**

10 Use structural steel members welded to and supported by pipe supports. Clean, prime and coat with three
11 coat rust inhibiting alkyd paint or one coat epoxy mastic. Where exposed to weather, treat with corrosive
12 atmosphere coatings.

13

14 **CORROSIVE ATMOSPHERE COATINGS**

15 Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication,
16 ASTM A123, 1.5 ounces/square foot of surface each side. Mechanical galvanize threaded products, ASTM
17 B695 Class 50, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich paint of
18 comparable thickness to factory coating.

19

20 Corrosive atmospheres include the following locations:

- 21 • Entire protect

22

23

24

PART 3 - EXECUTION

25

26 **INSTALLATION**

27 Size, apply and install supports and anchors in compliance with manufacturers recommendations.

28

29 Install supports to provide for free expansion of the piping system. Support all piping from the structure
30 using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and
31 wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

32

33 Coordinate hanger and support installation to properly group piping of all trades.

34

35 Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard
36 structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels
37 are used, pipe supporting devices made specifically for use with the channels may be substituted for the
38 specified supporting devices provided that similar types are used and all data is submitted for prior
39 approval.

40

41 Size and install hangers and supports, except for riser clamps, for installation on the exterior of piping
42 insulation. Where a vapor barrier is not required, hangers may be installed either on the exterior of pipe
43 insulation or directly on piping.

44

45 Perform welding in accordance with standards of the American Welding Society.

46

47 **STRUCTURAL SUPPORTS**

48 Provide all supporting steel required for the installation of mechanical equipment and materials, including
49 angles, channels, beams, etc. to suspended or floor supported tanks and equipment. All of this steel may
50 not be specifically indicated on the drawings.

51

52 **RISER CLAMPS**

53 Support vertical piping with clamps secured to the piping and resting on the building structure or secured
54 to the building structure below at each floor.

55

1 **CONCRETE INSERTS**

2 Select size based on the manufacturer's stated load capacity and weight of material that will be supported.

3 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

4 Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inch size. Where
5 concrete slabs form finished ceiling, provide inserts that are flush with the slab surface.

6

7 **ANCHORS**

8 Install where indicated on the drawings and details. Where not specifically indicated, install anchors at

9 ends of principal pipe runs and at intermediate points in pipe runs between expansion loops. Make

10 provisions for preset of anchors as required to accommodate both expansion and contraction of piping.

11

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SECTION 22 07 00
PLUMBING INSULATION

PART 1 - GENERAL

SCOPE

This Section includes insulation specifications for plumbing systems. Included are the following requirements:

PART 1 – GENERAL

- Scope
- Related Work
- Description
- Quality Assurance
- Definitions
- Submittals

PART 2 – PRODUCTS

- Acceptable Manufacturers
- Insulation and Jackets

PART 3 - EXECUTION

- General
- Installation
- Pipe Insulation Schedule

RELATED WORK

Requirements of Division 01 shall govern work under this Section.

- Section 22 05 00 - Common Work Results for Plumbing
- Section 22 05 29 - Hangers and Supports for Plumbing Piping and Equipment
- Section 22 11 00 - Facility Water Distribution
- Section 22 13 00 - Facility Sanitary Sewerage
- Section 22 14 00 - Facility Storm Drainage
- Section 22 30 00 - Plumbing Equipment

DESCRIPTION

Furnish and install insulating materials, fittings, finishes, and accessories specified for piping and related equipment. The following types of insulation are specified in this Section:

- Pipe insulation

Install insulation materials 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 Engineer.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section 22 05 00 and Division 01 of the Project Manual.

Label insulating products delivered to construction site with the manufacturer's name and description of materials.

1 **DEFINITIONS**

2 **Concealed:**

3 Shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. Other areas, including
4 walk-through tunnels, shall be considered as exposed.

5
6 **Exposed to weather:**

7 Located outdoors, either on grade, on a wall, or on a roof, in location where sun, wind, rain, snow and other
8 elements will come in contact with it.

9
10 **Unconditioned spaces:**

11 Unheated or non-cooled attics, utility tunnels and crawl spaces where ambient temperatures may rise above
12 90 degrees F, or drop below 50 Degrees F. Ducts in these instances are considered to be located outside of
13 building thermal envelope.

14
15 **SUBMITTALS**

16 Submit data in accordance with Section 22 05 00 and Division 01 of the Project Manual

17
18 Include manufacturer's data for the following:

- 19 • Pipe insulation

20
21 Submittal shall include the following information:

22
23 Manufacturer's technical data sheets for each product with the following information:

- 24 • Density
25 • Thermal characteristics
26 • Temperature limitations
27 • Jacket type
28 • Materials of composition
29 • Material safety data sheets

30
31 Schedule of all insulating materials to be used including:

- 32 • Application / intended use of each insulation type
33 • Insulation type and thickness
34 • Jacket type
35 • Fastening methods and adhesive type

36
37
38 **PART 2 - PRODUCTS**

39
40 **ACCEPTABLE MANUFACTURERS**

41 Armstrong, Halstead, Johns-Manville, Knauf, or Owens-Corning.

42
43 **INSULATION AND JACKETS**

44 **Glass Fiber:**

45 Manville Micro-Lok meeting ASTM C547; rigid molded, non-combustible, "K" Value: 0.23 at 75°F,
46 maximum service temperature: 850°F, with vapor Retarder Jacket: AP-T Plus White Kraft paper
47 reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and
48 butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed.

49
50 **PVC Fitting Covers and Jackets:**

51 White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade
52 GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet
53 radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be .02 inch (20
54 mil).

1
2 **PART 3 - EXECUTION**
3

4 **GENERAL**

5 Application of insulation to piping equipment shall be done in accordance with the manufacturer's
6 installation recommendations. Where thickness of insulation is not specified, use thickness recommended
7 by manufacturer or required by applicable Codes.
8

9 Insulation shall be applied in as warm an environment as possible, and in no instance below 25° F.
10

11 No pipe shall be covered until after it has been installed, inspected, tested and approved.
12

13 **INSTALLATION**

14 All pipe insulation shall be installed with joints butted firmly together. All valves and fittings shall be
15 insulated with mitered sections of insulation equal in density and thickness to the adjoining insulation, or
16 with insulating cement equal in thickness to the adjoining insulation, or with "Zeston" type, premolded
17 PVC fittings installed in accordance with the manufacturer's instructions. Fittings are to be finished with 8
18 oz. glass mesh and mastic (use breather mastic on systems operating above 50°F except where Zeston PVC
19 covers are used). Jackets on pipe insulation may be stapled using outward clinch staples spaced 3" apart at
20 least ¼" in from the lap edge on systems operating at 60°F and above; below 50°F the laps are to be vapor
21 sealed using self-sealing lap, lap-seal tape gun or adhesive such as Armstrong 520. All insulation ends are
22 to be tapered and sealed regardless of service.
23

24 On all piping insulated with vapor barrier covering, use protection shield to over bottom one-half of
25 insulated pipe. Shield to be minimum of 12" long and 16 gauge galvanized steel. Provide half-round, 12"
26 long, hanger block at the bottom half of the pipe in place of the fiberglass pipe insulation. The hanger
27 blocks shall be molded cork or calcium silicate pipe insulation of the same thickness as the adjoining
28 fiberglass pipe insulation. The vapor barrier jacket shall be continuous through the hanger location.
29

30 Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Pipe hangers shall be sized
31 large enough to be installed over the outer surfaces of the insulation.
32

33 Exception:

34 For insulated drain pipe, the pipe may rest directly on the hanger and the insulation to wrap around
35 the hanger and pipe.
36

37 Omit insulation for:

- 38 • Unions and flanges.
- 39 • Vents to atmosphere, discharges from safety and relief valves and drain pipes.
40

41 Provide finished edges at all access doors and end.
42

43 **PIPE INSULATION SCHEDULE**

44 Provide insulation on new and remodeled piping.
45
46
47
48
49
50
51
52
53
54
55

1 **Minimum Insulation Thickness:**

2

SYSTEMS	PIPE SIZE			
	1" or less	1-1/4" to 2"	2-1/2" to 4"	5" and up
Storm Drain*	---	---	1"	1"
Domestic Cold Water	1/2"	1/2"	1"	1"
Domestic Hot Water	1"	1"	1-1/2"	1-1/2"
Domestic Hot Water Return	1"	1"	1-1/2"	---
Non-Potable Cold Water	1/2"	1/2"	1"	---

3

4

* Provide pipe insulation on above ground horizontal storm drain piping, underside of roof drain, and initial 5 feet of vertical conductors.

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 – GENERAL

- Scope
- Related Work
- Description
- Quality Assurance
- Submittals

PART 2 – PRODUCTS

- Water Distribution Pipe and Fittings
- Valves
- Unions and Flanges
- Dielectric Couplings
- Water Hammer Suppressors

PART 3 – EXECUTION

- Trenching, Backfilling and Compacting
- Water Piping System
- Testing

RELATED WORK

Requirements of Division 01 shall govern work under this Section.

- 22 05 00 – Common Work Results for Plumbing
- 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- 22 05 14 – Plumbing Specialties

DESCRIPTION

Provide a domestic water distribution system including hot and cold water supply piping, hot water return piping, tempered water piping, pure water piping, valves, fittings, hardware, and specialties. Connect to plumbing fixtures, specialties, and equipment.

Work under this section shall commence 5'-0" outside the building structure with a connection to the combination water supply lateral provided by the site utility contractor.

QUALITY ASSURANCE

Substitution of Materials: Refer to Section 22 05 00 and Division 01 of the Project Manual.

Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1 To assure uniformity and compatibility of piping components in grooved piping systems, all grooved
2 products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied from the
3 same manufacturer as the grooved components.
4

5 **SUBMITTALS**

6 Submit valve product data sheets in accordance with Section 22 05 00 and Division 01 of the Project
7 Manual.
8

9 Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, and
10 identification as referenced in this section and/or on the drawings.
11

12 **PART 2 - PRODUCTS**

13 **WATER DISTRIBUTION PIPE AND FITTINGS**

14 **Under Ground:**

15 2" and Smaller:

16 Copper tube, type K, soft temper, ASTM B88, with wrought copper fittings. ANSI B16.22. Join using lead
17 free flux and solder, ASTM B32, flux ASTM B813.
18

19 3" and Larger:

20 Ductile iron pipe, mechanical or push on joint, thickness class 53 conforming to AWWA C-151 with
21 standard thickness cement mortar lining AWWA C-104; ductile iron or gray iron mechanical joint cement
22 mortar lined fittings, Class 250, AWWA C110; ductile iron restrained joint compact fittings, class 350,
23 AWWA C-153; rubber gasket joints with non-toxic gasket lubricant, AWWA C-111. Joints shall have
24 ASTM A506 steel clamps and straps for restraints with ASTM A307 steel bolts and ASTM A575 steel
25 rods. Provide 8-mil tube or sheet polyethylene encasement of iron pipe and pipe fittings, AWWA C105.
26
27

28 **Above Ground:**

29 Copper tube, Type L, hard temper, ASTM B88; with wrought copper fittings, ANSI B16.22. Join using
30 lead free flux, ASTM B813, and solder, ASTM B32.
31

32 Wrought copper, ANSI B16.22 or cast bronze, ANSI B16.18 fittings, copper tube dimensioned grooved
33 ends (flaring of tube and fitting ends to IPS dimensions is not permitted), joined with mechanical
34 couplings, synthetic rubber gasket seal, Victaulic style 607 QuickVic™ Installation Ready stab-on design,
35 for direct 'stab' installation onto roll grooved copper tube without prior field disassembly and no loose
36 parts.
37

38 **VALVES**

39 **Manufacturer:**

40 Valves throughout the project shall be by one manufacturer, unless otherwise specified.
41

42 Standard valves are based on Nibco models. Equivalent style valves as manufactured by Apollo, Crane,
43 DeZurik, Gustin-Bacon, Grinnell, Hammond, Jenkins, Lunkenheimer, Milwaukee Valve, Stockham,
44 Victaulic, or Watts are acceptable. Valves shall be of standard dimensions, comparable to the number
45 specified.
46

47 Balancing valves are based on Bell & Gossett models. Equivalent style valves by Armstrong, Flowset,
48 Nibco, Taco, or Victaulic/TA Hydronics are acceptable.
49

50 **Shutoff Valves:**

51 Except as otherwise specified, all shutoff valves 2-1/2 inch and smaller shall be ball valves and shutoff
52 valves 3 inch and larger shall be butterfly valves, unless required otherwise by local Water Utility
53 specifications.
54
55

- 1 Ball Valves:
2 Bronze, two piece full port ball valves with bronze body, solder or threaded ends, chromium plated brass or
3 stainless steel ball, reinforced Teflon seats and seals, blowout proof stem design, rated at 600 PSI non-
4 shock WOG, Nibco model T/S-585-70. Include handle extension for insulated piping, NIB-SEAL by
5 Nibco.
6
7 Bronze, two piece full port ball valves with bronze body, solder or threaded ends, stainless steel ball, reinforced
8 Teflon seats and seals, blowout proof stem design, rated at 600 PSI non-shock WOG, Nibco model T/S-
9 585-70-66. Include handle extension for insulated piping, NIB-SEAL by Nibco.
10
11 Bronze, three piece full port ball valves with bronze body, solder or threaded ends, stainless steel ball, reinforced
12 Teflon seats and seals, blowout proof stem design, rated at 600 PSI non-shock WOG, Nibco model T/S-
13 595-66. Include handle extension for insulated piping, NIB-SEAL by Nibco.
14
15 Butterfly Valves:
16 Ductile iron butterfly valve, polymid coated, EPDM elastomer coated disc, extended neck, grooved ends,
17 300 psi WOG pressure rated, Nibco GD 4765. Include lever handle through 6-inch size and gear operator
18 for 8 inch and larger size.
19
20 Cast bronze butterfly valve, EPDM elastomer coated ductile iron disc, copper tube dimensioned grooved
21 ends, 300 psi maximum pressure rated, Victaulic Series 608. Include lever handle through 6-inch size.
22
23 **Check Valves:**
24 3" and Smaller:
25 Bronze body, Class 125, Y-pattern, swing type, check valve with solder ends, all bronze internal
26 components and renewable seat and disc, Nibco model S-413-B.
27
28 2" and Smaller:
29 Bronze body, ASTM B62, in-line lift type, spring, Buna-N disc, 250 psig WOG rating. Nibco 480
30
31 2-1/2" and Larger
32 Iron body, bronze seat with Buna-N, bronze disc, in-line lift type, spring, 250 psig WOG rating, Nibco
33 W960
34
35 **Balancing Valves:**
36 1/2" thru 2":
37 Bronze body balancing valve with sweat or threaded ends, calibrated brass orifice, integral adjustment knob
38 with calibrated scale, memory stop indicator, drain tapping and differential pressure metering connections,
39 Bell & Gossett "Circuit Setter".
40
41 **Gauge Valves:**
42 1/4" Size:
43 Bronze body, rising stem gauge/globe valve with renewable seat and disc and malleable iron hand-wheel,
44 Nibco T-235. Valve shall be rated for 300 PSI non-shock WOG.
45
46 **UNIONS AND FLANGES**
47 **Unions:**
48 Bronze, solder connection, Nibco figure 733.
49
50 **Flanges:**
51 Cast copper alloy, class 125, MSS SP-106, Nibco figure 741.
52
53 **DIELECTRIC COUPLINGS**
54 Steel casing, zinc electroplated, with inert thermoplastic lining, various end types, Clearflow, style 47 by
55 Victaulic.
56

1 Dielectric flanges 2" and larger; with iron female pipe thread to copper solder joint or brass female pipe
2 thread end connections, non-asbestos gaskets and pressure rating of not less than 175 psig at 180 degrees
3 Fahrenheit. Watts Regulator Company, Lochinvar, Wilkins, Epco Sales, Inc.

4
5 **WATER HAMMER SUPPRESSORS**

6 Acceptable manufacturers are MIFAB, PPP, Sioux Chief, and Watts.

7
8 Piston compressed air column type, with sealed air chamber.

9
10 Water supply piping serving fixtures, appliances, equipment and devices with quick closing and/or
11 solenoid-actuated valves shall be provided with water hammer arrestors. Also provide where indicated on
12 the water supply piping as shown on the water supply isometrics. Devices shall be mechanical arrestors
13 installed in accordance with PDI Standard WH201. Air chambers are not considered to be equal.

14
15 Shop drawings are required. Submit to A/E for approval prior to installation.

16
17 Water hammer arrestors must be accessible for inspection and replacement. Provide access panel.

18
19
20 **PART 3 - EXECUTION**

21
22 **TRENCHING, BACKFILLING AND COMPACTING**

23 See Section 22 05 00.

24
25 **WATER PIPING SYSTEM**

26 Piping shall be pitched to drain entire system; install drain valves at low points. Provide unions at
27 equipment and valves. Provide offsets and transition fittings as required. Avoid dips or depressions in pipe
28 runs.

29
30 No water piping shall be installed in exterior walls, unless adequately protected from freezing. Two inch
31 insulation shall be installed on back and sides of chase, front shall be open to room heat, covered only by
32 finished wall material.

33
34 Install unions, couplings, or flanges at all final equipment connections and as required to facilitate removal
35 of equipment.

36
37 Install dielectric couplings at every connection between copper pipe and other metals. Use dielectric
38 unions for connecting copper and steel piping.

39
40 Provide backflow devices as required by Code on water connections to HVAC equipment and other
41 equipment.

42
43 Extend hot water piping from water heater and connect to all fixtures and equipment as required.

44
45 Hot water and cold water lines shall be kept at least 6 inches apart whenever possible.

46
47 **Grooved Joints:**

48 Grooved joint piping systems shall be installed in accordance with the manufacturer's guidelines and
49 recommendations. Grooved couplings, fittings and valves shall be of the same manufacturer. Grooving
50 tools shall be of the same manufacturer as the grooved components. The gasket style and elastomeric
51 material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded
52 and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from
53 indentations, projections and roll marks in the area from pipe end to groove.

1 Grooved coupling manufacturer's factory trained field representative shall provide on-site training for
2 contractor's field personnel in the proper use of grooving tools, application of groove, and installation of
3 grooved piping products. Factory trained representative shall periodically inspect the product installation.
4 Contractor shall remove and replace any improperly installed products.
5

6 **Pressure-Sealed Fittings:**

7 Stainless steel pipe shall be square cut, +/- 0.030", properly deburred and cleaned. Pipe ends shall be
8 marked at the required location, using a manufacturer-supplied gauge, to ensure full insertion into the
9 coupling or fitting during assembly. Use a tool provided by the Manufacturer with the proper sized jaw for
10 pressing (Victaulic "PFT" Series).
11

12 **Hot Water Re-Circulating System:**

13 Install return system including check valves, balancing valves, and pumps. Pitch and grade all lines as
14 required to ensure satisfactory circulation.
15

16 Adjust each balancing valve and set position stop. Balance system to minimum flow in return piping
17 branches needed to maintain even supply water temperature and to provide continuous circulation
18 throughout building. Provide balancing report along with O&M manual submittals. Test and demonstrate
19 to A/E upon request.
20

21 **Valve Installation:**

22 Install shutoff valves with stem vertical. Exception; the stem may be horizontal if a vertical installation
23 would not allow access to the valve handle
24

25 All valves with screwed ends shall be installed using "Teflon" tape applied on male portion of piping
26 fitting.
27

28 Each individual fixture or piece of equipment shall have an independent shut-off valve adjacent to fixture
29 in addition to the required branch shut-off. Where valves are installed in walls an access panel shall be
30 provided.
31

32 **Branches:**

33 Valve shut-off full size of branch for each branch take-off to supply stack or fixture group.
34

35 **Drains:**

36 Provide valved drains at low points of systems as required or directed. All piping shall be arranged to drain
37 through valved drains.
38

39 **Flushing Mains and Branch Piping:**

40 Upon completion of the water distribution system, test all valves to insure their full opening and flush out
41 the system progressively by opening drain valves and building outlets and permitting the flow to continue
42 from each until the water runs clear.
43

44 **Pipe Insulation:**

45 Provide pipe insulation for all domestic water piping per Section 22 07 00.
46

47 **Sterilization of Water Distribution System:**

48 As soon as the water distribution system has been flushed out as above specified, it shall be sterilized in
49 accordance with the requirements of the local Health Department/Water Utility or in the absence of such,
50 by the following method:
51

52 Introduce chlorine or a solution of calcium or sodium hypochlorite, filling the lines slowly and
53 applying the sterilizing agent at a rate of 50 parts per million of chlorine, as determined by residual
54 chlorine tests at the ends of the lines. Open and close all valves and hydrants while the system is
55 being chlorinated.
56

1 After the sterilizing agent has been applied for 24 hours, test for residual chlorine at the ends of
2 the lines. If less than 5 PPM as indicated, repeat the sterilization process.

3
4 When tests show at least 5 PPM of residual chlorine flush out the system until all traces of the
5 chemical used are removed.

6
7 **Samples**

8 After disinfecting the water distribution system, take water samples to check for bacteria. Take 5 water
9 samples from remote faucets, plus the main entrance. Send the samples to the Wisconsin Department of
10 Health Lab to sample for a safe water supply system.

11
12 **TESTING**

13 Refer to Division 01, "Starting of Systems" and Section 22 05 00.

14
15 Hydro-statically pressure test water piping to 150 psig for 4 hours. No decrease in pressure is allowed.
16 Provide pressure gauge with shutoff and a bleeder valve at the highest point of the system tested. Inspect
17 joints in system under test. No leaks allowed.

18
19 Do not conceal pipe until satisfactorily tested.

20
21 Testing with air will not be allowed.

22
23
24 **END OF SECTION**

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SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 – GENERAL

- Scope
- Related Work
- Description
- Quality Assurance
- Submittals

PART 2 – PRODUCTS

- Underground Pipe Fittings
- Above Ground Pipe and Fittings
- Drains and Cleanouts
- Trench Drains

PART 3 - EXECUTION

- Drain and Vent Piping System
- Pipe Joints
- Vent Flashing
- Cleanouts
- Traps
- Testing

RELATED WORK

Requirements of Division 01 shall govern work under this Section.

- 22 05 00 – Common Work Results for Plumbing
- 22 05 14 – Plumbing Specialties
- 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment

DESCRIPTION

Interior sanitary waste and vent and acid drain and vent piping systems including branches, drains, cleanouts, stacks, fittings and hardware.

Work under this section shall commence from 5 feet outside the building wall with connections to sanitary building sewer lateral(s).

QUALITY ASSURANCE

Substitution of Materials: Refer to Section 22 05 00 and Division 01 of the Project Manual.

Order all pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

1 **SUBMITTALS**

2 Submit data in accordance with Section 22 05 00 and Division 01 of the Project Manual.

3
4 Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being
5 proposed along with its type and grade, and sufficient information to indicate the type and rating of fittings
6 for each service.

7
8 Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, and
9 identification as referenced in this section and/or on the drawings.

10
11
12 **PART 2 - PRODUCTS**

13
14 **UNDERGROUND PIPE AND FITTINGS**

15 Cast iron, no-hub, service weight, ASTM A888, CISPI 301, with rubber gasket couplings, ASTM C564,
16 and stainless steel clamp, CISPI 310. Pipe and fittings shall be marked with the collective trademark of the
17 Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Piping and fittings shall be
18 manufactured by AB&I, Charlotte, or Tyler.

19
20 Cast iron soil pipe, bell and spigot, service weight, coated, ASTM A74, with rubber gaskets, ASTM C564.
21 Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or
22 receive prior approval of the engineer. Piping and fittings shall be manufactured by AB&I, Charlotte, or
23 Tyler.

24
25 PVC, Schedule 40, Type I, ASTM D-1785, and PVC drain-waste-vent fittings, ASTM D-2665, with
26 solvent weld joints, ASTM D2855. Solid wall PVC only.

27
28 **ABOVE GROUND PIPE AND FITTINGS**

29 Cast iron, no-hub, service weight, ASTM A888, CISPI 301, with rubber gasket couplings, ASTM C564,
30 and stainless steel clamp, CISPI 310. Pipe and fittings shall be marked with the collective trademark of the
31 Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Piping and fittings shall be
32 manufactured by AB&I, Charlotte, or Tyler.

33
34 PVC, Schedule 40, Type I, ASTM D-1785, and PVC drain-waste-vent fittings, ASTM D-2665, with
35 solvent weld joints, ASTM D2855. Solid wall PVC only.

36
37 **Optional Materials for Piping 2" and Smaller:**

38 Copper drainage tube, Type DWV, ASTM B-306; wrought copper and cast brass drainage fittings with
39 soldered joints.

40
41 **DRAINS AND CLEANOUTS**

42 Drains and cleanouts manufactured by J.R. Smith, Josam, Wade, Watts, or Zurn.

43
44 Refer to Plumbing Drain and Cleanout Schedule.

45
46 **TRENCH DRAINS**

47 Trench Drains manufactured by ACO, J.R. Smith, Josam, Polycast, Polydrain, or Zurn.

48
49 Refer to Plumbing Drain and Cleanout Schedule.

1
2
3 **PART 3 - EXECUTION**

4 **DRAIN AND VENT PIPING SYSTEM**

5 Connect all drain and vent piping to each fixture and piece of equipment and install all required piping as
6 shown on drawings. Provide all necessary fittings and hardware to make required offsets and transitions.

7 Changes in direction of drainage piping shall be made by the appropriate use of 45 degree wyes, long or
8 short sweep 1/4 bends, 1/6, 1/8, 1/16 bends or combination.

9
10 Fittings to be installed to make for the least possibility of stoppage. All horizontal drainage piping less than
11 3 inches shall be pitched a minimum of 1/4 inch per foot of run. Pitch drainage piping 3 inch and larger a
12 minimum of 1/8" per foot of run.

13
14 When running drain piping below a footing and parallel to it, piping shall be in all cases be at least one foot
15 greater in distance away from footing than below its bottom. Where possible, run sewers at centerpoint
16 between two parallel footings and maintain above-mentioned distances at a minimum. When running drain
17 piping under a footing, disturb as little of the soil under footing as possible. Provide concrete fill under all
18 footings where excavations wider than 18" are required.

19
20 When running drain piping through a footing, provide a steel pipe sleeve with 2" thick minimum
21 compressible wrap.

22
23 Connect to all drains, fixtures and equipment as required.

24
25 **PIPE JOINTS**

26 Install cast iron pipe and fittings, hubless pattern, as recommended by CISPI standards 301, 310, and in
27 their publication "Installation Suggestions for Cast Iron No-Hub Pipe and Fittings".

28
29 Prepare PVC pipe ends as recommended by manufacturer. Use a P-70 type primer (for PVC) and a PVC
30 solvent cement appropriate to the pipe size and temperature range.

31
32 Soldered joints shall be as described in Section 22 05 00.

33
34 **VENT FLASHING**

35 All vent pipes passing through roof shall be covered with sheet lead weighing not less than 4 pounds per
36 square foot. Sheet lead shall be well flashed onto the roof, 12" around pipe. Vent pipes shall extend a
37 minimum of 12" above roof.

38
39 **CLEANOUTS**

40 Provide and install cleanouts as shown on plans and as required by Code.

41
42 **TRAPS**

43 Trap all fixtures and equipment. Trap seals shall be standard depth, except when deep seals are required by
44 Code. Traps shall be set true and level and located within the limits of the Code requirements. A trap shall
45 not be used as a separator, interceptor or other type of device to retain solids. All traps above grade shall be
46 provided with approved screw-type cleanout plugs.

47
48 Traps shall be protected during construction and sealed to prevent foreign matter from entering. Provide
49 adjustable expansion plug, plastic cap, or approved equivalent.

1 **TESTING**

2 Refer to Testing paragraph of Section 22 05 00.

3

4 Hydro-statically pressure test all piping to 10 feet of water column pressure for 2 hours. No leaks allowed.

5 Provide mint test of entire system as required by local inspector.

6

7

8

END OF SECTION

1 Schedule from the contractor indicating the ASTM, or CISPI specification number of the pipe being
2 proposed along with its type and grade, and sufficient information to indicate the type and rating of fittings
3 for each service.

4
5 Include materials of construction, dimensional data, ratings/capacities/ranges, approvals, test data, and
6 identification as referenced in this section and/or on the drawings.

9 **PART 2 - PRODUCTS**

11 **UNDERGROUND PIPE AND FITTINGS**

12 Cast iron, no-hub, service weight, ASTM A888, CISPI 301, with rubber gasket couplings, ASTM C564,
13 and stainless steel clamp, CISPI 310. Pipe and fittings shall be marked with the collective trademark of the
14 Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Piping and fittings shall be
15 manufactured by AB&I, Charlotte, or Tyler.

16
17 Cast iron soil pipe, bell and spigot, service weight, coated, ASTM A74, with rubber gaskets, ASTM C564.
18 Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute or
19 receive prior approval of the engineer. Piping and fittings shall be manufactured by AB&I, Charlotte, or
20 Tyler.

21
22 PVC, Schedule 40, Type I, ASTM D-1785, and PVC drain-waste-vent fittings, ASTM D-2665, with
23 solvent weld joints, ASTM D2855. Solid wall PVC only.

25 **ABOVE GROUND PIPE AND FITTINGS**

26 Cast iron, no-hub, service weight, ASTM A888, CISPI 301, with rubber gasket couplings, ASTM C564,
27 and stainless steel clamp, CISPI 310. Pipe and fittings shall be marked with the collective trademark of the
28 Cast Iron Soil Pipe Institute or receive prior approval of the engineer. Piping and fittings shall be
29 manufactured by AB&I, Charlotte, or Tyler.

30
31 PVC, Schedule 40, Type I, ASTM D-1785, and PVC drain-waste-vent fittings, ASTM D-2665, with
32 solvent weld joints, ASTM D2855. Solid wall PVC only.

34 **DRAINS AND CLEANOUTS**

35 Drains and cleanouts manufactured by J.R. Smith, Josam, Wade, Watts, or Zurn.

36
37 Refer to Plumbing Drain and Cleanout Schedule.

40 **PART 3 - EXECUTION**

42 **DRAIN AND VENT PIPING SYSTEM**

43 Connect all drain and vent piping to each fixture and piece of equipment and install all required piping as
44 shown on drawings. Provide all necessary fittings and hardware to make required offsets and transitions.

45
46 Changes in direction of drainage piping shall be made by the appropriate use of 45 degree wyes, long or
47 short sweep 1/4 bends, 1/6, 1/8, 1/16 bends or combination.

48
49 Fittings to be installed to make for the least possibility of stoppage. All horizontal drainage piping less than
50 3 inches shall be pitched a minimum of 1/4 inch per foot of run. Pitch drainage piping 3 inch and larger a
51 minimum of 1/8" per foot of run.

1 When running drain piping below a footing and parallel to it, piping shall be in all cases be at least one foot
2 greater in distance away from footing than below its bottom. Where possible, run sewers at centerpoint
3 between two parallel footings and maintain above-mentioned distances at a minimum. When running drain
4 piping under a footing, disturb as little of the soil under footing as possible. Provide concrete fill under all
5 footings where excavations wider than 18" are required.

6
7 When running drain piping through a footing, provide a steel pipe sleeve with 2" thick minimum
8 compressible wrap.

9
10 Connect to all drains, fixtures and equipment as required.

11
12 **PIPE JOINTS**

13 Install cast iron pipe and fittings, hubless pattern, as recommended by CISPI standards 301, 310, and in
14 their publication "Installation Suggestions for Cast Iron No-Hub Pipe and Fittings".

15
16 Prepare PVC pipe ends as recommended by manufacturer. Use a P-70 type primer (for PVC) and a PVC
17 solvent cement appropriate to the pipe size and temperature range.

18
19 Soldered joints shall be as described in Section 22 05 00.

20
21 **CLEANOUTS**

22 Provide and install cleanouts as shown on plans and as required by Code.

23
24 **TRAPS**

25 Trap all fixtures and equipment. Trap seals shall be standard depth, except when deep seals are required by
26 Code. Traps shall be set true and level and located within the limits of the Code requirements. A trap shall
27 not be used as a separator, interceptor or other type of device to retain solids. All traps above grade shall be
28 provided with approved screw-type cleanout plugs.

29
30 Traps shall be protected during construction and sealed to prevent foreign matter from entering. Provide
31 adjustable expansion plug, plastic cap, or approved equivalent.

32
33 **TESTING**

34 Refer to Testing paragraph of Section 22 05 00.

35
36 Hydro-statically pressure test all piping to 10 feet of water column pressure for 2 hours. No leaks allowed.
37 Provide mint test of entire system as required by local inspector.

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END OF SECTION

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**SECTION 22 30 00
PLUMBING EQUIPMENT**

PART 1 - GENERAL

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 Work
- Description
- Quality Assurance
- Submittals
- Operation and Maintenance

PART 2 - PRODUCTS

- General
- Interior Grease Interceptors
- Water Softeners
- Water Heaters
- Hot Water Circulation Pumps

PART 3 - EXECUTION

- Installation
- Sumps and Pumps
- Interior Grease Interceptors
- Water Softeners
- Water Heaters and Circulating Pumps

RELATED WORK

Applicable provisions of Division 01 shall govern work under this section.

Section 22 05 00 – Common Work Results for Plumbing
Section 22 05 14 – Plumbing Specialties
Section 22 07 00 – Plumbing Insulation

Division 26 - Electrical

DESCRIPTION

Provide plumbing equipment as listed in this section and as scheduled on the drawings.

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 01 - General Conditions of the Contract, Article 7.

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.

SUBMITTALS

Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1 **OPERATION AND MAINTENANCE**

2 All operations and maintenance data shall comply with the submission and content requirements specified
3 under section GENERAL REQUIREMENTS.
4

5
6 **PART 2 - PRODUCTS**
7

8 **GENERAL**

9 Refer to Plumbing Equipment Schedule for specific model numbers and sizing information of the plumbing
10 equipment specified herein.
11

12 **INTERIOR GREASE INTERCEPTORS**

13 **Acceptable Manufacturers:**

14 Schier.
15

16 **Interceptor:**

17 High density polyethylene or acid resistant coated steel interceptor for in ground installation, with integral
18 flow control, removable screen and basket, 3" inlet/outlet connections, and bolted cover. Include 6"
19 extensions to bring top of interceptor up to finished floor level.
20

21 **WATER SOFTENERS**

22 Water softening systems, equipment, and components shall be manufactured by Bruner, Culligan,
23 Diamond, Hellenbrand, North Star, or Marlo.
24

25 **Mineral/Resin Tank:**

26 Fiberglass reinforced tank, cation exchange resin, automatic regeneration, meter actuated, internal bypass,
27 flow control backwash, 150 psi operation, N.S.F. approved, U.L. listed.
28

29 **Valve:**

30 Solid brass type, with hydraulically balanced piston valves, dual drive motors, backwash flow control,
31 automatic bypass and sample clock.
32

33 **Brine/Salt Storage Tank:**

34 Polyethylene tank construction, float system to limit brine, with salt platform and separate well for brine
35 valve. Include cover on tank assembly.
36

37 **Regeneration Control:**

38 Delayed regeneration system set to regenerate on off hours. 120 volt, A.C. with 3-prong plug and cord. Set
39 regeneration for early a.m. operation.
40

41 **WATER HEATERS**

42 **High Efficiency Stainless Steel Commercial Gas Fired Water Heater:**

43 Manufacturers:

44 Heat Transfer Products, National Combustion, Rheem, Voyager.
45

46 Type:

47 Gas fired sealed combustion condensing commercial water heater, minimum 94% thermal efficiency.
48 Design to be AGA certified with 3 year tank warranty and 1 year parts warranty.
49

50 Tank:

51 316L stainless steel tank rated for 150 psig complete with submerged combustion chamber, 90/10
52 cupronickel heat exchanger, foam insulation, plastic jacket, brass drain valve and temperature and pressure
53 relief valve.
54

55 Burner:

56 Side mounted power burner.

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Controls:

120 volt, 1 phase, 60 Hz self-diagnostic electronic controls, intermittent spark or hot surface ignition, operating thermostat with 70°-180°F adjustable temperature control, energy cutoff with manual reset, blower pressure switch, gas valve and pressure regulator.

Vent:

3" CPVC or ABS flue gas outlet and PVC, CPVC or ABS combustion air intake with DWV solvent weld fittings.

HOT WATER CIRCULATING PUMPS

Pump shall be manufactured by Armstrong, Bell & Gossett, Taco, or Thrush.

Pump shall be 120 volt, single phase, 3450 RPM, in-line bronze pump, with Noryl impeller. Refer to Plumbing Equipment Schedule on drawings for model number and capacity.

Time Control:

Time controls shall be manufactured by Paragon Electric Co. or equivalent. Provide a 120 VAC electronic programmable time controller for each circulating pump. Unit shall include seven day, 365 day per year programmable features and rechargeable battery backup; Paragon Electric Co. model number EC72.

Motor Starter:

Starters shall be manufactured by Allen-Bradley, Cutler-Hammer, G.E., or Square D. Provide a single phase manual motor starter switch for starting and controlling each pump, with internal overload protection, general purpose enclosure, neon pilot light and HAND-OFF-AUTO selector switch; Allen-Bradley Model 600-TAX142.

PART 3 - EXECUTION

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, commercial water softeners, storage tanks and booster pumps on concrete housekeeping pads. Adjust and level equipment.

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.

Cycle softeners and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

Lubricate pumps before startup. Adjust pumps for rated flow. Clean and blowdown strainers after 8 hours of operation.

INTERIOR GREASE INTERCEPTORS

Install in accordance with manufacturer's recommendations. Set level and plumb.

1 **WATER SOFTENERS**

2 Provide full size valved bypass and valved inlet/outlet piping. Pipe backwash to nearby hub drain.

3
4 Install softener per manufacturer's recommendation.

5
6 Provide 1000 lb. of pelletized salt for initial start-up and operation.

7
8 **WATER HEATERS AND CIRCULATING PUMPS**

9 Provide piping, unions, valves, thermometers, relief valves, and hardware.

10
11 Locate water heaters with controls, relief valves, and access holes accessible for service and replacement
12 without moving heaters. Install relief valve and extend relief piping individually and full size to the nearest
13 floor drain.

14
15 Install the domestic water heater(s) and circulator(s) in accordance with the Manufacturer's instructions and
16 recommendations.

17
18 Power wiring shall be provided by the EC.

19
20 Mount each domestic water heater and storage tank on a 3½" high concrete pad.

21
22 The manufacturer shall provide a written service warranty which shall provide factory service for a period
23 of one year following the acceptance of the installation. The one-year service warranty shall be submitted
24 at the time of the certified shop drawings submittal. The one-year service warranty by the manufacturer
25 shall provide free parts and labor to correct malfunctions of the boiler-burner unit during the warranty
26 period.

27
28 **Gas Fired Water Heaters:**

29 Provide the services of a local factory authorized representative for gas fired equipment startup. A letter of
30 compliance with factory recommendations and installation instructions shall be submitted with operation
31 and maintenance instructions.

32
33 The discharge of boiler relief or safety valves shall be piped individually and full size to the nearest floor
34 drain. Extend a condensate drain line from the boiler and also the boiler venting individually to the nearest
35 floor drain.

36
37 The vent connections on pressure regulating valves, shall be piped separately to the outside atmosphere and
38 terminated with an insect screened, weatherproof cap.

39
40 Venting:

41 Vent the gas fired units in accordance with the manufacturer's requirements. Vent piping and fittings shall
42 be provided by the boiler manufacturer in a single kit specific for this boiler and for this project. Install
43 venting to maintain appliance sealed combustion rating.

44
45
46 **END OF SECTION**

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

SCOPE

This section includes specifications for plumbing fixtures, faucets and trim for this project. Included are the following topics:

PART 1 – GENERAL

- Scope
- Related Work
- Description
- Reference Standards
- Quality Assurance
- Submittals

PART 2 – PRODUCTS

- General
- Manufacturers

PART 2 - EXECUTION

- Installation

RELATED WORK

Requirements of Division 01 shall govern work under this Section.

- Section 22 05 00 – Common Work Results for Plumbing
- Section 22 05 14 – Plumbing Specialties
- Section 22 05 29 – Hangers and Supports for Plumbing Piping and Equipment
- Section 22 11 00 – Facility Water Distribution
- Section 22 13 00 – Facility Sanitary Sewerage

DESCRIPTION

Furnish and install plumbing fixtures with traps, drains, stops, faucets, flush valves, carriers and hardware.

REFERENCE STANDARDS

ANSI A112.6.1M-88	Supports for Off-the Floor Plumbing Fixtures for Public Use.
ANSI A112.18.1-94	Finished and Rough Brass Plumbing Fixture Fittings.
ANSI A112.19.2M-82	Vitreous China Plumbing Fixtures.
ANSI A112.19.5-79(R1990)	Trim for Water Closet Bowls, Tanks and Urinals.
ARI-1010-94	Drinking Fountains and Self-Contained Mechanically Refrigerated Drinking Water Coolers.
ASSE 1011-93	Hose Connection Vacuum Breakers.

QUALITY ASSURANCE

Substitution of Materials: Refer to 22 05 00 and Division 01 of the Project Manual.

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.

SUBMITTALS

Submit product data sheets in accordance with Division 01 and Section 22 05 00.

1 Include data concerning sizes, utility sizes, rough in-dimensions, capacities, materials of construction,
2 ratings, weights, trim, finishes, manufacturer's installation requirements, manufacturer's performance
3 limitations, and appropriate identification.
4
5

6 **PART 2 - PRODUCTS**

7 **GENERAL**

8 Fixtures must conform to general requirements given below and to specified requirements for each type.

9 Vitreous china fixtures shall conform to ANSI A112.19.2M.

10 Stainless steel fixtures shall conform to ANSI A112.19.3.

11 Fixtures shall be installed so that parts are accessible for repairs when fixtures are in place. Manufacturer's
12 trademark or name shall be visible on fixtures.

13 Faucets, traps, exposed fittings and trim shall be polished chrome plated unless otherwise specified.
14 Provide polished chrome plated nipples at all lavatories.

15 Exposed piping penetrating walls, floors or ceilings shall have chrome plated escutcheons, or flanges of
16 sufficient depth to seal the opening.

17 Fixture stops shall be heavy duty commercial grade, slow compression angle valves with 1/2" inlet and 3/8"
18 or 1/2" chrome plated flexible riser.

19 Traps shall be semi-cast 17-gauge brass, chrome plated, with cleanout and escutcheon. Sink traps shall be
20 1-1/2" minimum.

21 **MANUFACTURERS**

22 Vitreous china and enameled cast iron fixtures shall be manufactured by American-Standard, Kohler,
23 Sloan, Toto, or Zurn. Fixture color shall be white unless specified otherwise.

24 Lavatory stations shall be manufactured by Bradley as specified on drawings.

25 Flush valves shall be manufactured by Sloan ("Royal" series) as specified on drawings.

26 Solid plastic toilet seats shall be manufactured by Bemis, Benneke, Centoco, Church, Olsonite, Kohler, or
27 Zurn. Seat color shall match fixture unless specified otherwise.

28 Carriers for wall-mounted fixtures shall be manufactured by J.R. Smith, Josam, MIFAB, Wade, Watts, or
29 Zurn.

30 Drinking fountains and electric water coolers shall be manufactured by Acorn Aqua, Elkay, Filtrine, Halsey
31 Taylor, Haws, Oasis, or Sunroc.

32 Cast terrazzo and molded stone products shall be manufactured by Crane/Fiat, Mustee, or Stern-Williams.

33 Stainless steel sinks shall be manufactured by Advance-Tabco, Elkay, or Just.

34 Manual faucets shall be manufactured by American Standard, Chicago Faucet, Kohler, Moen Commercial,
35 Speakman, Symmons, T&S Brass, Sloan (Polaris), or Zurn.

36 Heavy duty stops and supplies shall be manufactured by Chicago Faucet, Dearborn, EBC, Kohler,
37 McGuire, T&S Brass, or Zurn.

- 1 Lavatory drains shall be offset type, 1-1/4" size, with flat grid strainer, manufactured by Dearborn, EBC,
- 2 Keeney, Kohler, McGuire, or Zurn.
- 3
- 4 Traps shall be semi-cast 17 gauge brass, chrome plated, with cleanout and escutcheon as manufactured by
- 5 Dearborn, EBC, Keeney, Kohler, McGuire, or Zurn.
- 6
- 7 Supply, drain and trap insulating kits shall be manufactured by Brocar, EBC, McGuire, Plumberex, or
- 8 Truebro.
- 9
- 10 **Fixtures:**
- 11 See Plumbing Fixture Schedule on drawings for type, manufacturer, and model for fixtures.
- 12
- 13

14 **PART 3 - EXECUTION**

15 **INSTALLATION**

- 16 Install plumbing fixtures in accordance with manufacturer's instructions. Set level and plumb. Secure in
- 17 place to counters, floors and walls providing solid bearing and secure mounting. Bolt fixture carriers to
- 18 floor and wall. Secure rough-in fixture piping to prevent movement of exposed piping.
- 19
- 20
- 21 Install each fixture with trap easily removable for servicing and cleaning. Install fixture stops in readily
- 22 accessible location for servicing. Individual supplies to fixtures shall be provided with support to prevent
- 23 movement.
- 24
- 25 Install barrier free fixtures in compliance with COMM 52, 69 and Federal ADA Accessibility Guidelines.
- 26 Install barrier free lavatory traps parallel and adjacent to wall and supplies and stops elevated to avoid
- 27 contact by wheelchair users.
- 28
- 29 Seal joints between countertop, wall, floor and fixtures with G.E. Silicone caulk; white, clear or color to
- 30 match fixture with colored caulk by fixture manufacturer.
- 31
- 32 Each fixture shall have a stop valve installation to control the fixture. Stop valves shall be heavy duty type
- 33 with brass stems and screwed or sweat inlet connections. Compression type inlets are not acceptable.
- 34
- 35 Cover pipe penetrations with escutcheons. Exposed traps, stops, piping and escutcheons to be chrome
- 36 plated brass, same items in concealed locations may be of rough brass finish.
- 37
- 38 Set floor mounted water closets, floor mounted service sinks; counter mounted lavs and sinks; lav and sink
- 39 faucets and drains with full setting bed of flexible non-staining plumber's putty. Cover exposed water closet
- 40 bolts with bolt covers.
- 41
- 42 Set mop basins to floor and wall with grout or silicone sealant.
- 43
- 44 After installation, fixtures shall be protected to prevent scratching or other damage during construction.
- 45
- 46 Prior to acceptance, fixtures shall be cleaned with compounds recommended by the respective
- 47 manufacturer.
- 48
- 49

50 **END OF SECTION**

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1
2 **SECTION 23 05 00**
3 **COMMON WORK RESULTS FOR HVAC**
4

5
6 **PART 1 - GENERAL**
7

8 **SCOPE**

9 This section includes information common to two or more technical specification sections or items that are
10 of a general nature, not conveniently fitting into other technical sections. Included are the following topics:
11

12 **PART 1 - GENERAL**

13 Scope
14 Related Work
15 Reference
16 Reference Standards
17 Quality Assurance
18 Continuity of Existing Services
19 Protection of Finished Surfaces
20 Sleeves and Openings
21 Sealing
22 Equipment Furnished By Others
23 Provisions for Future
24 Submittals
25 Certificates and Inspections
26 Operating and Maintenance Data
27 Training of Owner Personnel
28 Record Drawings
29

30 **PART 2 - PRODUCTS**

31 Access Panels and Doors
32 Identification
33 Sealing and Fire Stopping
34

35 **PART 3 - EXECUTION**

36 Excavation and Backfill
37 Concrete Work
38 Cutting and Patching
39 Building Access
40 Equipment Access
41 Coordination
42 Identification
43 Lubrication
44 Sleeves and Openings
45 Sealing and Fire Stopping
46

47 **RELATED WORK**

48 Section 23 05 13 - Common Motor Requirements for HVAC.

49 Section 23 33 00 - Air Duct Accessories.
50

51 **REFERENCE**

52 Applicable provisions of Division 1 govern work under this section.
53

54 **REFERENCE STANDARDS**

55 Abbreviations of standards organizations referenced in other sections are as follows:
56

1	AABC	Associated Air Balance Council
2	ADC	Air Diffusion Council
3	AGA	American Gas Association
4	AMCA	Air Movement and Control Association
5	ANSI	American National Standards Institute
6	ARI	Air-Conditioning and Refrigeration Institute
7	ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
8	ASME	American Society of Mechanical Engineers
9	ASTM	American Society for Testing and Materials
10	AWS	American Welding Society
11	CGA	Compressed Gas Association
12	EPA	Environmental Protection Agency
13	GAMA	Gas Appliance Manufacturers Association
14	IEEE	Institute of Electrical and Electronics Engineers
15	ISA	Instrument Society of America
16	MCA	Mechanical Contractors Association
17	MICA	Midwest Insulation Contractors Association
18	MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
19	NBS	National Bureau of Standards
20	NEBB	National Environmental Balancing Bureau
21	NEC	National Electric Code
22	NEMA	National Electrical Manufacturers Association
23	NFPA	National Fire Protection Association
24	SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
25	UL	Underwriters Laboratories Inc.
26	ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
27	UL1479	Fire Tests of Through-Penetration Firestops
28	UL723	Surface Burning Characteristics of Building Materials

29

30 **QUALITY ASSURANCE**

31 Refer to Division 00 and 01.

32

33 Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings,
34 or engineering parameters from those indicated on the contract documents, the contractor is responsible for
35 all costs involved in integrating the equipment or accessories into the system and for obtaining the
36 performance from the system into which these items are placed. This may include changes found necessary
37 during the testing, adjusting, and balancing phase of the project.

38

39 **CONTINUITY OF EXISTING SERVICES**

40 Do not interrupt or change existing services without prior written approval from the owner.

41

42 **PROTECTION OF FINISHED SURFACES**

43 Refer to Division 1, General Requirements, Protection of Finished Surfaces.

44

45 Furnish one can of touch-up paint for each different color factory finish which is to be the final finished
46 surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the
47 General Requirements.

48

49 **SLEEVES AND OPENINGS**

50 Refer to Division 1, General Requirements, Sleeves and Openings.

51

52 **SEALING**

53 Sealing of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening
54 shall be the responsibility of the contractor whose work penetrates the opening.

55

56

1 **EQUIPMENT FURNISHED BY OTHERS**

2 None.

3

4 **PROVISIONS FOR FUTURE**

5 None.

6

7 **SUBMITTALS**

8 Refer to Division 00 and 01.

9

10 Submit for all equipment and systems as indicated in the respective specification sections, marking each
11 submittal with that specification section number. Mark general catalog sheets and drawings to indicate
12 specific items being submitted and proper identification of equipment by name and/or number, as indicated
13 in the contract documents.

14

15 Before submitting electrically powered equipment, verify that the electrical power and control requirements
16 for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a
17 statement on the shop drawing transmittal to the architect/engineer that the equipment submitted and the
18 motor starter schedules are in agreement or indicate any discrepancies. See related comments in Section
19 23 05 13 in Part 1 under Electrical Coordination.

20

21 Include wiring diagrams of electrically powered equipment.

22

23 **CERTIFICATES AND INSPECTIONS**

24 Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

25

26 Obtain and pay for all required State installation inspections except those provided by the
27 Architect/Engineer in accordance with code. Deliver originals of these certificates to the Owner or A/E.
28 Include copies of the certificates in the Operating and Maintenance Instructions.

29

30 **OPERATION AND MAINTENANCE DATA**

31 All operations and maintenance data shall comply with the submission and content requirements specified
32 under section GENERAL REQUIREMENTS.

33

34 In addition to the general content specified under GENERAL REQUIREMENTS supply the following
35 additional documentation:

36

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TRAINING OF OWNER PERSONNEL

Instruct user agency 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 than 10 hours of instruction (6 hours
at project completion and 4 additional hours 60 days after substantial completion), 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.

1 In addition to the data indicated in the General Requirements, maintain temperature control record
2 drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record
3 drawings with the Operating and Maintenance manuals.
4

5 6 **PART 2 - PRODUCTS** 7

8 9 **ACCESS PANELS AND DOORS**

10 16 gauge frame with not less than a 20 gauge hinged door panel, stainless steel, concealed hinges, key lock
11 operated, UL listed for use in fire rated partitions if required by the application. Use the largest size access
12 opening possible, consistent with the space and the equipment needing service; minimum size is 12" by
13 12".
14

15 **IDENTIFICATION**

16 **STENCILS:**

17 Not less than 1 inch high letters/numbers for marking pipe and equipment.
18

19 **SNAP-ON PIPE MARKERS:**

20 Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without
21 the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for
22 piping marking. W. H. Brady, Seton, Marking Services, or equal.
23

24 **ENGRAVED NAME PLATES:**

25 White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting,
26 Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by
27 Marking Services, or W. H. Brady.
28

29 **SEALING**

30 **Pipe Penetrations Through Below Grade Walls:**

31 In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking
32 synthetic rubber links shaped to continuously fill the annular space between the uninsulated pipe and the
33 cored opening or a water-stop type wall sleeve.
34

35 **Pipe Penetrations:**

36 At pipe penetrations of non-rated interior walls, floors and exterior walls above grade, use urethane caulk in
37 annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood walls where
38 sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.
39

40 **Duct Penetrations:**

41 Pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal
42 escutcheon around duct on both sides of partition or floor to cover annular space.
43
44

45 **PART 3 - EXECUTION** 46

47 **EXCAVATION AND BACKFILL**

48 Perform all excavation and backfill work to accomplish indicated mechanical systems installation in
49 accordance with Division 31 - Earthwork. Blasting will not be allowed without written permission of the
50 Architect/Engineer and the user agency.
51

52 Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there
53 is no disturbance of bearing soil.
54
55
56

1 **CONCRETE WORK**
2 All cast-in-place concrete for HVAC equipment pads will be provided by this contractor. Coordinate with
3 the General Contractor.
4
5 **CUTTING AND PATCHING**
6 Refer to Division 1, General Requirements, Cutting and Patching.
7
8 **BUILDING ACCESS**
9 Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the
10 building access was not previously arranged and must be provided by this contractor, restore any opening
11 to its original condition after the apparatus has been brought into the building.
12
13 **EQUIPMENT ACCESS**
14 Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance and
15 service. Coordinate the exact location of wall and ceiling access panels and doors with the General
16 Contractor, making sure that access is available for all equipment and specialties. Access doors in general
17 construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.
18
19 **COORDINATION**
20 Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not
21 limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units
22 installed in/on architectural surfaces.
23
24 Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated
25 and that interferes with other contractor's work shall be removed or relocated at the installing contractor's
26 expense.
27
28 Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify
29 system completion to the test and balance agency (clean filters, duct systems cleaned, controls adjusted and
30 calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work.
31
32 Install dampers temperature controls, etc., required for functional and balanced systems. Demonstrate the
33 starting, interlocking and control features of each system so the test and balance agency can perform its
34 work.
35
36 **IDENTIFICATION**
37 Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one
38 coat of black enamel against a light background or white enamel against a dark background. Use a primer
39 where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans
40 in occupied spaces.
41
42 Where stenciling is not appropriate for equipment identification, engraved name plates may be used.
43
44 Identify piping not less than once every 15 feet, not less than once in each room, adjacent to each access
45 door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs.
46 Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a
47 light background or white enamel against a dark background for stenciling, or provide snap-on pipe
48 markers as specified in Part 2 – Products.
49
50 **LUBRICATION**
51 Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is
52 operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the
53 manufacturer's instructions until the work is accepted by County. Maintain a log of all lubricants used and
54 frequency of lubrication; include this information in the Operating and Maintenance Manuals at the
55 completion of the project.
56

1 **SLEEVES AND OPENINGS**

2 Pipe penetrations in new poured concrete horizontal construction requiring F and T rating: Form opening
3 using hole form or core drill opening. Alternatively provide cast in place fire stopping devices/sleeves.
4

5 Pipe penetrations in new poured concrete horizontal construction requiring F rating but no T rating: Same
6 as pipe penetrations in new poured concrete construction requiring F and T ratings except that schedule 40
7 steel sleeves may also be used.
8

9 Pipe penetrations in new poured concrete horizontal construction that do not require F or T ratings:
10 Provide schedule 40 steel pipe sleeve, form opening using hole form or core drill opening.
11

12 Pipe penetrations in existing concrete floors: Core drill openings.
13

14 **DUCT SLEEVES:**

15 Duct sleeves are not required in non-rated partitions or floors.
16

17 **SEALING**

18 In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the
19 pipe and tighten in place, in accordance with manufacturer's instructions. Install so that the bolts used to
20 tighten the seal are accessible from the interior of the building or vault.
21

22 At all interior walls and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both
23 sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening
24 and the pipe or insulation is completely blocked.
25

26 Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or
27 mineral wool insulation fill.
28
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30 **END OF SECTION**

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SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

SCOPE

This sections includes requirements for single and three phase motors that are used with equipment specified in other sections. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operating and Maintenance Data
- Electrical Coordination
- Product Criteria

PART 2 - PRODUCTS

- Single Phase, Single Speed Motors

PART 3 - EXECUTION

- Installation

RELATED WORK

Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC
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 00 and 01.

SHOP DRAWINGS

Refer to Division 00 and 01

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.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

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

1 installed by the Electrical Contractor, except as specifically noted elsewhere in this division of
2 specifications.

3
4 Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by
5 this Contractor, together with their actuating devices if these devices are furnished by the Electrical
6 Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of
7 control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to
8 immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due
9 to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See
10 related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.

11 Electrical Contractor will provide all power wiring and control wiring, except temperature control wiring.

12
13
14 Furnish project specific wiring diagrams to Electrical Contractor for all equipment and devices furnished
15 by this Contractor and indicated to be wired by the Electrical Contractor.

16 **PRODUCT CRITERIA**

17 Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be
18 listed by U.L. for the service specified.

19
20
21 Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof,
22 explosion proof, standard duty, high torque or any other special type as required by the equipment or motor
23 manufacturer's recommendations.

24
25 Furnish motors for starting in accordance with utility requirements and compatible with starters as
26 specified.

27 28 29 **PART 2 - PRODUCTS**

30 31 **SINGLE PHASE, SINGLE SPEED MOTORS**

32 Use NEMA rated 115 volt, single phase, 60 hertz motors for all motors 1/3 HP and smaller.

33
34 Use permanent split capacitor or capacitor start, induction run motors equipped with permanently
35 lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

36 37 38 **PART 3 - EXECUTION**

39 40 **INSTALLATION**

41 Mount motors on a rigid base designed to accept a motor, using shims if required under each mounting foot
42 to get a secure installation.

43
44 When motor will be flexible coupled to the driven device, mount coupling to the shafts in accordance with
45 the coupling manufacturer's recommendations. Using a dial indicator, check angular misalignment of the
46 two shafts; adjust motor position as necessary so that the angular misalignment of the shafts does not
47 exceed 0.002 inches per inch diameter of the coupling hub. Again using the dial indicator, check the shaft
48 for run-out to assure concentricity of the shafts; adjust as necessary so that run-out does not exceed 0.002
49 inch.

50
51 When motor will be connected to the driven device by means of a belt drive, mount sheaves on the
52 appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check
53 alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave
54 faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added
55 and tighten the base so that the belt tension is in accordance with the drive manufacturer's

1 recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation
2 and again after 80 hours of operation.

3

4 Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use.
5 Include this information in the maintenance manuals.

6

7

8

9

END OF SECTION

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1 Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of
2 any truss or joist.

3
4 Support apparatus and material under all conditions of operation, variations in installed and operating
5 weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

6
7 Protect insulation at all hanger points; see Related Work above.

8 9 **SHOP DRAWINGS**

10 Applicable provisions of Division 00 and 01.

11
12 Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for
13 each pipe size and type of service. Reference section 23 05 00.

14 15 **DESIGN CRITERIA**

16 Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice
17 SP-58 unless noted otherwise.

18
19 Piping connected to rotating equipment is to have vibration isolation supports for a distance of one hundred
20 pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe
21 hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

22
23 Piping flexible connections and vibration isolation supports are required for piping connected to coils that
24 are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation
25 supports are required for a distance of one hundred pipe diameters or three supports away from the
26 equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not
27 required when the fan section is separately and independently isolated by means of vibration supports and
28 duct flexible connections. Standard pipe hangers/supports as specified in this section are required when
29 there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

30
31 Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

32
33 Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

34
35 Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine
36 maintenance, etc.

37 38 39 **PART 2 - PRODUCTS**

40 41 **PIPE HANGER AND SUPPORT MANUFACTURERS**

42 Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure
43 numbers are listed below; equivalent material by other manufacturers is acceptable.

44 45 **STRUCTURAL SUPPORTS**

46 Provide all supporting steel required for the installation of mechanical equipment and materials, whether or
47 not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support
48 tanks and equipment.

49 50 **PIPE HANGERS AND SUPPORTS**

51 **HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":**

52 Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

53 54 **MULTIPLE OR TRAPEZE HANGERS:**

55 Steel channels with welded spacers and hanger rods if calculations are submitted.

1 **WALL SUPPORT:**
 2 Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.
 3
 4 Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with
 5 interlocking, split type, bolt secured, galvanized pipe/tubing clamps. B-Line type S channel with B-2000
 6 series clamps, Anvil type AS200 H with AS 1200 clamps. When copper piping is being supported,
 7 provide flexible elastomeric/thermoplastic isolation cushion material to completely encircle the piping and
 8 avoid contact with the channel or clamp, equal to B-Line B1999 Vibra Cushion or provide manufacturers
 9 clamp and cushion assemblies, B-Line BVT series, Anvil cushion clamp assembly.

10
 11 **STEEL HANGER RODS:**
 12 Threaded both ends, threaded one end, or continuous threaded, black finish.

13
 14 Size rods for individual hangers and trapeze support as indicated in the following schedule.

15
 16 Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed
 17 the limits indicated.

18
 19

20	Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
21	610	3/8
22	1130	1/2
23	1810	5/8
24	2710	3/4

25

26 Provide rods complete with adjusting and lock nuts.

27
 28 **WOOD STRUCTURE SUPPORTS**

29 Carbon steel pipe short strap for piping 1/2" through 2". Fastened with two No. 24 x 2 (minimum size)
 30 wood screws. Anvil Figure 262.

31
 32 Carbon steel coach screw rods machine threaded on opposite ends, minimum 3/8" diameter . Anvil Figure
 33 142.

34
 35 Carbon steel side beam bracket with minimum 3/8" rod size and fastened with minimum 1/2" x 3" lag
 36 screws. Anvil Figure 207

37
 38 **BEAM CLAMPS**

39 MSS SP-58 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for
 40 single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with
 41 a hardened steel cup point set screw. Anvil figure 86.

42
 43 MSS SP-58 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable
 44 for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior
 45 approval. Anvil figure 228.

46
 47 **CONCRETE INSERTS**

48 Carbon steel expansion anchors, vibration resistant, with ASTM B633 zinc plating. Use drill bit of same
 49 manufacturer as anchor. Hilti, Rawl, Redhead.

50
 51 **ANCHORS**

52 Use welding steel shapes, plates, and bars to secure piping to the structure.

53
 54 **EQUIPMENT CURBS**

55 Constructed of wood blocking and anchored to the deck. The curb must be structurally capable of
 56 supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter

1 flashing. Do not use built-in metal base flashings or cants. Use 24 inch high equipment curbs where the
2 curb completely surrounds the perimeter of the equipment and there is no roof exposed to the weather.

3
4 **PIPE PENETRATIONS THROUGH ROOF**

5
6 **Multiple Pipe Penetrations:**

7 Refer to acceptable Equipment Curb types listed above for curb specifications. An 8" high (minimum)
8 curb height is required. The coping cap shall be constructed from laminated acrylic clad thermoplastic
9 (ABS) with graduated step boots to accommodate various size pipes, stainless steel fastening screws for
10 cover, stainless steel band clamps for securing boots around the pipe, and stainless steel band clamp or
11 mechanical locking seal for securing boots around the ABS coping cap flanges.

12
13 **Single Pipe Penetrations:**

14 A stack flashing penetration may be utilized for single pipe penetrations through built up roofs and single
15 ply membrane roofs. Utilize high temperature sealant for all high temperature applications. This includes
16 but is not limited to steam condensate vent piping, steam safety relief piping, and flues.

17
18 A single pre-manufactured boot may be utilized for single pipe penetrations through single ply membrane
19 roofs only.

20
21 **CORROSIVE ATMOSPHERE COATINGS**

22 Factory coat supports and anchors used in corrosive atmospheres with hot dip galvanizing after fabrication,
23 ASTM A123, 1.5 ounces/square foot of surface, each side. Mechanical galvanize threaded products,
24 ASTM B695 Class 150, 2.0 mil coating. Field cuts and damaged finishes to be field covered with zinc rich
25 paint of comparable thickness to factory coating.

26
27 Coat all supports and anchors.

28
29
30 **PART 3 - EXECUTION**

31
32 **INSTALLATION**

33 Install supports to provide for free expansion of the piping and duct system. Support all piping from the
34 structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling
35 plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

36
37 Piping shall be supported independently from ductwork and all other trades.

38
39 Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural
40 shapes for the supporting steel.

41
42 **HANGER AND SUPPORT SPACING**

43 Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

44
45 Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze
46 hangers.

47
48 Adjust hangers to obtain the slope specified in the piping section of this specification.

49
50 Space hangers for pipe as follows:

51

<u>Pipe Material</u>	<u>Pipe Size</u>	<u>Max. Spacing</u>
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"

55
56

1 **EQUIPMENT CURBS**
2 Secure bottom of support flat on roof deck. Secure equipment to curb in accordance with equipment
3 manufacturer's instructions. Flashing and counter flashing by the Division 07 Contractor.

4
5 Fill the entire void space with compressible fiberglass insulation.

6
7 **PIPE PENETRATION THROUGH ROOF**
8 Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to
9 the manufacturer's installation instructions. Flashing and counterflashing by the Division 07 Contractor.

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END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

SCOPE

This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Description
- Submittals

PART 2 - PRODUCTS

- Instrumentation

PART 3 - EXECUTION

- Preliminary Procedures
- Performing Testing, Adjusting and Balancing
- Deficiencies

RELATED WORK

- Section 23 05 00 Common Work Results for HVAC
- Section 23 07 00 HVAC Insulation
- Section 23 09 14 Pneumatic and Electric Instrumentation and Control Devices for HVAC
- Section 23 09 23 Direct Digital Control System for HVAC

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 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 distribution, adjustment of 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.

1 Test, adjust and balance all air systems so that each room, piece of equipment or terminal device meets the
2 design requirements indicated on the drawings and in the specifications.

3
4 Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If
5 problems are found, handle as specified in Part 3 under Deficiencies.

6 7 **QUALITY ASSURANCE**

8 9 **Qualifications**

10 An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3
11 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally
12 related to HVAC work other than that specifically related to installing Testing and Balancing components
13 necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

14
15 A certified member of AABC or certified by NEBB or TABB in the specific area of work performed.
16 Maintain certification for the entire duration of the project. If certification of firm or any staff performing
17 work is terminated or expires during the duration of the project, contact DFD immediately.

18
19 Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of
20 at least 50% in size, and of similar complexity. Size is defined as the quantity of each specific individual
21 item requiring testing and balancing such as, but not limited to, equipment, devices, terminal devices, and
22 grilles and diffusers.

23 24 **SUBMITTALS**

25 See also Related Work in this section.

26
27 Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB, AABC or
28 TABB Certified Test and Balance Supervisor. The reports certify that the systems have been tested,
29 adjusted and balanced in accordance with the referenced standards; are an accurate representation of how
30 the systems have been installed and are operating; and are an accurate record of all final quantities
31 measured to establish normal operating values of the systems.

32
33 Format: Cover page identifying project name, project number and descriptive title of contents. Divide the
34 contents of the report into the below listed divisions:

- 35 • General Information
- 36 • Summary
- 37 • Air Systems

38
39 Contents: Provide the following minimum information, forms and data:

40
41 General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect,
42 Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers.
43 Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

44
45 Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable
46 noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting
47 unsatisfactory performances and indicate whether modifications required are within the scope of the
48 contract, are design related or installation related. List instrumentation used during testing, adjusting and
49 balancing procedures.

50
51 The remainder of the report to contain the appropriate standard NEBB, AABC, or TABB forms for each
52 respective item and system. Fill out forms completely. Where information cannot be obtained or is not
53 applicable indicate same.

1
2
3 **PART 2 - PRODUCTS**

4 **INSTRUMENTATION**

5 Provide all required instrumentation to obtain proper measurements. Application of instruments and
6 accuracy of instruments and measurements to be in accordance with the requirements of NEBB, AABC, or
7 TABB Standards and instrument manufacturer's specifications.

8 All instruments used for measurements shall be accurate, and calibration histories for each instrument to be
9 available for examination upon request. Calibration and maintenance of all instruments to be in accordance
10 with the requirements of NEBB, AABC, or TABB Standards

11
12
13 **PART 3 - EXECUTION**

14
15 **PRELIMINARY PROCEDURES**

16
17 Review applicable construction bulletins, applicable change orders and approved shop drawings of
18 equipment, outlets/inlets and temperature controls.

19
20 Check filters for cleanliness, dampers for correct positioning, equipment for proper rotation and belt
21 tension and temperature controls for completion.

22
23 Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed
24 until systems are fully operational with all components necessary for complete testing, adjusting and
25 balancing. Installing Contractors are required to provide personnel to check and verify system completion,
26 readiness for balancing and assist Balancing Agency in providing specified system performance.

27
28 **PERFORMING TESTING, ADJUSTING AND BALANCING**

29 Perform testing, adjusting and balancing procedures on each system identified, in accordance with the
30 detailed procedures outlined in the referenced standards except as may be modified below.

31
32 Unless specifically instructed in writing, all work in this specification section is to be performed during the
33 normal workday.

34
35 In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is
36 complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is
37 such that access panels are required for the work of this section and the panels have not been provided,
38 inform the owner's project representative.

39
40 Cut insulation and ductwork for installation of test probes to the minimum extent necessary for adequate
41 performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier
42 integrity and pressure rating of systems.

43
44 In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway
45 between that of a clean filter and that of a dirty filter.

46
47 Measure and record system measurements at the fan to determine total flow. Adjust equipment as required
48 to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required
49 for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers,
50 deflectors, extractors and valves prior to adjustment of terminals.

51
52 Measure and record static air pressure conditions across fans and filters. Indicate in report if filter
53 measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead
54 of terminal units.

1 Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and
2 uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed
3 system.

4
5 Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive
6 changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is
7 inadequate for the application, advise the owner's project representative by giving the representative
8 properly sized motor/drive information (in accordance with manufacturers original service factor and
9 installed motor horsepower requirements); Confirm any change will keep the duct system within its design
10 limitations with respect to speed of the device and pressure classification of the distribution system.
11 Required motor/drive changes not specifically noted on drawings or in specifications will be considered an
12 extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior
13 authorization is needed before this work is started.

14
15 Final air system measurements to be within the following range of specified cfm:

16 Fans	0% to +10%
17 Supply grilles, registers, diffusers	0% to +10%
18 Return/exhaust grilles, registers	0% to -10%
19 Room pressurization air	-5% to +5%

20
21 Contact the temperature control Contractor for assistance in operation and adjustment of controls during
22 testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints.
23 Include in report description of temperature control operation and any deficiencies found.

24
25 Permanently mark equipment settings, including damper positions, control settings, and similar devices
26 allowing settings to be restored. Set and lock memory stops.

27
28 Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes,
29 and restoring temperature controls to normal operating settings.

30 **DEFICIENCIES**

31 Division 23 contractor to correct any installation deficiencies found by the test and balance agency that
32 were specified and/or shown on the Contract Documents to be performed as part of that division of work.
33 Test and balance agency will notify the County or A/E of these items. All corrective work to be done at no
34 cost to the Owner. Retest mechanical systems, equipment, and devices once corrective work is complete as
35 specified.
36

37
38
39 **END OF SECTION**
40
41

1	ASTM C355	Test Methods for Test for Water Vapor Transmission of Thick Materials
2	ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
3	ASTM C518	Heat Flux and Thermal Transmission Properties
4	ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
5	ASTM C547	Mineral Fiber Preformed Pipe Insulation
6	ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
7	ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
8	ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
9	ASTM C612	Mineral Fiber Block and Board Thermal Insulation
10	ASTM C921	Properties of Jacketing Materials for Thermal Insulation
11	ASTM C1136	Flexible Low Permeance Vapor Retarders for Thermal Insulation
12	ASTM C1728	Standard for Aerogel Insulation
13	ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
14	ASTM D1000	Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
15		
16	ASTM D1621	Standard Test Method for Compressive Properties Of Rigid Cellular Plastics
17	ASTM D1622	Standard Test Method for Apparent Density of Rigid Cellular Plastics
18	ASTM D1940	Method of Test for Porosity of Rigid Cellular Plastics
19	ASTM D2126	Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging
20	ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
21	ASTM E84	Surface Burning Characteristics of Building Materials
22	ASTM E814	Standard Test Method for Fire Tests of Penetration Firestop Systems
23	ASTM E2336	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems
24	MICA	National Commercial & Industrial Insulation Standards
25	NFPA 225	Surface Burning Characteristics of Building Materials
26	UL 723	Surface Burning Characteristics of Building Materials

27

28 **QUALITY ASSURANCE**

29 Refer to Division 00 and 01.

30

31 Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

32

33

34 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.

35

36 **DESCRIPTION**

37

38 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:

- 39 • Pipe Insulation
- 40 • Duct Insulation
- 41 • Equipment Insulation

42

43

44 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 County or A/E.

45

46 **DEFINITIONS**

47 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.

48

49 **SHOP DRAWINGS**

50 Refer to Division 00 and 01.

51

1 Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening
2 methods, fitting materials along with material safety data sheets and intended use of each material. Include
3 manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and
4 manufacturer's installation instructions.

5
6 **OPERATION AND MAINTENANCE DATA**

7 All operations and maintenance data shall comply with the submission and content requirements specified
8 under section GENERAL REQUIREMENTS.

9
10 **ENVIRONMENTAL REQUIREMENTS**

11 Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install
12 insulation products that have been exposed to water.

13
14 Protect installed insulation work with plastic sheeting to prevent water damage.

15
16
17 **PART 2 - PRODUCTS**

18
19 **MATERIALS**

20 Manufacturers: Armacell, CertainTeed, Manson, Childers, Dow, Extol, Fibrex, Halstead, Foster, Imcoa,
21 Johns Manville, Knauf, Owens-Corning, , Pittsburgh Corning, , VentureTape or approved equal.

22
23 Materials or accessories containing asbestos will not be accepted.

24
25 Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame
26 spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

27
28 Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a
29 smoke developed rating no higher than 450 when tested in accordance with UL 723 and ASTM E84.

30
31 **INSULATION TYPES**

32 Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation
33 shall be suitable to receive jackets, adhesives and coatings as indicated.

34
35 **FLEXIBLE FIBERGLASS INSULATION:**

36 Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.30 at 75
37 degrees F, rated for service to 250 degrees F.

38
39 **RIGID FIBERGLASS INSULATION:**

40 Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees
41 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
42 compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

43
44 **ELASTOMERIC INSULATION:**

45 Flexible closed cell, minimum nominal density of 5.5 lbs. per cu. ft., thermal conductivity of not more than
46 0.27 at 75 degrees F, minimum compressive strength of 4.5 psi at 25% deformation, maximum water vapor
47 permeability of 0.17 perm inch, maximum water absorption of 6% by weight, rated for service range of -20
48 degrees F to 220 degrees F on piping and 180 degrees F where adhered to equipment.

49
50 **ADHESIVES, MASTIC, SEALANTS, AND REINFORCING MATERIALS**

51 Products shall be compatible with surfaces and materials on which they are applied, and shall be suitable
52 for use at operating temperatures of systems to which they are applied.

53
54 **FIBERGLASS INSULATION ADHESIVE:**

55 Must comply with ASTM C916, Type II: Foster 85-60, Childers CP-127, Duro Dyne SSG.

1 LAGGING ADHESIVE / COATINGS:

2 For all indoor applications, coating must be anti-fungal and shall meet ASTM D 5590 with 0 growth rating
3 (AF): Foster 30-36 AF Seal Fas, Childers CP-137 AF Chil-Seal.

5 REINFORCING MESH:

6 Foster 42-24 Mast A Fab, Childers Chil Glas #10 or Pittsburgh Corning PC 79.

8 METAL JACKETING SEALANT FOR ALL ALUMINUM JACKETING:

9 Foster 95-44 Elastolar, Childers CP-76 Chil-Byl, Pittsburgh Corning 727.

11 INSULATION JOINT SEALANT: (cellular glass, polyisocyanurate, phenolic)

12 Used on all below ambient piping to prevent moisture ingress. Foster 95-50 Flextra, Childers CP-76 Chil-
13 Byl, Pittsburgh Corning CW Sealant.

15 **JACKETS**

16 PVC FITTING COVERS AND JACKETS (PFJ):

17 White PVC film, gloss finish one side, semi-gloss other side, FS LP-535D, Composition A, Type II, Grade
18 GU. Ultraviolet inhibited indoor/outdoor grade to be used where exposed to high humidity, ultraviolet
19 radiation, in kitchens or food processing areas or installed outdoors. Jacket thickness to be minimum .02”
20 indoors/.03”outdoors for piping 12” and smaller, .03” indoors/.04” outdoors for piping 15” and larger.

22 ALL SERVICE JACKETS (ASJ):

23 Heavy duty, fire retardant material with white kraft reinforced foil vapor retarding jacket, factory applied to
24 insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of .02 perms and
25 minimum beach puncture resistance of 50 units.

27 FOIL SCRIM ALL SERVICE JACKETS (FSJ):

28 Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms
29 and minimum beach puncture resistance of 25 units.

31 PROTECTIVE METAL JACKETS (PMJ):

32 0.016 inch thick aluminum or 0.010 inch thick stainless steel with safety edge for indoor installations and
33 0.024 inch thick aluminum or 0.016 inch thick stainless steel with safety edge for outdoor installations.

35 SELF-ADHERING JACKETS (SAJ):

36 5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density
37 polymer films and cold weather acrylic adhesive providing zero (0.0) permeance. Minimum 6 mils material
38 thickness, 25lb puncture resistance when tested in accordance with ASTM D1000 and flame spread/smoke
39 developed rating of 10/20 when tested in accordance with UL 723.

41 Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket
42 specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding
43 tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

45 FABRIC REINFORCED MASTIC JACKETS (FMJ):

46 Glass fiber reinforcing fabric imbedded in weather barrier mastic as per manufacturer’s recommended
47 procedure for 2 coat application.

49 VAPOR RETARDING JACKETS (VRJ):

50 Polyvinylidene chloride (PVDC) vapor retarding jacket material with minimum 6 mils material thickness
51 and maximum permeance of 0.01 perms. Material shall not support the growth of mold or mildew. Dow
52 Saran or equivalent.

54 Vapor retarding tape shall be specifically designed and manufactured for use with the vapor retarding
55 jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor
56 retarding tapes used with vapor retarding jackets shall have a maximum permeance of 0.01 perms.

1 **INSULATION INSERTS AND PIPE SHIELDS**

2 Manufacturers: B-Line, Pipe Shields, Value Engineered Products.

3
4 Construct inserts with calcium silicate or polyisocyanurate (service temperatures below 300 degrees F
5 only), minimum 140 psi compressive strength. Piping 12" and larger, supplement with high density 600 psi
6 structural calcium silicate insert. Provide galvanized steel shield. Insert and shield to be minimum 180
7 degree coverage on bottom supported piping and full 360 degree coverage on clamped piping. On roller
8 mounted piping and piping designed to slide on support, provide additional load distribution steel plate.

9
10 Where contractor proposes shop/site fabricated inserts and shields, submit schedule of materials,
11 thicknesses, gauges and lengths for each pipe size to demonstrate equivalency to pre-
12 engineered/premanufactured product described above. On low temperature systems, high density rigid
13 polyisocyanurate may be substituted for calcium silicate provided insert and shield length and shield gauge
14 are increased to compensate for lower insulation compressive strength.

15
16 Precompressed 20# density molded fiberglass blocks, Hamfab or equal, of the same thickness as adjacent
17 insulation may be substituted for calcium silicate inserts with one 1"x6" block for piping through 2-1/2"
18 and three 1"x6" blocks for piping through 4". Submit shield schedule to demonstrate equivalency to pre-
19 engineered/premanufactured product described above.

20
21 Wood blocks will not be accepted.

22
23 **ACCESSORIES**

24 All products shall be compatible with surfaces and materials on which they are applied, and be suitable for
25 use at operating temperatures of the systems to which they are applied.

26
27 Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for
28 applications specified.

29
30 Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be
31 0.015 inch for aluminum and 0.010 inch for stainless steel.

32
33 Tack fasteners to be stainless steel ring grooved shank tacks.

34
35 Staples to be clinch style.

36
37 Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

38
39 Finishing cement to be ASTM C449.

40
41 Fibrous glass or canvas fabric reinforcing used with lagging adhesive shall have a minimum untreated
42 weight of 6 oz./sq. yd.

43
44 Joint sealants and metal jacketing sealants to be non-shrinking and permanently flexible.

45
46 Vapor retarding coatings to have maximum applied water vapor permeance of 0.03 perms or less at 45 ,ils
47 dry as tested by ASTM E96.

48
49
50 **PART 3 - EXECUTION**

51
52 **EXAMINATION**

53 Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do
54 not insulate systems until testing and inspection procedures are completed.

55
56 Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

1 **INSTALLATION**

2 All materials shall be installed by skilled labor regularly engaged in this type of work. All materials shall be
3 installed in strict accordance with manufacturer's recommendations, building codes, and industry
4 standards. Do not install products when the ambient temperature or conditions are not consistent with the
5 manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

6
7 Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in
8 such a manner as to protect all raw edges, ends and surfaces of insulation.

9
10 Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be
11 accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other
12 locations where insulation terminates.

13
14 Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

15
16 Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or
17 pieces cut undersize and stretched to fit will not be accepted.

18
19 All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through
20 sleeves except where firestop or firesafing materials are required. Vapor retarding jacket shall be
21 maintained continuous through all penetrations.

22
23 Provide a continuous unbroken moisture vapor retarding jacket on insulation applied to systems noted
24 below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

25
26 Provide a complete vapor retarding jacket for insulation on the following systems:

- 27 • Refrigerant
- 28 • Insulated Duct
- 29 • Equipment, ductwork or piping with a surface temperature below 65 degrees F

30
31 **PROTECTIVE JACKET INSTALLATION**

32 **PVC FITTING COVERS AND JACKETS (PFJ):**

33 Lap seams and joints a minimum of 2 inches and continuously seal PVC with welding solvent
34 recommended by jacket manufacturer. Lap slip joint ends 4" without fasteners where required to absorb
35 expansion and contraction. For sections where vapor retarding jacket is not required and jacket requires
36 routine removal, tack fasteners may be used. Secure PVC fitting covers with tack fasteners. For systems
37 requiring a vapor retarding jacket, apply a 1-1/2" band of mastic over ends, throat, seams and penetrations.

38
39 **ALL SERVICE JACKETS (ASJ) and FOIL SCRIM ALL SERVICE JACKETS (FSJ):**

40 Install according to manufacturer's recommendations using factory supplied lap seals and butt strip seals.

41
42 **PROTECTIVE METAL JACKET (PMJ):**

43 Lap seams a minimum of 2 inches. Secure with metal bands for end to end joints, and rivets or sheet metal
44 screws for longitudinal joints. Rivets, screws, and bands to be constructed of the same material as the
45 jacket. Locate seams on bottom for exterior applications. Seal laps with 1/8" bead of metal jacketing
46 sealant to prevent water entry.

47
48 **SELF-ADHERING JACKETS (SAJ):**

49 Install according to manufacturer's recommendations. Cut allowing minimum 4" overlap on ends and 6" on
50 longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid
51 wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications,
52 provide a bead of compatible caulk along exposed edges.

53
54 Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2
55 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket

1 may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under
2 the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

3
4 **FABRIC REINFORCED MASTIC JACKETS (FMJ):**

5 Glass fiber fabric shall be fitted without wrinkles. Glass fiber fabric shall be sized immediately upon
6 application with lagging adhesive and shall be capable of drying within 6 hrs. Apply adhesive and coating
7 in accordance with manufacturer's recommendations. All seams shall overlap not less than 2".

8
9 **VAPOR RETARDING JACKETS (VRJ):**

10 Piping with vapor retarding jackets (VRJ) shall have elbows, fittings, valves and butt joints wrapped with 2
11 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the vapor retarding jackets
12 (VRJ) may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves
13 under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

14
15 **PIPING, VALVE, AND FITTING INSULATION**

16 **GENERAL:**

17 Install insulation with butt joints and longitudinal seams closed tightly. Provide minimum 2" lap on jacket
18 seams and 2" tape on butt joints, firmly cemented with lap adhesive unless otherwise noted. Additionally
19 secure with staples along seams and butt joints.

20
21 On systems requiring a vapor retarding jacket, seal off all raw ends of insulation and butt joints with vapor
22 retarding mastic at intervals of not more than 20 feet on piping. Coat staples, longitudinal and transverse
23 seams with vapor retarding mastic and on systems requiring vapor retarding jacket, coat insulated elbows,
24 fittings, and valves with vapor retarding mastic.

25
26 Install insulation continuous through pipe hangers and supports with hangers and supports on the exterior
27 of insulation. Where a vapor retarding jacket is not required or where roller hangers are not being used,
28 hangers and supports may be attached directly to piping with insulation completely covering hanger or
29 support and jacket sealed at support rod penetration. Where riser clamps are required to be attached directly
30 to piping requiring vapor retarding jacket, extend insulation and vapor retarding jacketing/coating around
31 riser clamp.

32
33 Where insulated piping is installed on hangers and supports, the insulation shall be installed continuous
34 through the hangers and supports. High density inserts shall be provided as required to prevent the weight
35 of the piping from crushing the insulation. Pipe shields are required at all support locations. The insulation
36 shall not be notched or cut to accommodate the supporting channels.

37
38 **INSULATION INSERTS AND PIPE SHIELDS:**

39 Provide pipe shields at all hanger and support locations. Rigid insulation inserts shall be installed between
40 the pipe and the insulation shields. Quantity and placement of inserts shall be according to the
41 manufacturer's installation instructions, however the inserts shall be no less than 12" in length. Inserts shall
42 be of equal thickness to the adjacent insulation and shall be vapor sealed as required for system.

43
44 Provide insulation inserts and pipe shields at all hanger and support locations. Inserts may be omitted on
45 3/4" and smaller copper piping provided 12" long 22 gauge pipe shields are used.

46
47 **FITTINGS AND VALVES:**

48 Fittings, valves, unions, flanges, couplings and specialties may be insulated with factory molded or built up
49 insulation of the same thickness as adjoining insulation. Where the ambient temperature exceeds 150
50 degrees F, cover insulation with fabric reinforcing and mastic. Where the ambient temperatures do not
51 exceed 150 degrees, furnish and install PVC fitting covers.

52
53 **ELASTOMERIC**

54 Where practical, slip insulation on piping during pipe installation when pipe ends are open. Miter cut
55 fittings allowing sufficient length to prevent stretching. Completely seal seams and joints for vapor tight
56 installation. For elastomeric insulation, apply full bed of adhesive to both surfaces. For polyolefin, seal

factory preglued seams with roller and field seams and joints with full bed of hot melt polyolefin glue to both surfaces. Cover elastomeric insulation on systems operating below 40 degrees F with vapor retarding mastic.

PIPING PROTECTIVE JACKETS

In addition to the jacket specified on the pipe insulation schedule, provide the following pipe jackets:

Provide a protective PVC jacket (PFJ) for the following insulated piping:

- All refrigeration piping located within the building.
- All condensate piping within building.

Provide a protective metal (PMJ) for the following insulated piping:

- Exterior installed refrigeration piping.

PIPE INSULATION SCHEDULE:

Provide insulation on piping as indicated in the following schedule:

SERVICE	INSULATION	JACKET	INSULATION THICKNESS BY PIPE SIZE				
			< 1"	1" to < 1-1/2"			
Refrigerant Piping	Elastomeric	None	1.5"	1.5"			
Cooling Coil Condensate Drain	Rigid Fiberglass	ASJ	0.5"	0.5"			

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.

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.

Where insulated low temperature (below 45°F) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor retarding barrier.

Where insulated duct risers are supported by steel channels secured directly to the duct, extend the insulation and vapor retarding jacketing to encapsulate the support channels.

1 **DUCTWORK PROTECTIVE COVERINGS:**

2 In addition to the jackets specified in the duct insulation schedule below the following protective coverings
3 are required:

4
5 Provide a protective covering of 2 coats of indoor/outdoor vapor retarding mastic with fibrous glass or
6 canvas fabric covering (FMJ) for the following ductwork:

- 7 • All ductwork in mechanical room connected to ERV-1.
8

9 **DUCT INSULATION SCHEDULE:**

10 Provide duct insulation on new and existing remodeled ductwork in the following schedule:
11

SERVICE	INSULATION TYPE	JACKET	THICKNESS
Outside air ducts (All duct upstream of Duct Furnace)	Rigid Fiberglass	FSJ	2"
Mixed air ducts	Rigid Fiberglass	FSJ	2"
Concealed supply ducts (Downstream of Duct Furnace and All Furnaces)	Flexible Fiberglass	FSJ	1-1/2"
Exhaust and relief ducts downstream of motorized backdraft dampers	Rigid Fiberglass	FSJ	2"
Exhaust ducts downstream of heat recovery units and desiccant dryers	Rigid Fiberglass	FSJ	2"
Louver blank-off panels	Rigid Fiberglass	FSJ	2"

12
13 **EQUIPMENT INSULATION**

14 **GENERAL:**

15 Do not insulate over equipment access manholes, fittings, nameplates or ASME stamps. Bevel and seal
16 insulation at these locations.

17
18 **EQUIPMENT INSULATION SCHEDULE**

19 Provide equipment insulation as follows:
20

EQUIPMENT	INSULATION TYPE	JACKET	THICKNESS
Duct Furnace	Flexible Fiberglass	FSJ	1-1/2"
Energy Recovery Unit Casings not factory insulated	Rigid Fiberglass	ASJ	2"

21
22
23 **END OF SECTION**

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SECTION 23 09 14
PNEUMATIC AND ELECTRIC INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 - GENERAL

SCOPE

This sections includes pneumatic control system specifications for all HVAC work as well as related pneumatic control for systems found in other specification sections. Included are the following topics:

PART 1 - GENERAL

- Scope
- Point List
- Related Work
- Reference
- Work Not Included
- Quality Assurance
- Reference Standards
- System Description
- Submittals
- Demolition
- Design Criteria
- Operation and Maintenance Data
- Material Delivery and Storage

PART 2 - PRODUCTS

- Control Dampers
- Thermostat Guards
- Electric/Electronic Thermostats
- Temperature Control Panels
- Temperature Sensors
- Current Status Switches
- Power Supplies

PART 3 - EXECUTION

- Installation
- Wire Conduit and Tubing Installation Schedule
- Control Dampers
- Room Thermostats and Temperature Sensors
- Low Limit Thermostats (Freezestats)
- Temperature Control Panels
- Current Status Switches

POINT LIST (Section 23 09 15)

RELATED WORK

- Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC - Coordination
- Section 23 09 23 - Direct Digital Control System for HVAC
- Section 23 09 93 - Sequence of Operation
- Section 23 33 00 - Ductwork Accessories - for control damper installation
- Division 23 - HVAC - Equipment provided to be controlled or monitored
- Division 26 - Electrical - Installation requirements & Equipment provided to be controlled or monitored
- Division 28 - Electronic Safety and Security

REFERENCE

Applicable provisions of Division 00 and 01 govern work under this section.

1 **QUALITY ASSURANCE**

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

11
12 **REFERENCE STANDARDS**

13 ANSI/ASTM B32 Specification for Solder Metal
14 ASTM D 635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of
15 Plastics in a Horizontal Position
16 UL 94 Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
17 AMCA 500-D Laboratory Method of Testing Dampers for Rating

18
19 **SYSTEM DESCRIPTION**

20 System is to use direct digital control with electric actuation.

21
22 **SUBMITTALS**

23 Include the following information:

24
25 Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and
26 materials of construction, installation instructions, and recommended maintenance. General catalog sheets
27 showing a series of the same device is not acceptable unless the specific model is clearly marked.

28
29 Schematic flow diagrams of systems showing fans, dampers, and other control devices. Each control
30 device provided under this Section shall be uniquely labeled. Duplicate labeling may be used within similar
31 mechanical systems. Label each device with setting or adjustable range of control. Indicate all wiring,
32 clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics
33 that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not
34 acceptable.

35
36 Details of construction, layout, and location of each temperature control panel within the building,
37 including instruments location in panel and labeling. Also include on drawings location of mechanical
38 equipment controlled (room number), horsepower and flow of motorized equipment (when this data is
39 available on plans), locations of all remote sensors and control devices (either by room number or column
40 lines).

41
42 Schedule of control dampers indicating size, leakage rating, arrangement, pressure drop at design airflow,
43 and number and size of operators required.

44
45 A complete description of each control sequence for equipment that is not controlled by direct digital
46 controls. Direct digital controlled equipment control sequences will be provided by the DDC control
47 contractor.

48
49 **DEMOLITION**

50 None.

51
52 **DESIGN CRITERIA**

53 Size all control apparatus to properly supply and/or operate and control the apparatus served.

54
55 Provide control devices subject to corrosive environments with corrosion protection or construct them so
56 they are suitable for use in such an environment.

1 Provide devices exposed to outside ambient conditions with weather protection or construct them so they
2 are suitable for outdoor installation.

3
4 Use only UL labeled products that comply with NEMA Standards. Electrical components and installation
5 to meet all requirements of the electrical sections (Division 26) of project specifications.

6
7 **OPERATION AND MAINTENANCE DATA**

8 All operations and maintenance data shall comply with the submission and content requirements specified
9 under section GENERAL REQUIREMENTS.

10
11 **MATERIAL DELIVERY AND STORAGE**

12 Provide factory shipping cartons for each piece of equipment and control device. This contractor is
13 responsible for storage of equipment and materials inside and protected from the weather.

14
15
16 **PART 2 - PRODUCTS**

17
18 **CONTROL DAMPERS**

19 Provide control dampers shown on the plans and as required to perform the specified functions. Dampers
20 shall be rated for velocities that will be encountered at maximum system design and rated for pressure
21 equal or greater than the ductwork pressure class as specified in Section 23 31 00 of the ductwork where
22 the damper is installed.

23
24 Use only factory fabricated dampers with mechanically captured replaceable resilient blade seals, stainless
25 steel jamb seals and with entire assembly suitable for the maximum temperature and air velocities
26 encountered in the system.

27
28 All dampers in aluminum ductwork shall be constructed of stainless steel or aluminum.

29
30 Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

31
32 All dampers, unless otherwise specified, to be rated at a minimum of 180° F working temperature. Leakage
33 testing shall be certified to be based on latest edition of AMCA Standard 500-D and all dampers, unless
34 otherwise specified, shall have leakage ratings as follows:

35

Damper Class	Differential Pressure	Leakage
Class IA	1" w.g.	≤3 CFM/ft ²
Class I	4" w.g.	≤8 CFM/ft ²

36
37
38

39 Leakage rate dampers for differential pressures that they will encounter at maximum system design
40 pressures.

41
42 Aluminum frame and blade dampers: Ruskin model CDTI-50 and TED50XT (see drawings for
43 applications). Others by Greenheck, Vent Products, Arrow model other approved equal.

44
45 Dampers used for isolation on the discharge of centrifugal fans shall have damper blades perpendicular to
46 the fan shaft to minimize system effect. Dampers mounted with blades vertically shall be designed for
47 vertical blade orientation.

48
49 Dampers to have frames of not less than 12 gauge extruded aluminum. Blades to be two-ply steel airfoil of
50 not less than 2 x 20 gauge galvanized steel (14 gauge equivalent) or extruded aluminum airfoil, with
51 stainless steel, acetal, Celcon, bronze, or nylon bearings. Maximum allowable blade width is 8 inches. Use
52 plated steel linkage hardware.

53
54 Maximum damper width is 48 inches; where required width exceeds 48 inches, use multiple damper
55 sections. Inside frame free area shall be a minimum of 90% of total inside duct area.

56

1 Multiple width damper sections shall utilize jack shaft linkages unless noted below. Sections over 144
2 inches wide shall be actuated from two locations on the jack shaft. Double width damper sections for two-
3 position operation may be actuated without jack shafts if each damper section is actuated separately.
4 Dampers that have multiple width and multiple vertical sections shall have a jackshaft for each vertically
5 stacked set of dampers and be provided with crossover linkages between jack shafts to transfer uneven
6 loading.

7
8 Jack shafts shall be extended outside of the ductwork for external actuator mounting. Provide bearings on
9 the point of exit for support of damper shafts to prevent wear on the shaft and the ductwork. If locating
10 actuators out of the air stream is impossible, obtain mounting location approval from the designer unless
11 the contract documents indicate in air stream mounting is acceptable. In no cases shall damper actuators
12 for fume exhaust systems be located in the air stream or require entering the air stream to service an
13 actuator.

14
15 Provide weatherproof NEMA 4 enclosures (Belimo N4 option or equal, Belimo ZS-100 or ZS-150 are not
16 acceptable) that have removable covers that have clasps or machine screws (no sheet metal screws) and that
17 do not require removing fasteners from the ductwork to prevent actuator failure or freeze-up when
18 mounting in locations exposed to harsh environments or outdoor locations.

19
20 Size operators for smooth and positive operation of devices served, and with sufficient torque capacity to
21 provide tight shutoff against system temperatures and pressure encountered. For pneumatic actuation, use
22 rolling diaphragm, piston type operators with adjustable stops. For electric modulating actuation, use fully
23 proportional actuators with zero and span adjustments. For two-position electric actuation use 24 VAC for
24 DDC controlled actuators, 120 VAC actuators may be used for hardwire interlocking. See 23 09 15 for
25 specific type of input signal required. Actuator stroke times shall match the requirements of the DDC
26 controllers provided under 23 09 24 and/or the specific system requirements for proper operation. All
27 electric actuators will be provided with overload protection to prevent motor from damage when stall
28 condition is encountered. Equip operators with spring return or stored energy fail-safe return for
29 applications involving fire, freeze protection, moisture protection or specified normally open/closed
30 operation. Face and bypass dampers for heating applications shall fail to the face position.

31
32 Provide independently mounted damper end switches (Kele TS-475, Ruskin SP-101/105, or equal) with
33 form "C" contacts where control sequences require damper position indication or interlock. Damper end
34 switches shall be independent of the damper actuators and be mounted directly to the damper shaft or
35 auxiliary shaft that is mounted to a drive blade of the damper. End switches shall not contain mercury.

36
37 All power required for electric actuation shall be provided by this contractor if it is not able to be directly
38 provided from the DDC controller.

39
40 Provide operators with linkages and brackets for mounting on device served.

41 42 **THERMOSTAT GUARDS**

43 Provide clear plastic locking covers keyed the same. For locations that are subject to physical abuse,
44 provide metal guard, Johnson Controls GRD10A-601, Shaw Perkins Series 16 or equal.

45 46 **ELECTRIC/ELECTRONIC THERMOSTATS**

47 **ELECTRIC THERMOSTATS:**

48 For single setpoint applications, provide line or low voltage electric type suitable for heating or heating and
49 cooling as required. Provide the required number of heating and/or cooling stages required for the
50 application. For line voltage ventilation applications utilizing fans and where otherwise specified in the
51 sequence of operations, provide an integral manual On/Off/Auto selector switch. Minimum contact rating
52 shall be equal or greater to electrical load of device being controlled.

53 54 **LOW VOLTAGE ELECTRONIC THERMOSTATS:**

55 Manufacturers: Honeywell, Johnson Controls, Viconics, or equal.

1 Where unoccupied setpoints are specified, provide electronic programmable type with seven day
2 setup/setback scheduling with a minimum of two occupied and unoccupied schedules per day through
3 keypad entry on front of unit. For heating and cooling applications, provide automatic heating/cooling
4 switchover. For applications that control fans, provide fan override switch. For ventilation or packaged
5 economizer applications provide a dry contact for ventilation damper or economizer initiation. For
6 thermostat control of economizer, provide a 0-10VDC modulated output for economizer damper control.
7 For applications that require integration to the building automation system, provide a BACnet
8 communication interface. If a communication interface is specified, occupancy scheduling in the
9 thermostat is not required.

10
11 **LOW LIMIT THERMOSTATS (freezestats):**

12 Electric two-position type with temperature sensing element and manual reset for all applications except
13 integral face and bypass steam heating coils which shall have auto-reset freezestats and latching relays (see
14 execution section for details). Unit to be capable of opening control circuit if any one-foot length of
15 sensing element is subject to a temperature below the setpoint. Length of sensing element to be not less
16 than one lineal foot per square foot of coil surface areas. Unless otherwise indicated, set low limit controls
17 at 36°F.

18
19 **AQUASTATS:**

20 Line voltage type with single pole, double throw switch of adequate rating for the applied load.

21
22 **TEMPERATURE CONTROL PANELS**

23 Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install
24 controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed
25 labels and provide asbuilt wiring/piping diagram within enclosure. Provide raceways for wiring and poly
26 within panel for neat appearance. Provide termination blocks for all wiring terminations. Label outside of
27 panel with panel number corresponding to plan tags and asbuilt control drawings as well as building
28 system(s) served.

29
30 Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the
31 devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the
32 under 50V devices and terminations within the control panel. As an alternative, a separate panel for only
33 the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.

34
35 For panels that have 120VAC power feeds provide a resettable circuit breaker. Provide label within the
36 panel indicating circuit number of 120VAC serving panel

37
38 **TEMPERATURE SENSORS**

39 Thermistor temperature sensor manufacturers: PreCon, BAPI, and ACI

40
41 Use thermistor or RTD type temperature sensing elements constructed so accuracy and life expectancy is
42 not affected by moisture, physical vibration, or other conditions that exist in each application.

43 RTD's shall be of nickel or platinum construction and have a base resistance of 1000Ω at 70°F and 32°F
44 respectively. 100Ω platinum RTD's are acceptable if used with temperature transmitters.

45
46 The temperature sensing device used must be compatible with the DDC controllers used on the project.

47
48 **RTD**

49 Accuracy (Room Sensor Only)	minimum \pm 1.0°F
50 Accuracy (Averaging)	minimum \pm 1.2°F
51 Accuracy (Other than Room Sensor or Averaging)	minimum \pm 0.65°F
52 Range	minimum -40 - 220°F

53
54 **Thermistor**

55 Accuracy (All)	minimum \pm 0.36°F
-------------------	----------------------

1	Range	minimum -30 - 230°F
2	Heat Dissipation Constant	minimum 2.7 mW/°C
3		
4	Temperature Transmitter	
5	Accuracy	minimum $\pm 0.1^\circ\text{F}$ or $\pm 0.2\%$ of span
6	Output	4-20 mA
7		

8 Provide limited range or extended range sensors if required to sense the range expected for a respective
9 point. Use RTD type sensors for extended ranges beyond -30 to 230°F. If RTD's are incompatible with
10 DDC controller direct temperature input use temperature transmitters in conjunction with RTD's.

11
12 Use wire size appropriate to limit temperature offset due to wire resistance to 1.0°F. If offset is greater than
13 1.0°F due to wire resistance, use temperature transmitter. If feature is available in DDC controller,
14 compensate for wire resistance in software input definition.

15
16 **CURRENT STATUS SWITCHES**

17 Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris
18 model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor
19 that will automatically compensate for frequency and amperage changes associated with variable frequency
20 drives. When used on variable speed motor applications, use a current sensor that will not change state due
21 to varying speeds.

22
23 **POWER SUPPLIES**

24 Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage
25 transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

26
27
28 **PART 3 - EXECUTION**

29
30 **INSTALLATION**

31 Install system with trained mechanics and electricians employed by the control equipment manufacturer or
32 an authorized representative of the manufacturer. Where installing contractor is an authorized
33 representative of the control manufacturer, such authorization shall have been in effect for a period of no
34 less than three years.

35
36 Install all control equipment, accessories, wiring, and piping in a neat and workmanlike manner. All control
37 devices must be installed in accessible locations. This contractor shall verify that all control devices
38 furnished under this Section are functional and operating the mechanical equipment as specified in Section
39 23 09 93.

40
41 Label all control devices with the exception of terminal unit devices with permanent printed labels that
42 correspond to control drawings. Labeling for each device shall be unique within each mechanical system.
43 Temperature control junction and pullboxes shall be identified utilizing spray painted green covers. Other
44 electrical system identification shall follow the 26 05 53 specification.

45
46 All control devices and electrical boxes mounted on insulated ductwork shall be mounted over the
47 insulation. Provide mounting stand-offs where necessary for adequate support. Cutting and removal of
48 insulation to mount devices directly on ductwork is not acceptable. This contractor shall coordinate with
49 the insulation contractor to provide for continuous insulation of ductwork.

50
51 Mounting of electrical or electronic devices shall be protected from weather if the building is not
52 completely enclosed. This Contractor shall be solely responsible for replacing any equipment that is
53 damaged by water that infiltrates the building if equipment is installed prior to the building being enclosed.

54
55 Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components.
56 Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical

1 Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter
2 referred to generically as conduit except above accessible ceilings as noted below. See Wire and Air
3 Piping Conduit Installation Schedule below for specific conduit or tubing to be used. All raceways,
4 enclosures, fittings and associated supports shall be provided and installed according to the requirements
5 set forth in Division 16, NFPA 90 (NEC) and Chapter SPS 316 of the Wisconsin Administrative Code. All
6 conduits shall be routed parallel and/or perpendicular to walls and adjacent piping. Raceways shall be
7 located to maintain headroom and working clearance around equipment and devices that require inspection
8 and service.

9
10 In general, support all raceways from the building structure. No component of a raceway system shall be
11 secured to corrugated metal roof deck. Do not impose on the installations of other trades. Securing
12 conduit, rods, straps, hangers, etc. to suspended ceiling components, electrical raceways, plumbing piping,
13 fire protection sprinkler piping, HVAC piping or ductwork, or their associated support systems, will not be
14 accepted.

15
16 Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

17
18 Where HVAC equipment control panels, or devices, do not provide for the direct connection of conduits,
19 exposed wiring may be extended to complete the final connections, providing it does not exceed 18 inches
20 in length.

21
22 Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage
23 wiring to be stranded.

24
25 Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in
26 mechanical rooms, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all
27 other locations shall be in conduit. Wire for wall sensors shall be run in conduit. Wiring for radiation
28 valves shall be run in conduit where routed through walls.

29
30 Where wiring is installed free-air, installation shall comply with the following:

- 31
- 32 • Wiring shall run at right angles and be kept clear of other trades work.
 - 33
 - 34 • Wiring shall be supported utilizing "J" or "Bridal-type" steel mounting rings anchored to ceiling
35 concrete, piping supports, walls above ceiling or structural steel beams. Mounting rings shall be of
36 open design (not a closed loop) to allow additional wire to be strung without being threaded through
37 the ring. For mounting rings that do not completely surround the wire, attach the wire to the mounting
38 ring with a strap.
 - 39
 - 40 • At HVAC terminal units only, where the wiring serves a specific device; e.g. controller, actuator,
41 transmitter, etc. associated with the unit, the j-hooks or Bridal rings required to support the wiring, may
42 be secured to the rods or straps that support the ductwork or piping that serves the unit. Wall
43 penetrations shall be sleeved.
 - 44
 - 45 • Supports shall be spaced at a maximum 4-foot interval unless limited by building construction. If
46 wiring "sag" at mid-span exceeds 6-inches; another support shall be used.
 - 47
 - 48 • Wall penetrations shall be sleeved and fire stopped as specified.
 - 49

50 Install "hand/off/auto" selector switches on systems where automatic interlock controls are specified and
51 "hand/off/auto" selector switches are not supplied with the equipment controlled. Control panel power will
52 not be required for "hand" switch to operate. When switch is in "hand" position, allow manual operation of
53 the selected device without operating the interlocked motors but allowing all unit safety devices to stay in
54 the circuit.

55

1 All wiring in control panels shall be terminated on a terminal strip. Wire nuts are not acceptable. A
2 maximum of two wires shall be terminated under any one terminal.

3
4 All electrical wiring are to be permanently tagged or labeled within one inch of terminal strip with a
5 numbering system to correspond with the "Record Drawings".

6
7 After completion of installation, test and adjust control equipment. Submit data showing set points and
8 final adjustments of controls.

9 10 **WIRE CONDUIT AND TUBING INSTALLATION SCHEDULE**

11 The following conduit schedule shall apply to both polyethylene tubing and wire in conduit where conduit
12 is specified for air tubing or wiring. Conduit and tubing referenced below shall meet specifications in
13 Section 26 05 33 and as defined below.

14
15 Conduit other than that specified below for specific applications shall not be used.

16
17 Underground Installations within Five Feet (1.5 m) of Foundation Wall: Rigid steel conduit.

18
19 Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Rigid steel conduit. Plastic-
20 coated rigid steel conduit. Schedule 40 PVC conduit.

21
22 Under Slab on Grade Installations: Schedule 40 PVC conduit.

23
24 Exposed Outdoor Locations: Rigid steel conduit.

25
26 Concealed in Concrete and Block Walls: Rigid steel conduit. Schedule 40 PVC conduit. Electrical
27 Nonmetallic Tubing (ENT).

28
29 Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing
30 (ENT).

31
32 Wet Interior Locations: Rigid steel conduit. [Schedule 40 PVC conduit][PVC coated rigid steel conduit].

33
34 Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic
35 tubing.

36
37 Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

38 39 **CONTROL DAMPERS**

40 All control dampers furnished by the control manufacturer are to be installed by the Mechanical Contractor
41 under the coordinating control and supervision of the Control Contractor in locations shown on plans or
42 where required to provide specified sequence of control.

43
44 Damper end switches, where required, shall be independently mounted to the damper drive shaft or
45 auxiliary shaft attached to a damper drive blade. End switches shall be adjusted to prove the damper the
46 position opposite the fail position of the damper actuator unless the control sequence requires a different
47 position to be proven to accomplish the specified control sequence.

48
49 Coordinate installation with the sheetmetal installer to obtain smooth duct transitions where damper size is
50 different than duct size. Blank off plates will not be accepted.

51
52 Each operator shall serve a maximum damper area of 36 square feet. Where larger dampers are used,
53 provide multiple operators.

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ROOM THERMOSTATS AND TEMPERATURE SENSORS

Check and verify location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation. Align with light switches. For drywall installations, thermostat mounting shall use a back-box attached to a wall stud, drywall anchors are not acceptable.

Any room thermostats or sensors mounted on an exterior wall shall be mounted on a thermally insulated sub-base. Subbase to provide a minimum of one half inch of insulation.

Where thermostats or sensors are mounted on exterior walls or in any location where air transfer will affect the measured temperature or humidity seal the conduit and any other opening that will effect the measurement.

Provide guards on thermostats and sensors in public areas.

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 sheetmetal 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.

CURRENT STATUS SWITCHES

Provide for each fan 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.

END OF SECTION

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SECTION 23 09 23
DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

SCOPE

Work in this section includes Direct Digital Control (DDC) panels, main communication trunk, software programming, and other equipment and accessories necessary to constitute a complete Direct Digital Control (DDC) system. This system interfaced with electric controls (Section 23 09 14) utilizing Direct Digital Control signals to operate actuated control devices will meet, in every respect, all operational and quality standards specified herein.

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Work Not Included
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Material Delivery and Storage

PART 2 - PRODUCTS

- General
- Local Control Panels
- Direct Digital Controls (DDC)
- Networking/Communications
- BACnet Requirements
- Supervisory Controllers
- System Software Features
- Programmable Controllers
- Application Specific Controllers - HVAC
- Operator Interface Requirements
- Operator Work Station & DDC Server
- Web Based HTML Browser Interface
- Portable Operator Terminal
- ASC Portable Service Terminal

PART 3 - EXECUTION

- General
- Installation
- Owner Training

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

- Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination
- 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 93 - Control Sequences

- Division 23 - HVAC - Equipment provided to be controlled or monitored
- Division 26 - Electrical - Equipment provided to be controlled or monitored

1 **REFERENCE**

2 Applicable provisions of Division 1 govern work under this section.

3
4 **REFERENCE STANDARDS**

5 FCC Part 15, Subpart J, Class A - Digital Electronic Equipment to Radio Communication Interference

6
7 **WORK NOT INCLUDED**

8 Section 23 09 14 work includes furnishing and installing all field devices, including electronic sensors for
9 the DDC of this section, equipment, and all related field wiring, interlocking control wiring between
10 equipment, pneumatic tubing, sensor mounting, etc., that is covered in that section.

11
12 Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control
13 valves and their actuators are also covered in Section 23 09 14.

14
15 **QUALITY ASSURANCE**

16
17 MANUFACTURERS:

18 Alerton, Andover, Distech or prior approved equal.

19
20 INSTALLER:

21 A firm specializing and experienced in DDC control system installation for no less than 3 years. All
22 engineering and commissioning work shall be done by qualified employees of this manufacturer, or
23 qualified employees of an Authorized Representative of that manufacturer that provides engineering and
24 commissioning of the manufacturer's control equipment. Where installing contractor is an authorized
25 representative of the control equipment manufacturer, submit written confirmation of such authorization.
26 Indicate in letter of authorization that the installing contractor has successfully completed all necessary
27 training required for the engineering, installation, and commissioning of equipment and systems to be
28 provided for the project and that such authorization has been in effect for a period of not less than three
29 years. The letter of authorization should also indicate that the installing contractor is authorized to install
30 the manufacturer's DDC equipment at the project location at the time the project is bid. Installation of the
31 equipment shall be done by qualified mechanics and/or electricians in the direct employ or be directly
32 subcontracted and under the supervision of the manufacturer or Authorized Representative. The contractor
33 providing and installing the equipment under this specification section shall be the same contractor
34 providing and installing equipment under the 23 09 14 specification section.

35
36 RESPONSE TIME:

37 During warrantee period, four (4) hours or less, 24-hours/day, 7 days/week.

38
39 ELECTRICAL STANDARDS:

40 Provide electrical products, which have been tested, listed and labeled by Underwriters' Laboratories (UL)
41 and comply with NEMA standards.

42
43 DDC Standards: DDC manufacturer shall provide written proof with shop drawings that the equipment
44 being provided is in compliance with F.C.C. rules governing the control of interference caused by Digital
45 Electronic Equipment to Radio Communications (Part 15, Subpart J, Class A).

46
47 **SUBMITTALS**

48 Include the following information:

49
50 Details of construction, layout, and location of each temperature control panel within the building,
51 including instruments location in panel and labeling. Indicate which piece of mechanical equipment is
52 associated with each controller and what area within the building is being served by that equipment. For
53 terminal unit control, provide a room schedule that would list mechanical equipment tag, room number of
54 space served, address of DDC controller, and any other pertinent information required for service.

1 PRODUCT DATA

2 Submit manufacturer's specifications for each control device furnished, including installation instructions
3 and startup instructions. General catalog sheets showing a series of the same device is not acceptable
4 unless the specific model is clearly marked. Annotated software program documentation shall be submitted
5 for system sequences, along with descriptive narratives of the sequence of operation of the entire system
6 involved. Submit wiring diagram for each electrical control device along with other details required to
7 demonstrate that the system has been coordinated and will function as a system.
8

9 MAINTENANCE DATA

10 Submit maintenance data and spare parts lists for each control device. Include this data in maintenance
11 manual.
12

13 RECORD DRAWINGS

14 Prior to request for final payment provide complete composite record drawings to incorporate the DDC and
15 Pneumatic/Electric field work. All software addressing for device communication shall be noted for all
16 devices provided under this section and the communication addressing required for devices provided by
17 others that are integrated into the direct digital control system provided under this section. Point to point
18 routing of communication trunks and power wiring between DDC controllers, DDC communication
19 devices, control panels, and Ethernet switches shall be documented. Coordinate with the supplier of the
20 equipment specified to be interfaced through digital communications for communication addressing.
21 Provide circuit number of 120VAC panel power circuit(s) feeding each control panel on record drawings.
22 Label circuit number(s) inside the panel served.
23

24 **OPERATION AND MAINTENANCE DATA**

25 All operations and maintenance data shall comply with the submission and content requirements specified
26 under section GENERAL REQUIREMENTS.
27

28 **MATERIAL DELIVERY AND STORAGE**

29 Provide factory shipping cartons for each piece of equipment and control device. This contractor is
30 responsible for storage of equipment and materials inside and protected from the weather.
31
32

33 **PART 2 - PRODUCTS**

34 **GENERAL**

35 Provide DDC control products in sizes and of capacities as required, conforming to manufacturer's standard
36 materials and components as published in their product information, designed and constructed as
37 recommended by the manufacturer and as required for application indicate.
38
39

40 System shall be capable of operating with 120 VAC power supply, fully protected with a shutdown-restart
41 circuit, and associated hardware and software.
42

43 **LOCAL CONTROL PANELS**

44 Use control panels with suitable mounting brackets for each supply fan system. Locate panel adjacent to
45 system served.
46

47 Fabricate panels of 14 gauge furniture grade steel or 6063-T5 extruded aluminum alloy, totally enclosed on
48 six sides, hinged door and keyed lock, with manufacturer's standard shop painted finish and color.
49

50 Provide UL listed cabinets for use with line voltage devices.
51

52 Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the
53 devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the
54 under 50V devices and terminations within the control panel. As an alternative, a separate panel for only
55 the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.
56

1 Plastic control enclosures will be approved provided all conduits are bonded and grounded.

2
3 Provide control panels for all DDC Controllers, ASC's and associated function modules. All controls to be
4 in control panels.

5
6 All wiring for controllers shall be managed in a neat and workmanlike manner.

7
8 Permanently label all controls; tag all control wiring, and document both on control drawings.

9 10 **DIRECT DIGITAL CONTROLS**

11 System to be capable of integrating multiple building functions, including equipment supervision and
12 control, alarm management, energy management, and trend data collection.

13
14 DDC to consist of Supervisory Controllers, Programmable Controllers, stand-alone Application Specific
15 Controllers (ASC's), Operator Terminals, Operator Workstations, DDC system servers, and other operator
16 interface devices.

17
18 The system shall be modular in nature, and shall permit expansion of both capacity and functionality
19 through the addition of sensors, actuators, ASC's, and operator devices.

20
21 The failure of any single component or network connection shall not interrupt the execution of control
22 strategies at other operational devices.

23 24 **NETWORKING/COMMUNICATIONS**

25 The design of the DDC shall be networked. The highest level networking shall use Ethernet and the sub-
26 level networking shall use serial communications. Inherent in the system's design shall be the ability to
27 expand or modify the highest network either via a local area network (LAN), wide area network (WAN), or
28 a combination of the two schemes.

29
30 The highest-level DDC communications network shall be capable of direct connection to and
31 communication with a high-speed LAN or WAN utilizing an Ethernet connection. Communication
32 protocol used shall be BACnet/IP.

33
34 The supervisory controller shall directly oversee a local network such that communications may be
35 executed directly to and between programmable controllers and ASC's. All operator devices, either
36 network resident or connected via dial-up modems, shall have the ability to access all points and
37 application reports on the network.

38
39 Provide serial communication ports on all ASC's for operator's terminal communications with the DDC
40 Controller.

41
42 Access to system data shall not be restricted by the hardware configuration of the DDC system.

43
44 Global data sharing or global point broadcasting shall allow point data to be shared between programmable
45 controllers and ASC's when it would be impractical to locate multiple sensors.

46
47 Network design shall include the following provisions:

- 48 • Data transfer rates for alarm reporting and quick point status from multiple programmable
49 controllers and ASC's. The minimum baud rate shall be 9600 baud.
- 50
51 • Support of any combination of programmable controllers and ASC's. A minimum of 32
52 programmable controllers and ASC's shall be supported on a single local network. The buss
53 shall be addressable for up to 32 ASC's.
- 54
55 • Detection of single or multiple failures of ASC's or the network media.

- 1 • Error detection, correction, and re-transmission to guarantee data integrity.
- 2
- 3 • Use commonly available, multiple-sourced, networking components.
- 4
- 5 • Use of an industry standard communication transport, such as, ARCNET, Ethernet, and IEEE
- 6 RS-485 communications interface.
- 7

8 Provide a temporary Ethernet network for communications between supervisory controllers and operator
9 workstation until the building IT network is available for use by the DDC system. The temporary Ethernet
10 network and all other communications required for the DDC system shall be installed as required for
11 specified operation of mechanical equipment so check out and commissioning of the equipment can occur
12 in a timely manner.

13
14 **BACNET REQUIREMENTS**

15 BACnet of highest level network communications will utilize BACnet/IP over Ethernet and field level
16 communications shall utilize BACnet MSTP. No other communication protocol is acceptable.

17
18 All controllers shall provide a Protocol Implementation Conformance Statement (PICS) and BACnet
19 Interoperability Building Blocks (BIBB'S) as required by the American National Standards
20 Institute/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ANSI/ASHRAE)
21 Standard 135-2001, BACnet protocol.

22
23 In general all devices shall support the following:

- 24 • Segmentation Capability
- 25 • Segmentation requests supported
- 26 • Segmentation responses supported

27
28 Standard Object Types Supported

- 29 • Analog input
- 30 • Analog output
- 31 • Analog value
- 32 • Binary input
- 33 • Binary output
- 34 • Binary value
- 35 • Calendar
- 36 • Device
- 37 • Event enrollment
- 38 • Group
- 39 • Multistate input
- 40 • Multistate output
- 41 • Multistate value
- 42 • Notification class
- 43 • Schedule

44
45 Character Sets supported

- 46 • ANSI X3.4
- 47 • ISO 10646 Universal Character Set-2

48
49 All highest level networked supervisory devices shall support the following:

50
51 Data Link Layer Option

- 52 • BACnet Internet Protocol (IP) (Annex J)

53
54 Networking Options: BACnet/IP Broadcast Management Device (BBDM)

BACnet object name and description shall match the naming conventions used by the Owner. Coordinate with Owner control personnel to establish the naming conventions prior to programming of any controllers provided under this specification section. All controllers shall have object names, descriptions, and engineering units that are writable at the controller level and shall be programmed so that the object names, descriptions, and engineering units match the desired naming standards as specified above. Ensure that the BACnet object attributes for object name, object description, engineering units and other required attributes will be transferred through to the Supervisory Controller when the auto-discovery function is executed.

The following table indicates the minimum VAV terminal unit objects, the associated naming, and the object values that are required to be writable that shall be provided for all VAV terminals. If the Owner does not have a convention for VAV terminal object names and descriptions that it prefers, use the naming standards as listed below. Provide similar naming and descriptions that are approved by the Owner for other types of terminal units and mechanical systems.

Object Type	Object Name	Object Description	Units
BV	DEVICE-S	DEVICE STATUS - SERVED BY AHU#	ONLINE/OFFLINE
MV	OCC-MODE	OCCUPIED MODE	OCC/UNOCC/STNDBY
BV	OCC-SCHED	OCCUPIED SCHEDULE Xam-Xpm	OCC/UNOCC
DI	OCC-S	OCCUPANCY SENSOR STATUS	OCC/UNOCC
AV	ZN-SP	ZONE TEMPERATURE SETPOINT	DEG F
AI	RM#-T	ROOM ##### TEMPERATURE	DEG F
AI	DA-T	DISCHARGE AIR TEMPERATURE	DEG F
AV	HTG-SP	HEATING TEMPERATURE SETPOINT	DEG F

SUPERVISORY CONTROLLERS

Supervisory controllers shall be microprocessor-based, multi-tasking, multi-user and digital control processors.

Each supervisory controller shall have sufficient memory to support its own operating system and databases including:

- Control processes
- Energy management application
- Alarm management
- Trend data
- Maintenance support applications
- Operator I/O
- Dial-up communications
- Manual override monitoring

The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.

Supervisory controllers shall provide at least two RS-232C or USB serial communication ports or Ethernet ports for simultaneous operation of multiple operator I/O devices, such as laptop computers, personal computers, and video display terminals.

Supervisory controllers shall monitor the status of all overrides and include this information in the logs and summaries to inform the operator that automatic control has been inhibited.

Each supervisory controller shall continuously perform self-diagnostics, communications diagnostics, and diagnostics of all subsidiary equipment. Supervisory controllers shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each supervisory controller.

1 Isolation shall provided at all network terminations, as well as all field point terminations, to suppress
2 induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently
3 high to allow all signal wiring to be run in the same conduit as high voltage wiring acceptable by electrical
4 code.

5
6 In the event of the loss of normal power, there shall be an orderly shutdown of the supervisory controller to
7 prevent the loss of data base or operating system software. Non-volatile memory shall be incorporated for
8 all critical controller configuration data, and battery backup shall be provided to support the real-time clock
9 and all volatile memory for a minimum of 72 hours.

10
11 Upon restoration of normal power, the supervisory controller shall automatically resume full operation
12 without manual intervention.

13
14 Should supervisory controller memory be lost for any reason, the supervisory controller shall have the
15 capability of reloading it's programming via high speed local area network from the control system archive
16 workstation or server, the local RS-232C port, or telephone line dial-in.

17
18 **SYSTEM SOFTWARE FEATURES**

19 All necessary software to form a complete operating system, as described in this specification, shall be
20 provided as an integral part of the supervisory controller, and shall not be dependent upon higher level
21 computer for execution.

22
23 Control software shall include a provision for limiting the number of times that each piece of equipment
24 may be cycled within any one-hour period.

25
26 The system shall provide protection against excessive demand situations during start-up periods by
27 automatically introducing time delays between successive start commands to heavy electrical loads.

28
29 Supervisory controllers shall have the ability to perform any or all of the following energy management
30 routines:

- 31
- 32 • Time of day scheduling
 - 33 • Calendar based scheduling
 - 34 • Holiday scheduling
 - 35 • Optimal start
 - 36 • Optimal stop
 - 37 • Demand limiting
 - 38 • Load rolling
 - 39 • Heating/cooling interlock

40 All programs to be executed automatically without the need for operator intervention, and be flexible
41 enough to allow user customization. Programs shall be applied to building equipment described in Section
42 23 09 93 of this specification.

43
44 Supervisory controllers shall be able to execute configured processes defined by the user to automatically
45 perform calculations and control routines.

46
47 It shall be possible to use any of the following in a configured process:

- 48
- 49 • Any system-measured point data or status
 - 50 • Any results from other processes
 - 51 • Boolean logic operators (and, or)

52 Configured processes may be triggered based on any combination of the following:

- 53
- 54 • Time of day
 - 55 • Calendar date
 - Events (e.g., point alarms)

1 A single process shall be able to incorporate measured or calculated data from any and all other ASC's.
2
3 A single process shall be able to issue commands to points in any and all other programmable controllers
4 and ASC's on the local network.
5
6 Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and
7 memory files. Each supervisory controller shall perform distributed; independent alarm analysis and
8 filtering to minimize network traffic and prevent alarms from being lost. At no time shall the ability of
9 supervisory controllers to report alarms be affected by either operator activity at the local I/O device or
10 communications with other ASC's on the network.
11
12 All alarm or point change reports shall include the English language description of each point and the time
13 and date of the occurrence.
14
15 The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to
16 minimize nuisance reporting and to speed operator response to critical alarms. A minimum of three priority
17 levels shall be provided. Users shall have the ability to manually inhibit alarm reporting for each point.
18
19 The user shall also be able to define conditions under which point changes need to be acknowledged by an
20 operator and/or logged for analysis at a later date.
21
22 Alarms reports and messages shall be directed to an operator device.
23
24 In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a
25 60-character alarm message to more fully describe the alarm condition or direct operator response.
26
27 Each supervisory controller shall be capable of storing a library of at least 100 messages. Each message
28 may be assignable to any number of points in the panel.
29
30 A data collection utility shall be provided to automatically sample, store, and display system data.
31
32 Measured and calculated analog and binary data shall be assignable to user definable trends for the purpose
33 of collecting operator specified performance data over extended periods of time. Sample intervals of 1
34 minute to 24 hours, in one minute or one hour intervals, shall be provided. Each supervisory controller
35 shall have a dedicated buffer for trend data and shall be capable of storing 16 trend logs. Each trend log
36 shall have up to four points trended at 48 data samples each. Data shall be stored at the supervisory
37 controller and up-loaded to the DDC system server when archiving is desired.
38
39 Supervisory controllers shall automatically accumulate and store runtime hours for binary input and output
40 points specified in Section 23 09 14 of this specification.
41
42 Supervisory controllers shall automatically sample, calculate and store consumption totals on a daily,
43 weekly, or monthly basis, user defined, for user-selected analog and binary pulse input type points.
44
45 Totalization shall provide calculation and storage accumulations of up to 9,999,999 units (e.g., KWH,
46 gallons KBTU, tons, etc.).
47
48 The totalization routine shall have a sampling resolution of one minute.
49
50 The user shall have the ability to define a warning limit. Unique, user specified messages shall be
51 generated when the limit is reached.
52
53 The information available from pulse totalization shall include, but not be limited to, the following:
54 • Peak demand, with date and time stamp
55 • 24-hour demand log
56 • Accumulated KWH for day

- 1 • Sunday through Saturday KWH usage
- 2 • Demand KW annual history for past 12 periods
- 3 • KWH annual history for past periods
- 4

5 Supervisory controllers shall have the ability to count events, such as the number of times a pump or fan
6 system is cycled on and off.

7
8 The event totalization feature shall be able to store the records associated with a minimum of 9,999,999
9 events before reset.

10
11 **PROGRAMMABLE CONTROLLERS**

12 Programmable controllers shall be provided with a software program that shall allow the user to design
13 flexible software algorithms for the control sequences as described in Sections 23 09 14 and 23 09 93
14 portions of this specification.

15
16 Programmable controllers shall support all necessary point inputs and outputs to perform the specified
17 control sequence in a totally stand-alone fashion.

18
19 Each programmable controller shall perform its own limit and status monitoring and analysis to maximize
20 network performance by reducing unnecessary communications.

21
22 Each programmable controller shall support the use of a locally mounted status and adjust panel interface
23 to allow for the local adjustment of all setpoints, temporary override of any input or output points and status
24 of all points directly at the controller. The capabilities of the locally mounted status and adjust panel shall
25 include, but not be limited to, the following information for the programmable controllers to which:

- 26 • Display temperatures
- 27 • Display status
- 28 • Display setpoints
- 29 • Display control parameters
- 30 • Override binary output control
- 31 • Override analog output control
- 32 • Override analog setpoints
- 33 • Modification of gain and offset constants
- 34

35 All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall
36 be stored such that a power failure of any duration does not necessitate reprogramming the programmable
37 controller.

38
39 Programmable controllers shall support, but not be limited to, the following configurations of systems to
40 address current requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification,
41 and for future expansion of air handling units:

- 42 • 100 percent outside air handling units
- 43

44 **APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS**

45 Each supervisory controller shall be able to extend its monitoring and control through the use of stand-
46 alone application specific controllers (ASC's).

47
48 Each ASC shall operate as a stand-alone controller capable of performing its specified control
49 responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor
50 based, multi-tasking, real-time digital control processor.

51 Each ASC shall have sufficient memory to support its own operating system and databases including:

- 52 • Control Processes
- 53 • Operator I/O (Portable Service Terminal)
- 54
- 55

1 The operator interface to any ASC point or program shall be through the supervisory controller connection
2 to any ASC on the network.

3
4 ASC's shall directly support the temporary use of a portable service terminal that can be connected to the
5 ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal
6 shall include, but not be limited to, the following information for the:

- 7 • Display temperatures
- 8 • Display status
- 9 • Display setpoints
- 10 • Display control parameters
- 11 • Override binary output control
- 12 • Override analog output control
- 13 • Override analog setpoints
- 14 • Modification of gain and offset constants

15
16 All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall
17 be stored such that a power failure of any duration does not necessitate reprogramming the ASC.

18
19 ASC's shall support, but not be limited to, the following configurations of systems to address current
20 requirements as described in Sections 23 09 14 and 23 09 93 portions of this specification, and for future
21 expansion of air handling units:

- 22 • Variable Air Volume Terminals
- 23 • Packaged Air Handling Units

24
25 Terminal unit space sensors shall be provided with digital displays with setpoint adjustments and manual
26 occupancy override and indication of occupancy status. Provide information to the AE on sensor colors
27 offered by the manufacturer and obtain approval on what color should be provided on the project. Provide
28 setpoint adjustment as specified in the DDC Input/Output Summary Table and sequence of operation
29

30 Provide a method to view and print a summary of current K-factors for flow correction for each VAV
31 terminal through the DDC system. The summary shall have a minimum of 50 K-factors per group of VAV
32 terminals.

33
34 All system setpoints, proportional bands, control algorithms, calibration constants, and any other
35 programmable parameters shall be stored such that a power failure of any duration does not necessitate
36 reprogramming the ASC.

37
38 All application specific controllers shall be fully programmable. Question and answer or template
39 programming is not acceptable unless this is used to generate the initial application program and the result
40 is able to be freely modified without restriction. Control sequences for terminal unit control that utilize
41 devices wired directly to the terminal unit application controller shall be programmed in the application
42 specific controller and shall be stand-alone in function, i.e. occupancy sensing, temperature setpoint
43 setback, etc. Supervisory controllers shall not be involved in the control sequence logic unless it involves
44 sharing data between or from individual terminal unit controllers to be utilized in a global sequence, i.e.
45 trim and respond strategies, terminal unit grouping, etc.

46 **OPERATOR INTERFACE REQUIREMENTS**

47 COMMAND ENTRY/MENU SELECTION PROCESS:

48
49 Operator interface software shall minimize operator training through the use of English language prompting
50 and English language point identification.
51
52
53
54
55

1 TEXT-BASED DISPLAYS:

2 The operator interface shall provide consistent text-based displays of all system point and application data
3 described in this specification. Point identification, engineering units, status indication, and application
4 naming conventions shall be the same at all operator devices.
5

6 GRAPHIC-BASED DISPLAYS:

7 The operator interface shall provide graphic based displays of each system. The point data associated with
8 each system shall dynamically update at a minimum of every 30 seconds. Graphic displays shall be linked
9 to each other to provide a “drill down” capability from main graphic displays to more specific system based
10 displays. Provide a building level graphic display that links to system graphics. For systems that have
11 ASC controlled terminal unit controls, provide a building floor plan with dynamic temperatures shown on
12 the graphic that can be drilled into for more specific terminal information. Points provided in the graphic
13 shall have the override and adjust capability specified under operator commands. The contractor providing
14 the DDC system under this Section shall provide all graphic displays for the project. Submit all graphic
15 displays to the Owner control personnel for review and approval. Graphics shall be completed to provide
16 enough time for approval and time for binding to be in place before control system commissioning is
17 scheduled to occur.
18

19 PASSWORD PROTECTION:

20 Multiple-level password access protection shall be provided to allow the user/manager to limit control,
21 display, and data base manipulation capabilities as he deems appropriate for each user, based upon an
22 assigned password.
23

24 Passwords shall be exactly the same for all operator devices.
25

26 A minimum of three levels of access shall be supported:

- 27 • Level 1: Data access and display
- 28 • Level 2 = Level 1 + operator overrides and commands
- 29 • Level 3 = Level 2 + database generation and modification
30

31 A minimum of 4 passwords shall be supported at each supervisory controller.
32

33 Operators will be able to perform only those commands available for their respective passwords. Menu
34 selections displayed at any operator device shall be limited to only those items defined for the access level
35 of the password used to log-on.
36

37 Provide user definable, automatic log-off timers of from 1 to 60 minutes to prevent operators from
38 inadvertently leaving devices on-line.
39

40 OPERATOR COMMANDS:

41 The operator interface shall allow the operator to perform commands including, but not limited to, the
42 following:

- 43 • Start-up or shutdown selected equipment
- 44 • Adjust setpoints
- 45 • Override analog and binary outputs
- 46 • Add/modify/delete time programming
- 47 • Enable/disable process execution
- 48 • Lock/unlock alarm reporting for each point
- 49 • Enable/disable totalization for each point
- 50 • Enable/disable trending
- 51 • Enter temporary override schedules
- 52 • Define holiday schedules
- 53 • Change time/date
- 54 • Enter/modify analog alarm limits
- 55 • Enable/disable analog alarm limits

- Enable/disable demand limiting
- Enable/disable duty cycle

LOGS AND SUMMARIES:

Reports shall be generated manually, and directed to the displays. As a minimum, the system shall allow the user to easily obtain the following general listing of all points in the system that shall include, but not be limited to:

- Points currently in alarm
- Off-line points
- Points currently in override status
- Points in weekly schedules
- Holiday programming

Summaries shall be provided for specific points, for a logical point group, for a user-selected group of groups, or for the entire facility without restriction due to the hardware configuration on the facility management system. Under no conditions shall the operator need to specify the address of hardware controller to obtain system information.

SYSTEM CONFIGURATION AND DEFINITION:

All temperature and equipment control strategies and energy management routines shall be definable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.

The system shall be provided complete with all equipment, software, and documentation necessary to allow an operator to independently perform the following functions:

- Add/delete/modify application specific controllers
- Add/delete/modify points of any type, and all associated point parameters, and tuning constants
- Add/delete/modify alarm reporting definition for each point
- Add/delete/modify energy management applications
- Add/delete/modify time and calendar-based programming
- Add/delete/modify totalization for every point
- Add/delete/modify historical data trending for every point
- Add/delete/modify configured control processes
- Add/delete/modify dial-up telecommunication definition
- Add/delete/modify all operator passwords
- Add/delete/modify alarm messages

PROGRAMMING DESCRIPTION:

Definition of operator device characteristics, ASC's, individual points, and shall be performed through fill-in-the-blank templates.

NETWORK-WIDE STRATEGY DEVELOPMENT:

Inputs and outputs for any process shall not be restricted to a single ASC, but shall be able to include data from any and all other ASC's to allow the development of network-wide control strategies.

SYSTEM DEFINITION/CONTROL SEQUENCE DOCUMENTATION:

All portions of system definition shall be self-documenting and be capable of providing hardcopy printouts of all configuration and application data.

DATA BASE SAVE/RESTORE/BACK-UP:

Backup copies of all programmable controller, ASC and supervisory controller databases shall be stored in at least one personal computer or laptop. Users shall have the ability to manually execute upload and downloading of a programmable controller, ASC and supervisory controller database.

1 **WEB BASED HTML BROWSER INTERFACE**

2 Provide a HTML based browser interface (Web Server) for accessing the DDC system. This shall include
3 all hardware and software to provide an Ethernet twisted pair connection to the owners local or wide area
4 network (LAN or WAN) that can be used to access the DDC system through a standard internet browser.

5
6 All information shall be provided to the owners IT staff to facilitate connection through the owners
7 LAN/WAN.

8
9 At a minimum, this interface shall be capable of all functions described under the Operator Interface
10 section, Password Protection, Operator Commands, and Logs and Summary subsections of this
11 specification.

12
13
14 **PART 3 - EXECUTION**

15
16 **GENERAL**

17 All electronic work required as an integral part of the Direct Digital Control system work is the
18 responsibility of this section unless specifically indicated otherwise in this section, Section 23 09 14, or in
19 Division 26.

20
21 This contractor shall provide all labor, materials, engineering, software, permits, tools, checkout and
22 certificates required to install a complete Direct Digital Control system as herein specified.

23
24 Any and all points added with this project shall be grouped for display purposes into the system such that
25 all points associated with a new or existing DDC system can appear together on the flat panel display or
26 printed log. Assignment of points to a group shall not be restricted by hardware configuration of the points
27 of direct digital control. It shall be possible to assign a point to appear in more than one system. An
28 English descriptor and an alpha/numeric identifier shall identify each system.

29
30 This Direct Digital Control system as herein specified shall be fully integrated and completely installed by
31 this section. It shall include all required computer CPU software and hardware. Include the engineering,
32 installation, supervision, calibration, software programming, and checkout necessary for a fully operational
33 system.

34
35 **INSTALLATION**

36 All work and materials are to conform in every detail to the rules and requirements of the National
37 Electrical Code and present manufacturing standards. All wiring and cable installation shall conform with
38 the wiring installation as specified in the installation section of Section 23 09 14. All material shall be UL
39 approved.

40
41 Install system and materials in accordance with manufacturer's instructions, rough-in drawings and details
42 on drawings.

43 Line voltage wiring to power the DDC Controllers, not provided by the Division 26 contractor, to be by
44 this contractor.

45
46 Control panels serving equipment fed by emergency power shall also be served by emergency power.

47
48 Provide uninterruptable power supplies where necessary to provide proper startup of equipment or to
49 accomplish power restart control sequences specified.

50
51 Mount control panels adjacent to associated equipment on vibration-free walls or free-standing angle iron
52 supports. One cabinet may accommodate more than one system in same equipment room. Provide
53 engraved plastic nameplates for instruments and controls inside cabinet and on cabinet face.

54
55 Provide as-built control drawings of all systems served by each local panel in a location adjacent to or
56 inside of panel cover. Provide a protective cover or envelope for drawings.

- 1 Cable tray routing of the communication trunks is acceptable.
2
3 Provide all necessary routers and or repeaters to accomplish connection to the BAN via the panel-mounted
4 port provided.
5
6 Provide two data jacks in control panels housing supervisory controllers and allocate 6"x6" for each data
7 jack in the panel. The first jack will be used for connecting the supervisory controller to the BAN. The
8 second jack will be used as a spare for connecting to the BAN by service personnel.
9
10 Provide an input for a service shutdown toggle switch for each air handling unit system provided inside the
11 temperature control panel that will initiate a logical shutdown of the air handling unit system.
12
13 All tubing, cable and individual wiring is to be permanently tagged, with numbers corresponding with
14 "Record Drawings", spares are to be labelled as "Spare".
15
16 Provide technician to work with air balancing contractor and/or provide balancing contractor with
17 necessary hardware to over-ride DDC controllers for air balancing.
18
19 Provide documentation to demonstrate that all points, input and output, have been checked out and verified
20 operational, note any points not operating properly with notation of reason.
21

22 **OWNER TRAINING**

- 23 Contractor to provide factory authorized representative and/or field personnel knowledgeable with the
24 operations, maintenance and troubleshooting of the system and/or components defined within this section
25 for a minimum period of 8 hours.
26
27 Provide two follow-up visits for troubleshooting and instruction, one six months after substantial
28 completion and the other at the end of the warranty period. Length of each visit to be not less than 2 hours
29 or the time necessary to provide required information and complete troubleshooting and inspection activity
30 for all controls installed under 23 09 23, 23 09 14, and 23 09 93. Coordinate the visit with the Owner and
31 provide an inspection report to the Owner of any deficiencies found.
32
33

34 END OF SECTION
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SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS

PART 1 - GENERAL

SCOPE

This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Description of Work
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

- ERV-1 / EF-1 / DF-1
- F-1 (F-2 Similar)
- ECUH-1 (ECUH-2 Similar)
- GUH-1 (GUH-2 Similar)
- EF-2
- TF-1

RELATED WORK

Applicable provisions of Division 00 and 01 govern work under this Section.

Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination

Section 23 09 14 - Pneumatic and Electric Controls

Section 23 09 23 - Direct Digital Controls (DDC)

Division 23 - HVAC - Equipment provided to be controlled or monitored

Division 26 - Electrical - Equipment provided to be controlled or monitored

Division 28 - Electronic Safety and Security

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 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, humidity, 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

1 signals shall be extended under Section 23 09 14, with adequate lead length for termination within the
2 appropriate control panel being provided under Section [23 09 24 or 23 09 23].
3

4 Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by
5 hardware and software provided under Section [23 09 24 or 23 09 23]. Sequences for equipment controlled
6 by pneumatic or electric self-contained controls are accomplished by hardware provided under Section 23
7 09 14.
8

9 **SUBMITTALS**

10 Refer to Division 1, General Conditions, Submittals, Section 23 05 00 and Sections 23 09 23, and 23 09 14
11 for descriptions of what should be included in the submittals.
12

13 Shop drawings shall be provided by contractor(s) providing equipment under Sections 23 09 23 and 23 09
14 14. The contractor providing the DDC equipment shall provide a complete narrative of the sequence of
15 operations for equipment that is controlled through the DDC system. The contractor providing the 23 09
16 14 equipment shall provide a complete narrative of the sequence of operation for equipment that is
17 controlled directly from that equipment (without control logic through the DDC system). The narrative of
18 the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect
19 the actual operation as applied by the contractor.
20

21 **OPERATION AND MAINTENANCE DATA**

22 All operations and maintenance data shall comply with the submission and content requirements specified
23 under section GENERAL REQUIREMENTS.
24

25 **DESIGN CRITERIA**

26 Reference Section 23 09 14.
27

28 **PART 2 - PRODUCTS**

29
30 Not applicable to this Section – reference Sections 23 09 23 and 23 09 14 for product descriptions.
31

32 **PART 3 - EXECUTION**

33 **CONTROL SEQUENCES**

34 **ERV-1 / EF-1 / DF-1**

35 This system will be controlled by the DDC system.
36
37

38 This system includes:
39

- 40 • Energy Recovery Unit with integral supply and return fans and VFD's (VFD's used for balancing
41 only).
 - 42 ○ Motorized exhaust air damper (D-7) (exhaust from ERV to louver).
 - 43 ○ Motorized exhaust air damper (D-8) (exhaust into ERV).
 - 44 ○ Motorized outside air intake damper (D-10) (outside air to ERV).
 - 45 • Roof mounted exhaust fan (EF-1) with motorized control damper (D-9).
 - 46 • Gas fired duct furnace (DF-1).
 - 47 • Space temperature sensors in the following rooms:
 - 48 ○ 100 – Concessions
 - 49 ○ 200 – Women's Toilet
 - 50 ○ 400 – Family
 - 51 ○ 500 – Men's Toilet
- 52

53 EF-1 shall only operate when the building is in the occupied mode, the outside air temperature is above 50F
54 (adjustable), ERV-1 is "off" and when the natural ventilation louvers are manually opened.
55

1 ERV-1 and DF-1 shall only operate when the building is in the occupied mode, the outside air temperature
2 is below 50F (adjustable), EF-1 is “off” and when the natural ventilation louvers are manually closed.

3
4 Provide building “occupied” and unoccupied times.

5
6 Ambient temperature above 50F (adjustable) and building occupied:

- 7 • Damper D-7 shall be closed.
- 8 • Damper D-10 shall be closed.
- 9 • Damper D-8 shall be closed.
- 10 • Damper D-9 shall be open and EF-1 shall be energized.
- 11 • Duct furnace shall be off.

12
13 Ambient temperature above 50F (adjustable) and building occupied:

- 14 • Damper D-7 shall be open.
- 15 • Damper D-10 shall be open.
- 16 • Damper D-8 shall be open.
- 17 • Damper D-9 shall be closed and EF-1 shall be “off”.
- 18 • Duct furnace (DF-1) shall be energized and modulate capacity to maintain 50F (adjustable)
19 discharge air temperature.

20
21 Building unoccupied:

- 22 • Damper D-7 shall be closed.
- 23 • Damper D-10 shall be closed.
- 24 • Damper D-8 shall be closed.
- 25 • Damper D-9 shall be closed and EF-1 shall be “off”.
- 26 • Duct furnace (DF-1) shall be off.

27
28 Emergency Heating:

29 If one of the DDC space temperature sensors in any space falls below 35F (adjustable), the following shall
30 occur:

- 31 • Damper D-7 shall be open.
- 32 • Damper D-10 shall be open.
- 33 • Damper D-8 shall be open.
- 34 • Damper D-9 shall be closed and EF-1 shall be “off”.
- 35 • Duct furnace (DF-1) shall be energized and modulate capacity to maintain minimum 50F
36 (adjustable) space temperature at each sensor.
- 37 • Once space setpoint temperature is achieved, the unit shall go back to “unoccupied”.

38
39 **F-1 (F-2 Similar)**

40 This system will be controlled by the DDC system.

41
42 This system includes:

- 43 • Natural gas furnace.
- 44 • Networkable / communicating 7-day programmable thermostat with remote sensors.

45
46 Provide all control wiring. Thermostat to be mounted in Mechanical Room. Remote sensor to be mounted
47 in space.

48
49 On a call for heating, the furnace shall be energized to maintain setpoint (50F adjustable) The heater shall
50 turn-off once setpoint has been reached.

51
52 **ECUH-1 (ECUH-2 Similar)**

53 This unit is not controlled by the DDC system or integrated into the DDC system. This unit is controlled
54 by “stand-alone controls”. There is a DDC sensor in the space to monitor space temperature and alarm.

1 This system includes:

- 2 • Electric Cabinet Unit Heater
- 3 • Thermostat with remote sensor.
- 4 • DDC Sensor.

5
6 Provide all control wiring. Thermostat to be mounted in Mechanical Room. Remote sensor to be mounted
7 in space.

8
9 On a call for heating, the heater shall be energized to maintain setpoint (50F adjustable). The heater shall
10 turn-off once setpoint has been reached.

11
12 **GUH-1 (GUH-2 Similar)**

13 This unit is not controlled by the DDC system or integrated into the DDC system. This unit is controlled
14 by “stand-alone controls”. There is a DDC sensor in the space to monitor space temperature and alarm.

15
16 This system includes:

- 17 • Gas unit heater.
- 18 • Thermostat (GUH-2 to have guard).
- 19 • DDC Sensor.

20
21 Provide all control wiring.

22
23 On a call for heating, the heater shall be energized to maintain setpoint (50F adjustable). The heater shall
24 turn-off once setpoint has been reached.

25
26 **EF-2**

27 This exhaust fan is not controlled by the DDC system or integrated into the DDC system. This fan is
28 controlled by “stand-alone controls”.

29
30 This system includes:

- 31 • Ceiling mounted exhaust fan.
- 32 • Motorized control damper (D-11).

33
34 Provide all control wiring and interlock wiring.

35
36 Fan to be energized by space lighting controls (either switch or occupancy sensor). When lights are on, the
37 fan damper shall open and the fan shall be energized.

38
39 The reverse shall occur when the lights are off.

40
41 **TF-1**

42 This unit is not controlled by the DDC system or integrated into the DDC system. This unit is controlled
43 by “stand-alone controls”. There is a DDC sensor in the space to monitor space temperature and alarm.

44
45 System includes:

- 46 • Ceiling Fan
- 47 • Thermostat.
- 48 • DDC Sensor.

49
50 Provide all control wiring.

51
52 On a rise in space temperature above setpoint, the fan shall energize and run. On a drop in space
53 temperature below setpoint, the fan shall energize and run.

54
55 END OF SECTION

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SECTION 23 11 00
FACILITY FUEL PIPING

PART 1 - GENERAL

SCOPE

This section contains specifications for fuel pipe and fuel 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
- Natural Gas Service

PART 2 - PRODUCTS

- Natural Gas Piping
- Shut-Off Valves
- Gas Pressure Regulators
- Vents and Relief Valves
- Unions and Flanges

PART 3 - EXECUTION

- Preparation
- Erection
- Threaded Pipe Joints
- Natural Gas
- Vents and Relief Valves
- Unions and Flanges
- Gaskets
- Piping System Leak Tests
- Piping System Leakage Test Report

RELATED WORK

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 00 and 01.

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

1 service.

2
3 **TYPE E OR S STEEL PIPE:**

4 Mill certification papers, also known as material test reports, for the pipe furnished for this project, in
5 English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis
6 indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM
7 specification.

8
9 **QUALITY ASSURANCE**

10 Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or
11 each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

12
13 Any installed material not meeting the specification requirements must be replaced with material that meets
14 these specifications without additional cost to the Owner.

15
16 **DELIVERY, STORAGE, AND HANDLING**

17 Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

18
19 Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do
20 not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where
21 end caps are provided or specified, take precautions so the caps remain in place.

22
23 Offsite storage agreements will not relieve the contractor from using proper storage techniques.

24
25 Storage and protection methods must allow inspection to verify products.

26
27 **DESIGN CRITERIA**

28 Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM
29 specifications as listed in this specification.

30
31 Construct all piping for the highest pressures and temperatures in the respective system in accordance with
32 ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

33
34 Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied
35 spaces and ventilation plenum spaces, including plenum ceilings.

36
37 Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a
38 centerline radius of 1.5 pipe diameters.

39
40 Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's
41 option. Where the grade or type is not specified, Contractor may choose from those commercially
42 available.

43
44 **NATURAL GAS SERVICE**

45 All charges for relocation of the existing gas service, or provisions of a new gas service as shown on the
46 plans, including the connection from a main in the street, sidewalk or other location to the gas meter, shall
47 be paid by this Contractor, including setting of gas meter(s) and all work performed by the gas company.

48
49
50 **PART 2 - PRODUCTS**

51
52 **NATURAL GAS PIPING**

53 2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM
54 A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI
55 B16.9 standard weight, seamless, carbon steel weld fittings.

1 **SHUT OFF VALVES**

2 2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or
3 conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working
4 pressure, U.L. listed for use as natural gas shut-off.

5
6 **GAS PRESSURE REGULATORS**

7 2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi
8 W.O.G., -20°F to 150°F.

9
10 **VENTS AND RELIEF VALVES**

11 Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

12
13 **UNIONS AND FLANGES**

14 2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron
15 on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure
16 class equal to or higher than that specified for the fittings of the respective piping service but not less than
17 250 psi.

18
19 Provide ASTM A 193 B7 grade bolts and A 194 2H grade nuts & hardened washers for connections (Star
20 washers for grounding.)

21
22 **GASKETS**

23 Fuel Oil and Natural Gas Systems: Branded, compressed, non-asbestos sheet gaskets. Klingsil C4401,
24 Garlock 3000, JM Clipper 978-C or approved equal.

25
26
27 **PART 3 - EXECUTION**

28
29 **PREPARATION**

30 Remove all foreign material from interior and exterior of pipe and fittings.

31
32 **ERECTION**

33 Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a
34 window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute
35 piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe
36 spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

37
38 Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and
39 contract without damage to itself, equipment, or building.

40
41 Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are
42 not acceptable.

43
44 "Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the
45 main.

46
47 Do not route piping through transformer vaults or above transformers, panelboards, or switchboards,
48 including the required service space for this equipment, unless the piping is serving this equipment.

49
50 Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed.
51 Make connections to all equipment installed by others where that equipment requires the piping services
52 indicated in this section.

53
54 **THREADED PIPE JOINTS**

55 Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement
56 or caulking will be allowed.

1 **NATURAL GAS**

2 Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at
3 the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight
4 each tee or pipe end which will not be immediately extended. All branch connections to the main shall be
5 from the top or side of the main.

6
7 Do not install gas pipe in a ventilation air plenum.

8
9 If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five
10 feet above grade.

11
12 Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and
13 appliances furnished by others.

14
15 Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

16
17 Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the
18 building, terminated with a screened vent cap, and located according to gas utility regulations.

19
20 **VENTS AND RELIEF VALVES**

21 Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for
22 each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a
23 roof line.

24
25 **UNIONS AND FLANGES**

26 Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece
27 of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located
28 at a piece of equipment, locate the flange or union connection on the equipment side of the valve.
29 Concealed unions or flanges are not acceptable.

30
31 **GASKETS**

32 Store horizontally in cool, dry location and protect from sunlight, water and chemicals. Inspect flange
33 surfaces for warping, radial scoring or heavy tool marks. Inspect fasteners, nuts and washers for burrs or
34 cracks. Replace defective materials.

35
36 Align flanges parallel and perpendicular with bolt holes centered without using excessive force. Center
37 gasket in opening. Lubricate fastener threads, nuts and washers with lubricant formulated for application.

38
39 Draw flanges together evenly to avoid pinching gasket. Tighten fasteners in cross pattern sequence (12 – 6
40 o'clock, 3 – 9 o'clock, etc.), one pass by hand and four passes by torque wrench at 30% full torque, 60%
41 full torque and two passes at full torque per ASME B16.5.

42
43 **PIPING SYSTEM LEAK TESTS**

44 Verify that the piping system being tested is fully connected to all components and that all equipment is
45 properly installed, wired, and ready for operation. If required for the additional pressure load under test,
46 provide temporary restraints at expansion joints or isolate them during the test.

47
48 Provide all piping, fittings, blind flanges, and equipment to perform the testing.

49
50 Conduct pressure test with air. Minimum test time is indicated in the table below; additional time may be
51 necessary to conduct an examination for leakage. If leaks are found, repair the area with new materials and
52 repeat the test; caulking will not be acceptable.

53
54 For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the
55 pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached.
56 Examine all joints and connections with a soap bubble solution or equivalent method. The piping system

1 exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking.
2 After testing is complete, slowly release the pressure in a safe manner.

3

4 Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in
5 increments not greater than 0.1 inch water column. System will not be approved until it can be
6 demonstrated that there is no measurable loss of test pressure during the test period.

7

System	Pressure	Medium	Duration
Natural gas	100 psig	Air	24 hr

8

9

10

END OF SECTION

PIPING SYSTEM LEAKAGE TEST REPORT

Date Submitted: _____

Project Name: _____

Location: _____

Contractor: _____

- HVAC Refrigeration Controls
 Power Plant Plumbing Sprinkler
Test Medium: Air Water Other _____

Test performed per specification section No. _____

Specified Test Duration _____ Hours Specified Test Pressure _____ PSIG

System Identification: _____

Describe Location: _____

Test Date: _____	
Start Test Time: _____	Initial Pressure: _____ PSIG
Stop Test Time: _____	Final Pressure: _____ PSIG

Tested By: _____

Witnessed By: _____

Title: _____

Title: _____

Signed: _____

Signed: _____

Date: _____

Date: _____

Comments: _____

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SECTION 23 31 00
HVAC DUCTS and CASINGS

PART 1 - GENERAL

SCOPE

This section includes specifications for all duct systems used on this project. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS

- General
- Materials – Above Grade
- Materials – Below Grade
- Low Pressure Ductwork – Above Grade (Maximum 2 inch pressure class)
- Low Pressure Ductwork – Underground (Maximum 2 inch pressure class)
- Exhaust Duct (Moisture laden air)
- Duct Sealant
- Gaskets

PART 3 - EXECUTION

- Installation
- Low Pressure Duct (Maximum 2 inch pressure class)
- Low Pressure Ductwork – Above Grade (Maximum 2 inch pressure class)
- Low Pressure Ductwork – Underground (Maximum 2 inch pressure class)
- Exhaust Duct (Moisture laden air)
- Cleaning

RELATED WORK

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 A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process

1	ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated
2		(Galvanized) by the Hot-Dip Process, Lock-Forming Quality
3	ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-
4		coated by the Hot-dip Method
5	ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
6	ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal
7		Insulation
8	ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
9	ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials
10		and Facings
11	ASTM G 21	Standard Practice for Determining Resistance of Synthetic Polymeric Materials
12		to Fungi
13	ASTM C 916	Standard Specification for Adhesives for Duct Thermal Insulation
14	NFPA 90A	Standard for the Installation of Air Conditioning and Ventilating Systems
15	UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.

16
17 **QUALITY ASSURANCE**

18 Refer to Division 00 and 01.

19
20 **SHOP DRAWINGS**

21 Refer to Division 00 and 01.

22
23 Include manufacturer's data and/or Contractor data for the following:

- 24 • Schedule of duct systems including material of construction, gauge, pressure class, system class,
- 25 method of reinforcement, joint construction, fitting construction, and support methods, all with
- 26 details as appropriate.
- 27
- 28 • Duct sealant and gasket material.
- 29

30 **DESIGN CRITERIA**

31 Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under

32 specified operating conditions.

33
34 Use material, weight, thickness, gauge, construction and installation methods as outlined in the following

35 SMACNA publications, unless noted otherwise:

- 36 • HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- 37 • HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
- 38 • HVAC Systems - Duct Design, 4th Edition, 2006
- 39 • Rectangular Industrial Duct Construction Standard, 2nd Edition, 2004
- 40 • Round Industrial Duct Construction Standards, 2nd Edition, 1999
- 41 • Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995
- 42

43 Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke

44 developed rating no higher than 50.

45
46 **DELIVERY, STORAGE AND HANDLING**

47 Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

48
49 Protect Ductwork against damage.

50
51 Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store

52 material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end

53 caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

54
55 Offsite storage agreements do not relieve the contractor from using proper storage techniques.

1 Storage and protection methods must allow inspection to verify products.
2
3

4 **PART 2 - PRODUCTS**

5 6 **GENERAL**

7 All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral
8 ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC
9 Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005.

10
11 Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net,
12 inside of liner.

13 14 **DUCTWORK PRESSURE CLASS**

15 Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive
16 or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1
17 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on
18 the drawings to be as follows:

19 Supply duct	2 in. pressure class
20 Exhaust air ducts	2 in. pressure class
21 Return air ducts	2 in. pressure class
22 Outside air ducts	2 in. pressure class

23 24 **MATERIALS – ABOVE GRADE**

25 **GALVANIZED STEEL SHEET:**

26 Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per
27 square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish or
28 galvanneal sheetmetal for ductwork that will be painted.

29 30 **ALUMINUM SHEET:**

31 Use ANSI/ASTM B209 aluminum sheet, alloy 3003H-14, capable of double seaming without fracture.

32 33 **MATERIALS – UNDERGROUND**

34 BlueDuct by AQC Industries installed by factory certified installation crew or prior approved material /
35 systems

36
37 Ductwork shall be HDPE, closed cell plastic material that is recyclable, does not emit volatile organic
38 compounds, and conforms to ASTM-D2412. Ductwork shall be resistant to mildew, mold (UL 181B), and
39 radon gas (BSS 7239-88). Ductwork shall not rust or crack under external stress or strain. Ductwork shall
40 have R-10 thermal insulation value without the use of external insulation.

41
42 Duct system shall carry a 10 year warranty.

43 44 **LOW PRESSURE DUCTWORK – ABOVE GRADE (Maximum 2 inch pressure class)**

45 Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA
46 recommendations, except as modified below.

47
48 Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction
49 when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral
50 ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA
51 approved locations if the screw does not extend more than 1/2 inch into the duct.

52
53 Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits.
54 When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in
55 accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the
56 radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes

1 as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or
2 bullhead tees are not acceptable.

3
4 Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

5
6 Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork
7 airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be
8 accepted.

9
10 Button punch snaplock construction will not be accepted.

11
12 Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of
13 equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by
14 written permission of the Architect/Engineer.

15
16 Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence
17 upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

18
19 **LOW PRESSURE DUCTWORK – UNDERGROUND (Maximum 2 inch pressure class)**

20 Complete duct system must be from one manufacturer and be of the same material, construction and
21 connection method throughout. Field made duct components will not be acceptable.

22
23 Include the complete underground duct system including plenums and transitions.

24
25 All duct and fittings shall be constructed per SMACNA's Duct Construction Standards.

26
27 Provide all elbows, duct, diffusers, plenums, clamp & gasket, boots, caulk, water gauge test and adapters as
28 required for underground installation.

29
30 All joints shall be gasket and sealed. Clamps and gaskets shall be used on ductwork without flanges.

31
32 Clamps shall be polyethylene with 410 stainless steel plates and stainless steel screws. Gaskets shall
33 comprise of 1/4" thick butyl rubber sealant tape with silver polyester facing that is water and UV resistant
34 and shall not stain. Gaskets shall comply with ASTM-E84 for flame and smoke spread.

35
36 Flanged joints and duct branches shall use a co-polymer adhesive caulking sealant that is water and UV
37 resistant. Flanges shall be connected with stainless steel bolts.

38
39 Assembled ductwork shall be approved for installations 48" below flood plain elevation without water
40 intrusion.

41
42 Duct system installed by manufacture trained installer will be an air and water tight system.

43
44 **EXHAUST DUCT (Moisture laden air)**

45 Moisture laden ductwork systems include:

- 46 • All exhaust air ducts located in plumbing chases.

47
48 Exhaust ducts conveying moisture laden air to be constructed of sheet aluminum in accordance with
49 SMACNA standards.

50
51 Seal all joints and seams watertight

1 **DUCT SEALANT**

2 Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold
3 sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in
4 any type of ductwork installation.

5
6 Install sealants in strict accordance with manufacturer's recommendations, paying special attention to
7 temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup
8 of air handling systems.

9
10 **GASKETS**

11 **2 INCH PRESSURE CLASS AND LOWER:**

12 Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.
13

14
15 **PART 3 - EXECUTION**

16
17 **INSTALLATION**

18 Verify dimensions at the site, making field measurements and drawings necessary for fabrication and
19 erection. Check plans showing work of other trades and consult with Architect in the event of any
20 interference.

21
22 Make allowances for beams, pipes or other obstructions in building construction and for work of other
23 contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct
24 Construction Standards, Figure 4-7, except do not reduce duct to less than six inches in any dimension and
25 do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts,
26 construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 4-8, Fig. E. In
27 all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or
28 fume exhaust ductwork.

29
30 Test openings for test and balance work will be provided under Section 23 05 93.

31
32 Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in
33 duct systems, and make all connections to such equipment including equipment furnished by others.
34 Secure frames with gaskets and screws or nut, bolts and washers.

35
36 Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to
37 form watertight joints.

38
39 Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not
40 contact each other by using proper seal or compound.

41
42 Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all
43 unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized
44 sheet metal backing on both sides.

45
46 Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this
47 room or space.

48
49 Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

50
51 Provide adequate access to ductwork for cleaning purposes.

52
53 Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

54
55 Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to
56 maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

1 During construction provide temporary closures of metal or taped polyethylene on open ductwork to
2 prevent construction dust from entering ductwork system.

3
4 **DUCTWORK SUPPORT**

5 Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 5-5, except
6 supporting ductwork with secure wire method is not allowed.

7
8 Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching serrated spring loaded wedge
9 mechanism fasteners rated for actual load. Steel cable hanging systems will be allowed on round ductwork
10 under 12 inches diameter if installed utilizing two fasteners with two cable loops. Comply with the
11 manufacturer's installation instructions.

12
13 **LOW PRESSURE DUCT – ABOVE GRADE (Maximum 2 inch pressure class)**

14 Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams,
15 joints, and penetrations shall be sealed.

16
17 Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter
18 dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

19
20 Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws
21 or pop rivets. Trapeze hangers may be used at contractor's option.

22
23 **LOW PRESSURE DUCT – UNDERGROUND (Maximum 2 inch pressure class)**

24 Excavate a trench evenly per manufacturer's installation requirements.

25
26 Backfill per manufacturer's requirements. Acceptable material includes pea gravel or sand. Backfill
27 should not contain particles larger than 3/4 inch.

28
29 Hand tamp backfill material to hold in place. Do not allow heavy loads to travel over backfilled duct, as
30 crushing may occur.

31
32 Assemble duct per manufacturers requirements.

33
34 Only AQC approved and supplied materials may be used.

35
36 Complete underground duct system shall be tested for leakage after final assembly. Follow SMACNA air
37 duct leakage test standard. Allow 24 hours after final assembly for the sealants to cure before testing the
38 duct system.

39
40 Remove dust and debris from ductwork.

41
42 **EXHAUST DUCT (Moisture laden air)**

43 Pitch duct to drain back to equipment or exhaust grille.

44
45 Provide water tight drain pan at low points or at locations where moisture may collect. Pipe drain pan to
46 nearest floor drain.

47
48 **CLEANING**

49 Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the
50 inside of air-handling units before operating fans.

51
52 Clean duct systems with high power vacuum machines where systems have been used for temporary heat,
53 air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by
54 excessive dirt with filters, or bypass during cleaning.

1 **LEAKAGE TEST**

2 Leakage testing of ductwork will not be required unless excessive leakage is found during testing and
3 balancing.

4

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END OF SECTION

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SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 - GENERAL

SCOPE

This sections includes accessories used in the installation of duct systems. Included are the following topics:

PART 1 - GENERAL

- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS

- Manual Volume Dampers
- Turning Vanes
- Control Dampers
- Access Doors
- Flashings
- Duct Flexible Connections
- Hoods for Intake and Exhaust
- Louvers

PART 3 - EXECUTION

- Manual Volume Dampers
- Turning Vanes
- Control Dampers
- Access Doors
- Flashings
- Duct Flexible Connections
- Hoods for Intake and Exhaust
- Louvers

RELATED WORK

- Section 23 05 29 – Hanger and Supports for HVAC Piping and Equipment
- Section 23 05 48 – Vibration and Seismic Controls 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

- NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems
- SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
- UL 214

QUALITY ASSURANCE

Refer to Division 00 and 01.

SHOP DRAWINGS

Refer to Division 00 and 01.

1 Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and
2 appropriate identification.

3
4 Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance
5 of sound attenuators.

6
7 Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

8 **OPERATION AND MAINTENANCE DATA**

9 All operations and maintenance data shall comply with the submission and content requirements specified
10 under section GENERAL REQUIREMENTS.

11 **PART 2 - PRODUCTS**

12 **MANUAL VOLUME DAMPERS**

13
14 Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

15
16
17 Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to
18 these figures, except as modified below.

19
20 Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections
21 with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components;
22 sheet metal screws will not be accepted. Provide operators with locking devices and damper position
23 indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings
24 for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

25 **TURNING VANES**

26
27 Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

28
29 Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4
30 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one
31 dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

32 **CONTROL DAMPERS**

33
34 Control dampers are specified in section 23 09 14.

35 **ACCESS DOORS**

36
37 Access doors to be designed and constructed for the pressure class of the duct in which the door is to be
38 installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be aluminum or
39 steel full length continuous piano type. Doors in concealed spaces shall be secured in place with cam sash
40 latches. For both hinged and non-hinged doors provide sufficient number of cam sash latches to provide
41 air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict
42 access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge
43 galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with
44 frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene
45 gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are
46 installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is
47 provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners
48 will not be accepted.

49 **FLASHINGS**

50
51 Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed
52 of material similar to louver material.

53
54 Flashing and counterflashing for roof curbs will be provided by others.

55
56 Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

1 **DUCT FLEXIBLE CONNECTIONS**

2 Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

3
4 Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections
5 to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected
6 equipment, and other movement.

7
8 Use coated glass fiber fabric for all applications. Material to be double coated with neoprene, air and water
9 tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per
10 square yard.

11
12 **HOODS FOR INTAKE AND EXHAUST**

13 Manufacturers: Ammerman, Carnes, Cook, Greenheck, Louvers and Dampers, Penn, or approved equal.

14
15 Use low silhouette type hoods.

16
17 Construct hoods of aluminum.

18
19 Construct hoods of galvanized steel with a custom color baked enamel finish. Final color to be determined
20 by the Architect during the submittal stage.

21
22 Provide bird screen and motor operated damper for each hood.

23
24 **LOUVERS**

25 Manufacturers: Airolite K6776, Industrial Louvers 658, American Warming and Ventilating LE-31,
26 Construction Specialties 6177, Ruskin ELF6375DX or approved equal.

27
28 Similar to Airolite Type K6776, extruded aluminum alloy not less than 12 gauge (.081" thick), 6063 series
29 frame and blades, all-welded assembly, 35 degree or 45 degree blades with water baffle, 6 inches thick.
30 Provide with bird screen of 1/2" x 1/2" mesh aluminum in 12 gauge aluminum frame and an aluminum sill.
31 Locate the bird screen inside of the louver unless noted otherwise.

32
33 Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a
34 free area not less than 50% based on a 48" x 48" section, a water penetration less than 0.1 oz/square foot
35 under AMCA test at 1000 feet per minute, and an intake pressure drop less than 0.20 inches of water at
36 1000 feet per minute.

37
38 Finish to be anodized or Kynar 500 in a custom color to be determined by the Architect. Furnish sufficient
39 paint in the same color as the louver to paint the outer surface of panels over unused portions of louvers and
40 to paint the interior portion of ductwork visible through the louvers.

41
42
43 **PART 3 - EXECUTION**

44
45
46 **MANUAL VOLUME DAMPERS**

47 Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away
48 from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter
49 or vibration of the damper blade(s).

50
51 **TURNING VANES**

52 Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or
53 manufacturer's recommendations.

1 Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air
2 velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner
3 length 18" or greater and air velocity 2000 fpm or greater.
4

5 If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct
6 size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in
7 accordance with SMACNA Figure 2-5 and Figure 2-6.
8

9 **CONTROL DAMPERS**

10 Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's
11 instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing
12 plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent
13 to each control damper for inspection and maintenance.
14

15 **ACCESS DOORS**

16 Install access doors where specified, indicated on the drawings, and in locations where maintenance,
17 service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers,
18 fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and
19 control devices needing periodic maintenance.
20

21 Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access
22 door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as
23 indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted
24 coils.
25

25 **FLASHINGS**

26 Flashing for roof curbs, equipment supports or rails located on roof, will be installed by others.
27

28 **DUCT FLEXIBLE CONNECTIONS**

29 Install at all duct connections to rotating or vibrating equipment (ERV, Furnaces, Duct Furnace, Ceiling
30 Fans) or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to
31 prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.
32

33 **HOODS FOR INTAKE AND EXHAUST**

34 Install in locations indicated on the drawings, coordinating the roof opening location with the General
35 Prime Contractor. Curbs are covered in Section 23 05 29.
36

37 **LOUVERS**

38 Furnish louvers to the General Prime Contractor for mounting in exterior walls. Connect outside air intake
39 duct to the louver, sealing all connections air and water tight.
40

41 Provide bird screen on inside of active louver area where none is provided with louvers. Where louvers are
42 equipped with inside birdscreen, remove screen at all locations where duct connections are not made.
43

44 Install insulated metal panel on unused portion of louver. Panels must be sealed weathertight to louver
45 assembly with flashing as required for proper drainage to outside of building. Paint outside surface of
46 panel to match louver prior to installation. Where ductwork is visible through louver when viewed from
47 outside the building, paint inside of duct to match louver color.
48

49
50 **END OF SECTION**

1 Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake
2 horsepower, recommended selection range, and limits of operation are to also be indicated on the curves.
3 Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's
4 recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.
5

6 **OPERATION AND MAINTENANCE DATA**

7 All operations and maintenance data shall comply with the submission and content requirements specified
8 under section GENERAL REQUIREMENTS.
9

10 **DESIGN CRITERIA**

11 Tested and certify all fans in accordance with the applicable AMCA test code.
12

13 Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled
14 static pressure. The motor furnished with the fan shall not operate into the motor service factor when
15 operating under these conditions.
16

17 Consider drive efficiency in motor selection according to manufacturer's published recommendation or
18 according to AMCA Publication 203, Appendix L.
19

20 Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any
21 motor, drive and/or wiring changes required due to increased static pressure or baffling necessary to
22 prevent uneven airflow or improve mixing.
23

24 All internal insulation and other components exposed to the airstream are to meet the flame spread and
25 smoke ratings contained in NFPA 90A.
26

27 All roof mounted equipment to be provided with curbs or equipment stands in accordance with
28 specification in Section 23 05 29.
29
30

31 **PART 2 - PRODUCTS**

32 **GENERAL**

33 Use fan size, class, type, arrangement, and capacity as scheduled.
34
35

36 Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and
37 accessories required for specified performance and proper operation. All single phase motors to have
38 inherent thermal overload protection.
39

40 Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal
41 to allow for ventilation; provide tachometer openings at shaft locations.
42

43 Statically and dynamically balance all fans so they operate without objectionable noise or vibration.
44

45 **POWER ROOF EXHAUST FANS**

46 Manufacturers: Carnes, Greenheck, Penn, Jenn-Air, Cook, S&P or approved equal.
47

48 Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal
49 wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.
50

51 Electrical Contractor will provide disconnect switches.
52

53 Provide with motorized low leakage thermally broken damper with insulated blades as specified in Section
54 23 09 14.
55

56 **CEILING EXHAUST FANS**

1 Carnes, Greenheck, Penn, Jenn-Air, Cook, ACME, S&P or approved equal.
2
3 Centrifugal blower wheel, steel housing with acoustical lining, integral exhaust grille, adjustable mounting
4 brackets to allow for any ceiling thickness, permanently lubricated motor, integral junction box with
5 permanently lubricated and thermally protected motor factory.
6
7 Provide wall, eave, or roof discharge assembly, as indicated on the drawings, as required.
8
9

10 **PART 3 - EXECUTION**

11
12 **INSTALLATION**

13 Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions. On
14 units provided with a drain connection, reduce drain connection down to 1/2" fitting and leave open.
15

16
17 **END OF SECTION**

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1 **DESIGN CRITERIA**

2 All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC)
3 Test Code 1062 GRD 84.

6 **PART 2 - PRODUCTS**

8 **MANUFACTURERS**

9 Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price, and United Sheet Metal.

11 **SIDE-WALL REGISTERS AND GRILLES**

12 Aluminum unless otherwise indicated, with frame type appropriate to installation.

14 Double deflection type blade supply registers and supply grilles allow deflection adjustment in all direction.

16 Aluminum opposed blade volume control damper supply registers, operable from face where scheduled.

18 Fixed blade (0 degree, 45 degree) core return and exhaust registers and grilles.

20 Aluminum opposed blade volume control damper return registers, operable from face where scheduled.

22 Register and grille sizes as shown on drawings and/or as scheduled.

24 White finish, unless otherwise indicated.

26 Screw holes on surface counter sunk to accept recessed type screws.

29 **PART 3 - EXECUTION**

31 **INSTALLATION**

32 Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

34 Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

36 Seal connections between ductwork drops and diffusers/grilles airtight.

38 Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct
39 with flat black paint to reduce visibility.

42 **END OF SECTION**

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SECTION 23 54 00
GAS FIRED FURNACES

PART 1 - GENERAL

SCOPE

This section includes specifications for gas fired furnaces. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Energy Efficiency
- Submittals
- Operation and Maintenance Data
- Warranty

PART 2 - PRODUCTS

- Furnaces
- Training

PART 3 - EXECUTION

- Installation
- Furnaces

RELATED WORK

Section 23 05 13 - Common Motor Requirements for HVAC Equipment
Section 23 11 00 - Facility Fuel Piping

REFERENCE

Refer to Division 00 and 01.

REFERENCE STANDARDS

AGA	American Gas Association
ANSI Z21.64	Direct Vent Central Furnaces
GAMA	Gas Appliance Manufacturers Association
NEC	National Electrical Code

QUALITY ASSURANCE

Refer to Division 00 and 01.

ENERGY EFFICIENCY

Provide gas furnaces that bear the ENERGY STAR label and meet the ENERGY STAR specifications for energy efficiency.

SUBMITTALS

Refer to Division 00 and 01.

1 Include specific manufacturer and model numbers, equipment identification corresponding to project
2 drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power
3 requirements and wiring diagrams, filter information and information for all accessories.
4

5 **OPERATION AND MAINTENANCE DATA**

6 All operations and maintenance data shall comply with the submission and content requirements specified
7 under section GENERAL REQUIREMENTS.
8

9 **WARRANTY**

10 Furnace primary and secondary heat exchangers warranted for 20 years under normal use and maintenance.
11 Remainder of furnace components warranted for 1 year from date of start up.
12
13

14 **PART 2 - PRODUCTS**

15 **FURNACES**

16 Manufacturers: Bryant, Carrier, Daikin, Lennox, Trane or York.
17
18

19 Direct vent, sealed combustion, condensing type AGA certified for use with natural gas. Minimum annual
20 fuel utilization efficiency (A.F.U.E.) of 93. All ratings are to be certified by GAMA. All wiring shall
21 comply with the National Electrical Code.
22

23 22 gauge steel casing with baked enamel finish or prepainted galvanized steel. Insulate casing back and
24 side panels with foil faced fiberglass insulation.
25

26 Construct primary heat exchanger of stainless steel. Construct secondary heat exchanger of stainless steel
27 with aluminum fins or of polypropylene laminated steel. Stainless steel multi-port in-shot burner with hot
28 surface or electronic spark ignition, approved for vertical or sidewall venting.
29

30 AGA listed gas controls including manual main shut-off valve, double automatic gas valves for redundancy
31 and gas pressure regulator. Provide modulating heating capacity.
32

33 Centrifugal type blower fan statically and dynamically balanced with multiple speed, direct drive or belt
34 drive fan motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas
35 venting.
36

37 Provide unit with 2" thick 30% efficient disposable type panel air filter and filter holding rack.
38

39 Provide concentric vent kit for thru roof venting.
40

41 Provide solid state integral control unit with all necessary controls and relays including but not limited to:

- 42 • Pressure switch for airflow of flue products through furnace and out vent system.
- 43 • Rollout switch with manual reset to prevent over temperature in burner area.
- 44 • Electronic flame sensor.
- 45 • Blower access safety interlock.
- 46 • Timed blower start after main burners ignite.
- 47 • Factory installed 24 v transformer for controls and thermostat.
- 48 • LED's to indicate status and to aid in troubleshooting.
49

50 This Contractor shall provide all temperature control and interlocking necessary to perform the specified
51 control sequence. All wiring is to be in conduit in accordance with Division 26 00 00 - Electrical. All
52 relays, transformers and controls are to be in enclosures.
53

1 Provide a 7 day programmable thermostat with 2 occupied periods per day, automatic changeover, separate
2 heating and cooling set points for both occupied and unoccupied modes. Provide auxiliary controls for (2)
3 remote sensors. Equal to Honeywell model T7300 with Q7300 sub-base.

4

5 Provide lockable thermostat guards in public spaces.

6

7 Unit to fan and gas burner to cycle "on" as required to maintain space setpoint temperature.

8

9

10

PART 3 - EXECUTION

11

INSTALLATION

12 Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.

13

14 Pipe vents from gas regulator to outside (where regulators are provided).

15

16 Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote
17 panels/thermostats and the gas fired item.

18

19

20

21

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34

FURNACES

Install on concrete housekeeping pad, steel stand or suspend unit from structure as indicated on the
drawings. Pipe condensate to floor drain.

Provide schedule 40 PVC, ASTM D1785 combustion air and vent piping and fittings with solvent welded
joints as indicated on the drawings. Terminate as recommended by the furnace manufacturer with
concentric vent kit.

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 4 hours.

END OF SECTION

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SECTION 23 55 00
FUEL-FIRED HEATERS

PART 1 - GENERAL

SCOPE

This section includes specifications for fuel-fired heaters. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Warranty

PART 2 - PRODUCTS

- Gas Fired Unit Heaters
- Duct Furnaces

PART 3 - EXECUTION

- Installation
- Gas Fired Unit Heaters
- Duct Furnaces

RELATED WORK

- Section 23 05 13 - Common Motor Requirements for HVAC Equipment
- Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
- Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment
- Section 23 11 00 - Facility Fuel Piping

REFERENCE

Applicable provisions of Division 00 and 01 govern work under this section.

REFERENCE STANDARDS

- AGA American Gas Association
- GAMA Gas Appliance Manufacturers Association
- NEC National Electrical Code
- CSA Canadian Standards Association

QUALITY ASSURANCE

Refer to Division 00 and 01.

SUBMITTALS

Refer to Division 00 and 01.

Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

1 **WARRANTY**

2 Gas fired unit heaters heat exchangers warranted for five years. Remainder of unit heater components
3 warranted for 1 year from startup.

4
5 Duct furnace heat exchangers warranted for five years. Remainder of unit heater components warranted for
6 1 year from startup.

7
8
9 **PART 2 - PRODUCTS**

10
11 **GAS FIRED UNIT HEATERS**

12 Manufacturers: Modine, Reznor, Sterling or Trane

13
14 Horizontal discharge, direct vent sealed combustion type. AGA certified for use with natural gas.
15 Minimum combustion efficiency (Ec) of 82%. All wiring shall comply with the National Electrical Code.

16
17 Construct casing of cold rolled steel with baked enamel finish. Direct drive propeller type fan statically
18 and dynamically balanced and including fan safety guard and adjustable vertical and horizontal louvers for
19 control of air diffusion on discharge of unit. Stainless steel steel burners, electronic spark ignition with
20 electronic flame supervision and timed lockout control. Stainless steel (409) heat exchanger and factory
21 installed induced draft blower for heat exchanger prepurge and combustion gas venting. Provide a hinged
22 access panel on the bottom of the unit to access the burner or provide side access (pull out drawer) to
23 burner assembly. Single point power connection. Unit must be approved for vertical or side wall venting.

24
25 Provide concentric vent kit for thru roof venting.

26
27 Provide spark ignited intermittent pilot system with electronic flame supervision

28
29 AGA gas controls, including manual main shut-off valve, 24 volt redundant combination gas control valve
30 with 100 percent safety shut-off valve and main gas pressure regulator.

31
32 Provide fan controls and limit safety controls including but not limited to:

- 33
- 34 • Pressure switch to verify combustion/exhaust gas airflow
 - 35 • High limit controls
 - 36 • Fan time delay to delay the fan start until the heat exchanger reaches a predetermined temperature
37 and to allow the fan to operate, after burner shut down, to remove heat exchanger residual heat.

38 Provide all temperature control and interlocking necessary to perform the specified control sequence. All
39 relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control
40 transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with
41 Division 26 00 00 - Electrical and comply with the NEC.

42
43 Provide an air inlet/vent termination assembly and threaded hanger connections.

44
45 **DUCT FURNACES**

46 Manufacturers: Modine, Reznor, Sterling or Trane

47
48 Direct vent sealed combustion type. AGA certified for use with natural gas. Minimum combustion
49 efficiency (Ec) of 80%. All wiring shall comply with the National Electrical Code.

50
51 Construct casing of cold rolled steel with baked enamel finish. Stainless steel steel burners, electronic
52 spark ignition with electronic flame supervision and timed lockout control. Stainless steel (409) heat
53 exchanger and factory installed induced draft blower for heat exchanger prepurge and combustion gas
54 venting. Stainless steel bottom drip pan. Single point power connection. Unit must be approved for
55 vertical or side wall venting.

- 1 Provide concentric vent kit for thru roof venting.
2
3 Provide spark ignited intermittent pilot system with electronic flame supervision
4
5 AGA gas controls, including manual main shut-off valve, 24 volt redundant combination gas control valve
6 with 100 percent safety shut-off valve and main gas pressure regulator.
7
8 Provide fan controls and limit safety controls including but not limited to:
9 • Pressure switch to verify combustion/exhaust gas airflow
10 • High limit controls
11
12 Provide all temperature control and interlocking necessary to perform the specified control sequence. All
13 relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control
14 transformer along with 24 v wall mounted thermostat. All wiring shall be in conduit in accordance with
15 Division 26 00 00 - Electrical and comply with the NEC.
16 Provide an air inlet/vent termination assembly and threaded hanger connections.
17
18 Provide electronic modulation – (28%-100% of firing rate) with duct mounted discharge air thermostat and
19 remote setpoint adjustment.
20
21 Provide all temperature control and interlocking necessary to perform the specified control sequence. All
22 relays, transformers and controls are to be in enclosures. Provide factory installed 24 volt control
23 transformer along with 24 v wall mounted and duct mounted thermostats. All wiring shall be in conduit in
24 accordance with Division 26 00 00 - Electrical and comply with the NEC.
25
26

27 **PART 3 - EXECUTION**

28 **INSTALLATION**

29 Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.
30
31

32 Provide gas shut-off valve and dirt leg at gas connection to each piece of equipment.
33

34 **GAS FIRED UNIT HEATERS**

35 Install units and connect gas, combustion air and vent piping as instructed by the manufacture and in
36 compliance with applicable code requirements. Suspend from building structure to maintain headroom
37 beneath units. Connect combustion air and venting to outside of building as indicated on the drawings and
38 terminate per the manufacturer's instructions.
39

40 **DUCT FURNACES**

41 Install units and connect gas, combustion air and vent piping as instructed by the manufacture and in
42 compliance with applicable code requirements. Connect combustion air and venting to outside of building
43 as indicated on the drawings and terminate per the manufacturer's instructions.
44
45

46 **END OF SECTION**

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SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

PART 1 - GENERAL

SCOPE

This section includes specifications for energy recovery equipment that is used to recover heating and/or cooling energy. Included are the following topics:

PART 1 - GENERAL

- Scope
- Reference
- Related Work
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS

- Air-to-Air Heat Exchangers (Fixed plate type)

PART 3 - EXECUTION

- Installation
- Air-to-Air Heat Exchangers (Fixed plate type)
- Owner Training

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

RELATED WORK

- Section 23 07 00 - HVAC Insulation
- Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC
- Section 23 09 15 - Direct Digital Control Input/Output Point Summary Tables
- Section 23 09 93 - Sequence of Operations for HVAC Controls
- Section 23 33 00 - Air Duct Accessories

QUALITY ASSURANCE

Refer to Division 00 and 01.

SUBMITTALS

Refer to Division 00 and 01.

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.

PART 2 - PRODUCTS

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AIR-TO-AIR HEAT EXCHANGERS (Fixed plate type)

MANUFACTURERS:

Renewaire, Greenheck, Cook or prior approved equal.

DESIGN:

The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.

CASING:

The unit case shall be constructed of G90 galvanized, 20-gauge steel, with lapped corners and zinc plated screw fasteners.

Access doors shall provide easy access to blowers, ERV cores, and filters. Doors shall have an airtight compression seal using closed cell foam gaskets. Pressure taps, with captive plugs, shall be provided allowing cross-core pressure measurement allowing for accurate airflow measurement.

Case walls and doors shall be insulated with 1 inch, 4 pound density, foil/scrim faced, high-density fiberglass board insulation, providing a cleanable surface and eliminating the possibility of exposing the fresh air to glass fibers, and with minimum R-value of 4.3 (hr·ft²·°F/BTU).

HEAT TRANSFER SURFACE:

The energy recovery component shall be of fixed-plate cross-flow construction, with no moving parts.

FILTERS:

Furnish 2" MERV 8 pleated filters and filter track on both entering air sides of unit. Filter rack may be integral with unit or installed independently in duct upstream of unit.

MOTORS:

Blower motors shall be Premium Efficiency, EISA compliant for energy efficiency. The blower motors shall be totally enclosed (TEFC) and be shall be supplied with factory variable frequency drives.

Blowers shall be quiet running, forward curve type and be belt drive. Belt drive motors shall be provided with adjustable pulleys and motor mounts allowing for blower speed adjustment, proper motor shaft orientation and proper belt tensioning.

ELECTRICAL:

The unit electrical box shall include a factory installed, non-fused disconnect switch and a 24 VAC, Class II transformer/relay package.

Unit shall have single-point power connection and a single-point 24 VAC contactor control connection.

CONTROLS:

Unit shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10 degree F and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function or performance of the element. No Condensate drains will be allowed. Unit shall have the capacity to operate continuously without the need for bypass, recirculation, preheaters, or defrost cycles under normal operating conditions.

PART 3 - EXECUTION

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INSTALLATION

Install units in accordance with unit manufacturer's installation requirements in locations indicated on the drawings and as detailed.

Provide concrete equipment pad for unit mounting.

Install "filter" gauges for both airstreams to measure air pressure drop through unit while in operation.

Install thermometers in both supply and exhaust airstreams at inlet and outlet connections.

AIR-TO-AIR HEAT EXCHANGERS (Fixed Plate Type)

Coordinate insulation of unit casing with section 23 07 00 so that the casing is insulated in the manner specified.

Install filter rack with panel filters where supply and exhaust airstreams enter units if units do not already have filters provided or installed.

END OF SECTION

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SECTION 23 81 26
SPLIT-SYSTEM HEAT PUMP

PART 1 - GENERAL

SCOPE

This Section contains specifications for split system heat pump units. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Quality Assurance
- Design Criteria
- Shop Drawings

PART 2 - PRODUCTS

- Manufacturers
- Indoor Unit
- Outdoor Unit
- Unit Electrical and Controls

PART 3 - EXECUTION

- General
- Indoor Unit
- Outdoor Unit
- Start-up

RELATED WORK

Applicable provisions of Division 01 govern work under this Section.

- Section 23 05 00 – Common Work Results for HVAC
- Section 23 05 13 – Common Motor Requirements for HVAC Equipment
- Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment
- Section 23 09 93 – Sequence of Operations for HVAC Controls

QUALITY ASSURANCE

Substitution of Materials: Refer to Division 00 and 01.

DESIGN CRITERIA

Units shall be certified in accordance with ARI Standard 210.

Units and remote electrically powered components shall contain unit mounted, factory prewired terminal block. Electrical components shall be U.L. tested and U.L. labeled.

Units (except for power and control wiring to remote condensing units, thermostats and other specialty control interlocking) shall be factory prewired within unit cabinet and shall meet National, State and local codes. Wiring shall be numbered and connected to numbered wiring terminal.

Split system heat pump unit shall be furnished and installed with components and accessories required for a fully functional system. Verify field piping requirements with the manufacturer.

SHOP DRAWINGS

Submit Shop Drawings for equipment specified under this Section. Include data concerning sizes, dimensions, weights, heating capacities, materials of construction, ratings, electrical data, wiring diagrams, refrigerant piping

1 diagrams, controls, options and manufacturers installation requirements, instructions and recommendations.

2
3 Manufacturer's Shop Drawing submittal shall include complete component descriptive literature, detailed
4 electrical wiring and refrigerant piping diagrams and drawings specifically prepared for this Project.

7 **PART 2 - PRODUCTS**

9 **MANUFACTURERS**

10 Daikin, Mitsubishi, Friedrich, or Carrier.

12 **INDOOR UNIT**

13 Steel frame and cabinet with neutral color, furniture quality exposed exterior panels; removable exterior
14 panels for access for servicing, and built-in discharge louvers. Unit shall include permanent, washable air
15 filters. Filters shall be easily removable for cleaning.

16
17 Indoor unit shall be high wall mount.

18
19 Fans shall be vibration isolated, direct drive type.

20
21 Unit evaporator coil shall have copper tubes, with aluminum fins, refrigerant distributor, and a condensate
22 drain pan with built-in condensate pump capable of providing a 10-foot lift for condensate removal.

24 **OUTDOOR UNIT**

25 Air-cooled, remote mounting, compressor-condensing heat pump unit.

26
27 Unit cabinet shall be zinc or similarly coated with corrosion resistant coating and have removable panels for
28 service access.

29
30 Compressor shall be high efficiency, inverter type with thermal overloads. Compressor shall have vibration
31 isolators to keep sound to a minimum.

32
33 Condenser coil shall have copper tubes with aluminum fins.

34
35 Condenser fan shall be propeller type with totally enclosed, direct drive fan motor.

36
37 Condenser low ambient capacity control shall be capable of providing continuous unit cooling capability
38 down to 30 degrees F ambient outside temperature.

39
40 Outdoor unit shall contain full charge of refrigerant and oil for entire system.

41
42 Refrigeration system shall include external service valves on outdoor unit for unit servicing, and factory
43 supplied, pre-insulated liquid and suction line kit for field installation.

45 **UNIT ELECTRICAL AND CONTROLS**

46 Units shall be complete with motor starters, relays, and control thermostat. Indoor unit fan shall have fan
47 speed controller to allow for fan speed selection from 3 speeds.

48
49 Units shall have single point electrical connection (on each section) with electrical characteristics as
50 specified on Equipment Schedule, and shall allow either aluminum or copper main conductors to be
51 connected to terminal block power connections.

52
53 Control thermostat shall be electronic, 7-day programmable type with LCD display, auto-changeover
54 control, set-up and set-back schedules, built-in compressor time delay and battery back-up.

1 **PART 3 - EXECUTION**

2
3 **GENERAL**

4 System and components shall be installed and operated in strict accordance with manufacturer's instructions
5 and recommendations.

6
7 Both indoor and outdoor sections shall be mounted level.

8
9 **INDOOR UNIT**

10 Suspend indoor unit from building structure with hanger rods and spring vibration isolators.

11
12 Extend cooling coil condensate drain line from unit condensate connection to nearest clear water waste
13 drain location.

14
15 Adjust unit fan speed to provide proper unit operation.

16
17 **OUTDOOR UNIT**

18 Furnish weatherproof fusible electrical disconnect switch with fuses to disconnect electrical power to
19 outside units.

20
21 Outdoor units shall be mounted on roof on roof rail supports.

22
23 **START-UP**

24 3 copies of a written service report shall be submitted to Engineer following initial start-up, signed by
25 serviceman responsible for performing startup and adjustment work. It shall indicate installation is complete,
26 readings taken, and state unit has been placed in proper running condition as recommended by unit
27 manufacturer and within intent of Contract Documents.

28
29 **END OF SECTION**
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SECTION 23 82 00
HEATING AND COOLING TERMINAL UNITS

PART 1 - GENERAL

SCOPE

This section includes specification for heating and cooling terminal equipment using water and/or steam as the source. Included are the following topics:

PART 1 - GENERAL

- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS

- Electric Cabinet Unit Heaters

PART 3 - EXECUTION

- Installation
- Electric Cabinet Unit Heaters

RELATED WORK

Section 23 05 13 - Common Motor Requirements for HVAC Equipment

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.

DESIGN CRITERIA

Forced Circulation Coils: Ratings certified in accordance with ARI 410.

Electrical Equipment and heaters shall be UL listed for the service specified.

1 Electrical components and work must be in accordance with National Electrical Code.
2
3

4 **PART 2 - PRODUCTS**

5 **ELECTRIC CABINET UNIT HEATERS**

6 Manufacturers: Berko, Chromalox, Markel, Trane, or approved equal.
7
8

9 Steel with baked on enamel finish in color as selected by Architect, removable front panel and access door
10 to speed switch and integral thermostat (when so equipped). Unit types shall be configured as follows in
11 accordance with schedules as specified on Drawings:
12

13 Ceiling recess mounted non-ducted units shall be provided with bottom inlet grille and air discharge grille.
14

15 Electric resistance elements mounted in fin tube bundle.
16

17 Centrifugal, double width, forward curved type.
18

19 Integral prewired disconnect switch, thermostatic fan switch to dissipate residual heat, thermostatic
20 automatic high temperature cut out sensing temperature along full length of coil, silent operating contactors
21 to control stages of heating and integral control circuit transformer.
22

23 Fan powered units must be provided with thermostat and controls to maintain fan operation until residual
24 heat in the heating elements has been dissipated. The fans and motors shall be balanced and mounted for
25 vibration free operation.
26

27 NEMA approved, resiliently mounted permanent split capacitor type of speeds indicated with speed
28 selector switch.
29

30 Units shall have remote mounted thermostat with remote sensor (thermostat to be mounted in adjacent
31 mechanical room with remote sensor located in Family Room and Mothers Room).
32

33 Provide all temperature control, wiring and interlocking necessary to perform the specified control
34 sequence. All relays, transformers and controls are to be in enclosures. All wiring shall be in conduit in
35 accordance with Division 26 00 00 - Electrical and comply with the NEC.
36

37 On a call for heating by the remote sensor thru the thermostat, the unit shall cycle on. The reverse shall
38 occur once space temperature setpoint has been reached.
39

40 **PART 3 - EXECUTION**

41 **INSTALLATION**

42 Install units in accordance with manufacturer's installation instructions.
43
44

45 Coordinate location of units with other trades to assure correct recess size for recessed units.
46
47

48 After installation, provide protective covers to prevent accumulation of dirt on units during balance of
49 construction.
50

51 **ELECTRIC CABINET UNIT HEATERS**

52 Install units where indicated on the drawings and details.
53

54 Units will be wired by the Electrical Contractor.
55
56

END OF SECTION

1 SECTION 26 05 00

2
3 GENERAL ELECTRICAL REQUIREMENTS

4 PART 1 - GENERAL

5 1.01 SCOPE

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

8 1.02 GENERAL PROVISIONS

- 9 A. In general, the work includes: Electrical work and the kindred materials and operations as indicated
10 on the drawings and as specified in the following articles of Section 26 05 00, 26 09 23, 26 20 00 and
11 27 10 00.
- 12 B. Job Information: Obtain at building including:
- 13 1. Conditions affecting this Section of the Work.
 - 14 2. Accessibility
 - 15 3. Storage space.

16 1.03 GENERAL REQUIREMENTS

- 17 A. This Section of the Specifications applies to all electrical work. The General Conditions,
18 Supplementary Conditions, Summary of the Work, Instructions to Bidders and all Sections of the
19 Conditions of the Contract form a part of these specifications and the Contractor shall consult them in
20 detail. Electrical work indicated in other Sections of the Specifications to be done by the Electrical
21 Contractor shall be included in the Work of this Section.

22 1.04 DEFINITIONS

- 23 A. Certain terms used herein; on the drawings; and in the contract documents, shall be defined as
24 follows:
- 25 B. Provide: Furnish and install complete and ready for service.
- 26 C. Exposed: Exposed to view in any room, hallway, passageway, or outside.
- 27 D. Approval: The approval of the Architect in writing or by signed rubber stamp applied to drawings,
28 illustrations, etc.

29 1.05 INTENT OF DRAWINGS AND SPECIFICATIONS

- 30 A. These specifications and attendant drawings are intended to cover a complete installation of systems.
31 The omission of expressed reference to any item of labor or material necessary for the proper
32 execution of the work in accordance with present practice of the trade shall not relieve the Contractor
33 from providing such additional labor and materials.

34 1.06 DRAWINGS

- 35 A. The Electrical drawings do not attempt to show the complete details of building construction which
36 affect the electrical installation. The Contractor shall refer to the architectural, civil, structural and
37 mechanical drawings for additional details which affect the proper installation of this work. The
38 Contractor is cautioned that diagrams showing electrical connections and/or circuiting are
39 diagrammatic only and must not be used for obtaining lineal runs of wire to conduit. Wiring diagrams
40 do not necessarily show the exact physical arrangement of the equipment.
41

1 1.07 MATERIAL AND EQUIPMENT

- 2 A. All material and equipment shall be new and of the quality used for the purpose in good commercial
3 practice, and shall be standard product of reputable manufacturers. Each major component of
4 equipment shall have the manufacturer's name, catalog number, and capacity or rating on a nameplate,
5 securely affixed on the equipment in a conspicuous place.

6 1.08 SUBSTITUTION AND APPROVAL OF MATERIAL

- 7 A. See Instructions to Bidders.
- 8 B. Such requests shall be accompanied by three copies of all necessary illustrations, cuts, drawings and
9 descriptions of material proposed for substitution and shall fully describe all points in which it differs
10 from the articles specified. Two copies will be retained by the Architect and one copy returned to the
11 Contractor with approval or revisions indicated thereon.

12 1.09 DAMAGE TO OTHER WORK

- 13 A. The Electrical Contractor will be held rigidly responsible for all damages to the work of his own or
14 any other trade resulting from the execution of his work. It shall be the Contractor's responsibility to
15 adequately protect his work at all times. All damages resulting from his operations shall be repaired
16 or the damaged portions replaced by the party originally performing the work, (to the entire
17 satisfaction of the Architect), and all cost thereof shall be borne by the Contractor responsible for the
18 damage.

19 1.10 COOPERATION WITH OTHER TRADES

- 20 A. This Contractor shall completely cooperate with all other trades in the matter of planning and
21 executing of the work. Every reasonable effort shall be made to prevent conflict and interferences as
22 to space requirements, dimensions, locations, openings, sleeving or other matters which tend to delay
23 or obstruct the work of any trade.

24 1.11 NEGLIGENCE

- 25 A. Should the Contractor fail to provide materials, templates, etc., or other necessary information causing
26 delay or expense to another party, he shall pay the actual amount of the damages to the party who
27 sustained the loss.

28 1.12 FIELD CHANGES

- 29 A. Should any change in drawings or specifications be required to comply with local regulations and/or
30 field conditions, the Contractor shall refer same to Architect for approval before any work which
31 deviates from the original requirements of the drawings and specifications is started. In the event of
32 disagreements as to the necessity of such changes, the decision of the Architect shall be final.

33 1.13 CUTTING AND PATCHING IN NEW CONSTRUCTION

- 34 A. As necessary and with approval to permit the installation of conduit or any part of the work under this
35 branch. Any cost caused by defective or ill-timed work shall be by the party responsible therefor.
36 Patching of holes, openings, etc. resulting from the work of this branch shall be furnished by this
37 contractor.

- 38 B. See Division 1 for additional requirements.

39 1.14 COMPLETION DATES

- 40 A. This Contractor shall be in a position to meet all completion dates established by the Architect and
41 shall furnish all labor of all classes required to meet such schedules and completion dates.
42

1 1.15 STANDARDS, CODES AND PERMITS

- 2 A. All work shall be installed in accordance with National, State and Local electrical codes, laws,
3 ordinances and regulations. Comply with all applicable OSHA regulations.
- 4 B. All materials shall have a U.L. label where a U.L. standards and/or test exists.
- 5 C. Prepare and submit to all authorities having jurisdiction, for their approval, all applications and
6 working drawings required by them.
- 7 D. Secure and pay for all permits and licenses required.

8 1.16 CLEAN-UP

- 9 A. This Contractor shall at all times keep the premises free from excessive accumulation of waste
10 material or rubbish resulting from his work, including tools, scaffolding and surplus materials, and he
11 shall leave his work broom clean or its equivalent.
- 12 B. In case of dispute, Architect may order the removal of such rubbish and charge the cost to the
13 responsible contractor as determined by the Architect. At the time of final clean-up all fixtures and
14 equipment shall be thoroughly cleaned and left in proper condition for their intended use.

15 1.17 TESTS

- 16 A. The Contractor shall provide all instrumentation, labor and conduct all tests required by the Architect.
17 All tests shall be made before any circuit or item of equipment is permanently energized. Circuits
18 shall be phased out and loads shall be distributed as evenly as possible on all phases. All phase
19 conductors shall be entirely free from grounds and short circuits. All instrumentation and personnel
20 required for testing shall be provided by the Contractor and all tests shall be conducted in the presence
21 of the Architect or his authorized representative.
- 22 B. System Tests:
- 23 1. The following tests are required prior to energization of the electrical system:
- 24 a. Secondary feeders shall have an insulation resistance test utilizing a megger applying a
25 test potential of 500 volts DC minimum.
- 26 b. Establish secondary phase to ground voltages.
- 27 c. Establish proper phase relationship and motor rotation.
- 28 2. The following tests are required under normal load condition:
- 29 a. Record secondary phase to phase and phase to ground voltages and phase currents at all
30 major equipment, apparatus, and on all secondary feeders. Voltage readings shall be
31 taken at line side terminals of distribution centers and panelboards.
- 32 b. Confirm proper phase relationship and motor rotation.
- 33 c. Confirm load balance at distribution centers and panels. Rebalance load if necessary
34 such that the minimum unbalance between phases shall not exceed 7-1/2%.
- 35 d. Confirm operation of all electrically operated apparatus, such as circuit breakers,
36 transfer switches, etc., by exercising same under load.
- 37 e. Record all settings and calibrations of circuit breakers, transfer switches, transformers,
38 meters, timing devices, etc.
- 39 C. Records:
- 40 1. All test data obtained by the E.C. or manufacturer/supplier shall be recorded and filed with the
41 maintenance manual as part of permanent job records. Test data shall include identification of
42 instruments employed (field test only), condition of test (time, date, weather, etc.), parameters
43 of test, personnel conducting test, and any pertinent information or conditions noted during the
44 test.
45

1 1.18 SHOP DRAWINGS

- 2 A. Submit to Engineer for review, copies of manufacturer's shop drawings and/or equipment brochure
3 depicting:
- 4 1. Lighting Fixtures
 - 5 2. Panelboards
 - 6 3. Occupancy Sensors
 - 7 4. Telecommunications Equipment and Cabling
 - 8 5. Wiring Devices
 - 9 6. Other materials at the request of the Engineer
- 10 B. See Section 01300.
- 11 C. Shop drawings shall bear the Contractor's stamp indicating approval.
- 12 D. Any equipment fabrication prior to shop drawing review shall be at the Contractor's risk.

13 1.19 WORKMANSHIP

- 14 A. The installation of all work shall be made so that its several component parts will function as a
15 workable system complete with all accessories necessary for its operation, and shall be left with all
16 equipment properly adjusted and in working order. The work shall be executed in conformity with
17 the best accepted standard practice of the trade so as to contribute to efficiency and appearance. It
18 shall also be executed so that the installation will conform and adjust itself to the building structure,
19 its equipment and its usage.

20 1.20 DRAWINGS OF OTHER TRADES

- 21 A. The Contractor shall consult the drawings of the work for the various other trades; field layouts of the
22 parties performing the work of the other trades; their shop drawings, and he shall be governed
23 accordingly in laying out his work.
- 24 B. Specifically examine shop drawings to confirm voltage, current characteristics, and other wiring
25 requirements for utilization equipment. Bring any discrepancies to the attention of the A/E.

26 1.21 FIELD MEASUREMENTS

- 27 A. The Contractor shall take all field measurements necessary for his work and shall assume the full
28 responsibility for their accuracy.

29 1.22 STRUCTURAL INTERFERENCES

- 30 A. Should any structural interferences prevent the installation of the outlets, running of conduits, etc., at
31 points shown on drawings, the necessary minor deviation therefrom, as determined by the Architect,
32 may be permitted. Minor changes in the position of the outlets or equipment if decided upon before
33 any work has been done by the Contractor shall be made without additional charge.

34 1.23 EXAMINATION OF PLANS, SPECIFICATIONS AND SITE

- 35 A. Before submitting a bid, the Contractor shall visit the site and familiarize himself with all features of
36 the building and site which may affect the execution of his work. No extra payment will be allowed
37 for the failure to obtain this information. If in the opinion of the Contractor there are omissions or
38 errors in the plans or specifications, the Contractor shall clarify these points with the Architect before
39 submitting his bid. In lieu of written clarification by addendum, resolve all conflicts in favor of the
40 greater quantity or better quality.

1 1.24 GUARANTEE

- 2 A. The Contractor shall unconditionally guarantee his work and all components thereof, excluding
3 lamps, for a period of one year from the date of his final payment. He shall remedy any defects in
4 workmanship and repair or replace any faulty equipment which shall appear within the guarantee
5 period to the entire satisfaction of the Architect at no additional charge.

6 1.25 TEMPORARY WIRING AND SERVICE

- 7 A. Provide 200 ampere 120/240 volt temporary service. Temporary service shall support construction
8 activities as well as the following:
- 9 1. Provide 100 amperes for existing tent feed.
 - 10 2. Provide four 20A, 1P circuits for gazebo receptacles.
- 11 B. All contractors shall provide and maintain their own extension cords and additional lamps as required
12 to perform his work properly. Contractors requiring temporary connections to 3 phase power service
13 and single phase feeders for other than lighting and small fractional horsepower motorized tools shall
14 make arrangement with the Electrical Contractor. Contractors requiring lighting outside of the
15 building shall make their own arrangements with the Electrical Contractor and pay all costs for
16 installation, maintenance and removal. Contractors requiring electrical equipment over one HP,
17 including welders, hoists, heaters and coolers shall make their own arrangements for such service
18 beyond the main switch and shall pay all costs thereof.
- 19 C. No permanent electrical equipment or wiring shall be used for temporary connections, unless
20 authorized by this Section, upon signed order and with approval by the Architect in behalf of the
21 Owner. Such approvals shall not shorten guarantee period.
- 22 D. Electrical energy to be paid for by owner.

23 1.26 ELECTRICAL SERVICE

- 24 A. Provide new electrical service at 120/240 volt single phase three wire.
- 25 B. Refer to the electrical drawings for the one line riser diagrams.
- 26 C. Cost for utility charges is by Owner.
- 27 D. Coordinate all work with utility.

28 1.27 BRANCH CIRCUIT WIRING

- 29 A. See plans for general arrangement of circuits, conduit runs, and ratings of branch circuits and special
30 circuits.
- 31 B. Provide everything necessary to comply with the general scheme shown, including all types of
32 control.
- 33 C. Circuit numbers as shown on plans are for contractor to plan his wiring and for estimating purposes.
34 These numbers are not necessarily consecutive numbers of the panelboard breakers. Balanced load on
35 bus is to be the determining factor in arrangement of circuits. Balance loading to within 7 1/2%.
- 36 D. Minimum size of lighting system branch circuit conductors to be #12 AWG.
- 37 E. Conductors terminating at wired outlets shall extend at least eight (8) inches beyond outlet box
38 conduit fitting.
- 39 F. 120 volt circuit home runs greater than 50 feet in length shall have #10 AWG minimum size between
40 panel and first receptacle or fixture outlet.

41 1.28 MOTOR WIRING

- 42 A. Unless otherwise indicated on the drawings or elsewhere in these specifications, all motors shall be
43 furnished by others.

- 1 B. Motors shall be set in place by others and the associated motor starters and controllers shall be turned
2 over to this Contractor for erection and line voltage power wiring.
- 3 C. Any contractor supplying starters and controllers that are not part of this contract shall index same and
4 provide this Contractor with instructions as to proper location in sufficient time to permit the
5 installation of a concealed raceway system.
- 6 D. Where this Contractor is required to provide control wiring, the Contractor supplying the controllers
7 shall provide all necessary and required wiring diagrams for proper installation.
- 8 E. Low voltage (less than 115 volts) control wiring shall be by others, unless noted elsewhere in the
9 specifications except that this Contractor shall extend circuit to associated transformers, wire and
10 connect to same.
- 11 F. This Contractor shall examine the plans and specifications of other sections and shall include in his
12 bid all control wiring, as referenced to be performed by Section 16001.
- 13 G. Required disconnect switches furnished by other sections shall be installed by Section 16001.
14 Furthermore, this Contractor shall provide all disconnect switches required by code that are not
15 furnished by other sections.

16 1.29 SPECIAL OUTLETS

- 17 A. General: Furnish and install outlets, wiring and receptacles accordingly, at locations required by
18 equipment serviced or otherwise as directed. Extend wiring to outlets on equipment and make final
19 connection.

20 1.30 IDENTIFICATION

- 21 A. General:
- 22 1. Materials and equipment installed under this Section shall be clearly identified as listed below.
23 2. Locate identification conspicuously.
24 3. Terminology to be approved by Architect.
25 4. See plans for any additional items to be identified.
26 5. Loads such as motors shall be described by function rather than by the system of arbitrary
27 number as shown on electrical plans.
28 6. Use abbreviations sparingly.
- 29 B. Laminated Bakelite Plates: Engraved plastic nameplate shall be securely screwed or riveted to the
30 following equipment. Size 1" x 4" with 3/8" high letters; unless space available dictates differently.
- 31 1. Each panelboard, contactor, time switch, starter or disconnect switch. Locate on inside cover
32 of panels.
33 2. Each feeder at all accessible locations.
34 3. Each end of empty conduit runs to indicate the intended use of the conduit and the location of
35 opposite end. Use room numbers that are permanently assigned.
- 36 C. Typewritten Directory: Each panelboard both new and existing shall be provided with a typewritten
37 directory attached to the inside of panel door and covered with clear plastic indicating load served and
38 rooms served by each protective device in the respective panel. Spares and spaces shall be clearly
39 identified.
- 40 D. Switch Station:
- 41 1. All key switches shall be engraved indicating controlled item.
42 2. All remote switches shall be engraved indicating controlled item.
- 43 E. Conductor Identification:
- 44 1. Identify each conductor at each wiring device, connector or splice point with permanently
45 attached wrap-around adhesive markers as manufactured by Brady Co. or 3M.
46 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. Refer to the electrical specification section 27 10 00 – Telecommunication Distribution System for detailed information on the telephone system.
- B. Dane County is currently using a VOIP (voice over internet protocol) telephone system so all telephone cabling will be using same cabling used for data.
- C. Telephone instruments, switching equipment, wiring, terminal blocks, and other accessories shall be furnished and installed by the Owner (Dane County)
- D. This Contractor shall supply all required conduit, sleeves, and service fittings for the telephone system.
- E. All conduits shall be complete with fish wire by this Contractor, and all telephone outlets shall be fed by a minimum 3/4" conduit.
- F. All telephone boxes shall be two gang boxes with one gang plaster cover.
- G. Verify all phone locations with the Architect in the field.

1.33 SEALING AND FIREPROOFING

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 1.06 SYSTEM OPERATION

- 2 A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction
3 with the occupancy system.

4 PART 2 - PRODUCTS

5 2.01 ACCEPTABLE MANUFACTURERS

- 6 A. The Watt Stopper, Inc.
7 B. Or Equivalent Devices by the Following Manufacturers
8 1. Hubbell
9 2. Leviton
10 3. Sensor Switch

11 2.02 SYSTEM OPERATION

- 12 A. All products shall be Watt Stopper product numbers:
13 1. Ceiling Sensors: W-500A, W-1000A, W-2000A, W-2000H, W-PIR, DT-100L, CI-100, CI-
14 200.
15 2. Wall Sensors: WI-120A, WI-277A, WS-120, WS-277, WM-120, WM-277.
16 3. Power and Slave Packs: A-120E, A-277E, S-120/277.
17 4. Low Temperature: CB-100, CB-200.
18 B. Wall switch sensors shall be capable of detection of motion at desk top level up to 300 square feet,
19 and gross motion up to 1,000 square feet.
20 C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,000 watts at 277
21 volts, and shall have 180 degree coverage capability.
22 D. Bi-level wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1,000
23 watts to 277 volts.
24 E. Passive Infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier
25 configuration, with grooves-in to eliminate dust and residue build-up.
26 F. Passive Infrared and Dual Technology sensors shall have fully automatic operation, offer daylighting
27 footcandle adjustment control and be able to accommodate dual level lighting.
28 G. All sensors shall be capable of operating normally with electronic ballast, PL lamp systems, and rated
29 motor loads.
30 H. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic
31 reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
32 I. All sensors shall have readily accessible, user adjustable controls for time delay and sensitivity.
33 Controls shall be recessed to limit tampering.
34 J. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is
35 utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is
36 replaced. This control shall be recessed to prevent tampering.
37 K. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.005% tolerance
38 to assure reliable performance and eliminate sensor cross talk. Sensors using multiple frequencies are
39 not acceptable.
40 L. All sensors shall provide a method of indication to verify that motion is being detected during testing
41 and that the unit is working.
42

- 1 M. Where specified, sensor shall have an internal additional isolated relay with Normally Open,
2 Normally Closed, and Common outputs for use with HVAC control, Data Logging, and other control
3 options. Sensors utilizing separate components to achieve this function are not acceptable.
- 4 N. All sensors shall have no leakage current to load in manual or in Auto/Off mode for safety purposes
5 and shall have voltage drop protection.
- 6 O. The Contractor shall certify in writing that installed sensors comply with the specified California
7 Energy Commission criteria for ultrasonic sound.
- 8 P. All sensors shall have UL rated, 94V-0 plastic enclosures.

9 2.03 CIRCUIT CONTROL HARDWARE - CU

- 10 A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to
11 mount on external J boxes and be integrated self-contained unit consisting internally of load switching
12 control relay and a transformer to provide low-voltage power to a minimum of two (2) sensors.
- 13 B. Relay Contacts shall have ratings of:
14 1. 13A - 120 VAC Tungsten
15 2. 20A - 120 VAC Ballast
16 3. 20A - 277 VAC Ballast

17 2.04 CONTROL WIRING

- 18 A. Control wiring between sensors and controls units shall be Class II, 18-24 AWG stranded U.L.
19 Classified, PVC insulated or Teflon jacketed cable approved for use in plenums, where applicable.

20 PART 3 - EXECUTION

21 3.01 INSTALLATION

- 22 A. It shall be the contractor's responsibility with the suppliers assistance to locate and aim sensory in the
23 correct location required for complete and proper volumetric coverage within the range of coverage(s)
24 of controlled areas. Rooms shall have ninety (90) to one hundred (100) percent coverage to
25 completely cover the controlled area to accommodate all occupancy habits of single or multiple
26 occupants at any location within in the room(s). The locations and quantities of sensors shown on the
27 drawings are diagrammatic and indicate only rooms which are to be provided with sensors. The
28 contractor shall provide additional sensors if required to properly and completely cover the respective
29 room.
- 30 B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's
31 factory authorized representative, at the owner's facility, to verify placement of sensors and
32 installation criteria.
- 33 C. Proper judgement must be exercised in executing the installation in the available space and to
34 overcome local difficulties due to space limitations or interference of structural components. The
35 contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's
36 personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy
37 sensing devices and systems, or;

38 END OF SECTION 26 09 23

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SECTION 26 20 00

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 Section 01340.
- E. Operation and Maintenance (O&M) Data:
 - 1. Maintenance data for materials and products for inclusion in Operating and Maintenance specified in Section 01730.
 - 2. Submit in accordance with Section 01340 and 01730.
- 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.

1 PART 2 - PRODUCTS

2 2.01 ELECTRICAL METALLIC TUBING (EMT)
3 INTERMEDIATE METALLIC CONDUIT (IMC)
4 GALVANIZED RIGID STEEL CONDUITS (GRS)

5 A. Manufacturers:

- 6 1. Allied Steel
- 7 2. Omega
- 8 3. Wheatland
- 9 4. Columbia

10 B. Manufacturer's standard lengths and size.

11 C. Protected inside and out by hot-dipped galvanized or electrogalvanized coating.

12 D. Minimum size: 3/4 inch, except as follows:

- 13 1. Conduit for lighting switch legs containing switched conductors only may be 1/2 inch.
- 14 2. As noted on drawings.

15 E. Do not use aluminum conduit.

16 2.02 PLASTIC CONDUIT (PVC)

17 A. Manufacturers:

- 18 1. Carlon.
- 19 2. Genova.
- 20 3. Certainteed.

21 B. Standard lengths and sizes.

22 C. Schedule 40 or 80, heavy wall rigid plastic (PVC) conduit manufactured to NEMA TC2 standards,
23 UL listed, and as required by NEC.

24 D. Rated for 90EC cable.

25 E. Minimum size: 2" inches.

26 2.03 FLEXIBLE CONDUIT

27 A. Manufacturers:

- 28 1. Triangle PWC, Inc.
- 29 2. Anaconda
- 30 3. Flexsteel
- 31 4. American Flexible Conduit

32 B. Galvanized flexible steel.

33 C. Standard conduit sizes.

34 D. Minimum Size: 1/2 inch.

35 2.04 LIQUIDTIGHT FLEXIBLE CONDUIT

36 A. Manufacturers:

- 37 1. O-Z/Gedney Company
- 38 2. American Flexible Conduit
- 39 3. Flex-Guard, Inc.
- 40 4. Liquatite

- 1 5. Anaconda
- 2 B. Galvanized flexible steel.
- 3 C. Standard conduit sizes.
- 4 D. Minimum Size: 1/2 inch.
- 5 E. Heavy wall PVC jacket.
- 6 2.05 FITTINGS
- 7 A. Manufacturers:
- 8 1. Appleton Electric Company.
- 9 2. Steel City, American Electric.
- 10 3. Oz-Gedney Co.
- 11 B. Steel or malleable iron, zinc galvanized or cadmium plated.
- 12 C. Do not use set screw or indentor type fittings.
- 13 D. Do not use aluminum or die cast fitting.
- 14 E. EMT IMC and GRS Connectors and Couplings:
- 15 1. Threaded.
- 16 2. Gland compression type.
- 17 3. Insulated throat.
- 18 4. Rain and concrete type.
- 19 F. Flexible Conduit Connectors and Couplings:
- 20 1. Threaded.
- 21 2. Insulated throat.
- 22 3. Grounding type.
- 23 4. Gland compression type.
- 24 G. Liquidtight Flexible Conduit Fittings:
- 25 1. Liquidtight.
- 26 2. Insulated throat.
- 27 3. Threaded.
- 28 4. Gland compression type.
- 29 5. Grounding type.
- 30 H. Expansion Joints:
- 31 1. Conduit expansion fittings complete with copper bonding jumper, Crouse-Hinds Type XJ.
- 32 2. Conduit expansion/deflection fittings with copper bonding jumper, Crouse-Hinds Type XD.
- 33 I. Seals:
- 34 1. Wall entrance, Appleton Type FSK or FSC.
- 35 J. Drain Fittings:
- 36 1. Automatic Drain Breather:
- 37 a. Explosionproof.
- 38 i. Safe for Class I, Groups C and D.
- 39 b. Capable of passing minimum 25 cc water/minimum and minimum 0.05 cubic foot
- 40 air/minimum at atmospheric pressure.
- 41

- 1 2. Condensate Drain:
- 2 a. Conduit outlet body, Type T.
- 3 b. Threaded, galvanized plug with 3/16 inch drilled holed through plug.
- 4 2.06 WIRES, CABLES, AND CONNECTORS
- 5 A. Manufacturers:
- 6 1. Wire and Cable:
- 7 a. Continental
- 8 b. Southwire.
- 9 c. Rome Cable.
- 10 d. Houston Wire and Cable.
- 11 e. Beldon.
- 12 f. Dekoron.
- 13 g. Royal
- 14 h. South
- 15 i. General
- 16 2. Connectors:
- 17 a. Burdy.
- 18 b. Thomas and Betts.
- 19 c. Blackburn, American Electric.
- 20 3. Electrical Tape:
- 21 a. 3M Scotch Brand.
- 22 b. Plymouth.
- 23 c. or equal.
- 24 B. Copper wire only.
- 25 C. 600 v insulation (ASTM standard compounds) and color code conductors for low voltage (secondary
- 26 feeders and branch circuits) as required by NEC.
- 27 1. Type THWN-2 Stranded: Single conductor No. 12 AWG minimum for branch circuit and
- 28 feeder conductors size No. 8 AWG and smaller.
- 29 2. Type XHHW-2 Stranded: Single conductor for branch circuits, feeders and service conductors
- 30 larger than No. 8 AWG.
- 31 3. Provide grounding conductor with same insulation as circuit conductors when run with circuit
- 32 conductors.
- 33 4. Type THWN-2 Stranded: Single conductor No. 12 AWG minimum for 120 v control wiring
- 34 and No. 14 AWG minimum for graphic indication, nonshielded instrumentation and other
- 35 control wiring operating at less than 120 v unless otherwise noted on Drawings.
- 36 a. Provide high density polyethylene jacketed multi-wire cable assemblies in underground
- 37 conduit or duct.
- 38 D. Joints, Taps, and Splices:
- 39 1. Joints, Taps, and Splices in Conductors No. 10 AWG and Smaller: UL listed compression
- 40 spring-type solderless connectors with plastic cover.
- 41 2. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless two or four-bolt
- 42 compression type connectors of type that will not loosen under vibration or normal strains.
- 43 3. Terminations: Compression-type crimp lugs.
- 44

1 2.07 BOXES

2 A. Manufacturer:

- 3 1. Interior Outlet Boxes:
- 4 a. Appleton Electric Company.
- 5 b. Raco.
- 6 c. Steel City, American Electric.
- 7 2. Weatherproof Outlet Boxes:
- 8 a. Appleton Electric Company.
- 9 b. Crouse-Hinds Company.
- 10 c. O-Z/Gedney company.
- 11 d. Perfect-Line, American Electric.
- 12 3. Junction and Pull Boxes:
- 13 a. Hoffman Engineering Company.
- 14 b. Keystone Columbia, Inc.
- 15 c. Electromate.

16 B. Outlet Boxes - Flush Mounted:

- 17 1. Wall Outlets: Square corner, galvanized masonry type with internally mounted ears or 4-
- 18 inches square with raised cover having square corners and internally mounted ears.
- 19 2. Ceiling Lighting Fixture Outlet Boxes: 4-inch square galvanized box with raised cover set
- 20 flush with finished surface, complete with 3/8 inch fixture stud.

21 C. Outlet Boxes - Surface Mounted:

- 22 1. General Use: 4-inches square with raised device cover.
- 23 2. Weatherproof: Cast galvanized with threaded hub.
- 24 3. Safety outlet enclosure - Tay Mac Co. - Verify outlet configuration.
- 25 4. Hazardous Locations: Cast galvanized approved for classification of area.

26 D. Junction and Pull Boxes:

- 27 1. Fabricate from code gauge galvanized steel, with covers held in-place by corrosion resistant
- 28 machine screws.
- 29 2. Size as required by code for number of conduits and conductors entering and leaving box.
- 30 3. Provide with welded seams where applicable, and equipment with corrosion resistant nuts,
- 31 bolts, screws, and washers.
- 32 4. Finish with rust inhibiting primer.

33 2.08 FIRE RATED THROUGH FLOOR FITTINGS

- 34 A. None required.

35 2.09 WIRING DEVICES

36 A. Manufacturers:

- 37 1. Hubbell Wiring Device Division.
- 38 2. Pass and Seymour, Inc.
- 39 3. Leviton
- 40 4. Cooper Wiring Devices

41 B. Fabricated Devices:

- 42 1. Factory-fabricated, specification grade wiring devices in type, color, and electrical rating for
- 43 service indicated. Ivory color or as selected by ENGINEER OR OWNER.

- 1 2. Wiring devices of one manufacturer.
- 2 3. See Drawing symbol schedule for identification of device type.
- 3 C. Switches:
- 4 1. General Use Lighting Switches: 20 amp toggle, equal to Hubbell No. 1221-I series.
- 5 2. Switches controlling equipment, operation of which is not evident from switch position, shall
- 6 include flush neon pilot light in conjunction with proper switch. Each switch shall be complete
- 7 with engraved plate to identify equipment being controlled (white letters on black, 1/8 inch
- 8 high minimum).
- 9 D. Receptacles:
- 10 1. General use duplex receptacles: NEMA No. 5-20R, grounding type, 20 amp Hubbell No. 5362
- 11 Specification Grade.
- 12 2. Special purpose receptacles as shown on Drawings and schedules.
- 13 3. Receptacles supplied from standby emergency system to have red face.
- 14 4. GFI receptacles shall be Hubbell GFR5352IA
- 15 E. Wiring Device Plates and Covers:
- 16 1. Wall plates for wiring devices with ganging and cut-outs as indicated, provided with metal
- 17 screws for securing plates to devices, screw heads colored to match finish of plate.
- 18 2. Plates for Flush Mounted Devices: Equal to Sierra P line specifications grade Type No. 430
- 19 brushed stainless steel.
- 20 3. Telephone outlet configuration to match telephone outlet jack or cable.
- 21 4. Device plates for surface mounted Type FS or FD boxes to be Type FSK galvanized steel.
- 22 5. Device plates for surface mounted, 4-inch square bossed to be ½ inch raised galvanized steel
- 23 covers.
- 24 6. Weatherproof outlet enclosure for exterior devices or devices in damp locations to be marked
- 25 galvanized gray cast malleable with gasketed lift cover plate as shown on Drawings. Suitable
- 26 for wet locations while in use. Enclosure must be gasketed. Provide Intermatic WP1010MC,
- 27 WP1010HMC, or WP1030MC with appropriate mounting base(s) and inserts.

28 2.10 MOTOR STARTERS

- 29 A. None required.

30 2.11 MOTOR AND CIRCUIT DISCONNECTS

- 31 A. Manufacturers:
- 32 1. Eaton/Cutler-Hammer
 - 33 2. Siemens
 - 34 3. Square D
 - 35 4. Westinghouse
 - 36 5. Allen Bradley
 - 37 6. General Electric
 - 38 7. Furnas

39 B. Enclosed Circuit Breaker Construction:

- 40 1. Dual cover interlock.
- 41 2. External trip indication.
- 42 3. Provisions for control circuit interlock.
- 43 4. Padlock provisions for padlock in Off position.
- 44 5. Handle attached to box, not cover.
- 45 6. Handle position indicates On, Off or Tripped.

- 1 7. Provisions for insulated or groundable neutral.
- 2 C. Safety Switches:
- 3 1. NEMA heavy duty Type HD.
- 4 2. Dual cover interlock.
- 5 3. Visible blades.
- 6 4. Provisions for control circuit interlock.
- 7 5. Pin type hinges.
- 8 6. Tin plated current carrying parts.
- 9 7. Quick make and break operator mechanism.
- 10 8. Handle attached to box, not cover.
- 11 9. Handle position indication, On in up position and Off in down position.
- 12 10. Padlock provisions for up to 3 padlocks in Off position.
- 13 11. UL listed lugs for type and size of wire specified.
- 14 12. Spring reinforced fuse clips for Class R fuses.
- 15 13. Provisions for insulated or groundable neutral.
- 16 14. UL listed short circuit rating 200,000 RMS amp with Class R fuses.
- 17 D. Enclosures:
- 18 1. Indoor: NEMA 1 code gauge steel with rust inhibiting primer and baked enamel finish.
- 19 2. Outdoor: NEMA 3R code gauge zinc coated steel with baked enamel finish.
- 20 2.12 FUSES
- 21 A. Manufacturers:
- 22 1. Bussmann
- 23 2. Gould Shawmut
- 24 3. Littlefuse
- 25 4. Brush
- 26 B. 250 v. Fuses:
- 27 1. Class RK-1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000-amp
- 28 interrupting rating.
- 29 a. Gould Shawmut Tri-Onic TR-R, dual element, time delay with short circuit protection
- 30 for motor, transformer, welder, feeder, and main service protection.
- 31 C. 600v Fuses:
- 32 1. Class RK-1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000-amp
- 33 interrupting rating.
- 34 a. Gould Shawmut Tri-Onic TR-R, dual element, time delay with short circuit protection
- 35 for motor, transformer, welder, feeder and main service protection.
- 36 2. Class L, bolt-in 601 to 6,000 amps, 200,000-amp interrupting rating.
- 37 a. Gould Shawmut A48Y, time delay for overload and short circuit protection for motor,
- 38 transformer, feeder, and main service protection.
- 39 3. Class CC, fast acting, single element, 1/10 to 30 amps, 200,000-amp interrupting rating.
- 40 a. Gould Shawmut ATDR, UL listed for motor control circuits, lighting ballasts, control
- 41 transformers, and street lighting fixtures.
- 42 D. Spare Fuses:
- 43 1. 10%, minimum of 3, of each type and rating of installed fuses.
- 44

- 1 E. Spare Fuse Cabinet:
- 2 1. Cabinet: Wall-mounted, 18-gauge minimum steel unit with full-length, recessed piano-hinged
- 3 door with key coded cam lock and pull.
- 4 2. Size: Provide for orderly storage of spare fuses of this project plus 15% spare capacity,
- 5 minimum.
- 6 3. Finish: Gray baked enamel.
- 7 4. Cabinet Door: Bear legend in stencilled 1-1/2 inch high letters, "Spare Fuses."

8 2.13 PANELBOARDS

- 9 A. Manufacturers:
- 10 1. Eaton-Cutler-Hammer
- 11 2. Siemens
- 12 3. Square D
- 13 4. Westinghouse
- 14 5. General Electric
- 15 B. Panelboard Ratings:
- 16 1. UL listed short circuit rating (integral equipment rating):
- 17 a. Up to 240 v: 10,000 RMS symmetrical amp minimum.
- 18 b. Up to 480 v: 14,000 RMS symmetrical amp minimum.
- 19 c. As shown on Drawings.
- 20 C. Panelboard Construction:
- 21 1. Main breaker or main lugs only, per panelboard schedule.
- 22 2. Molded case circuit breakers.
- 23 3. Terminals:
- 24 a. UL listed for type or wire specified.
- 25 b. Anti-turn solderless compression type.
- 26 4. Bussing:
- 27 a. Distributed phase sequence type.
- 28 b. 225 amps, 98% conductivity hard drawn copper or as shown on panelboard schedule or
- 29 Drawings.
- 30 c. Copper.
- 31 d. Mounting hardware behind usable space.
- 32 5. Gutters adequate for wire size used, 4-inch minimum.
- 33 6. Boxes:
- 34 a. Code gauge galvanized steel.
- 35 b. Without knockouts.
- 36 7. Fronts:
- 37 a. Panel front cover shall have piano hinge to allow access to wiring gutters without
- 38 removal of panel trim. Hinged trim held in place with screw fasteners. Door shall be
- 39 built into trim, which allows access to breakers as well as to hinged trim screw
- 40 fasteners. Breaker access door shall have the following features:
- 41 i. Concealed piano hinge.
- 42 ii. Flush stainless steel cylinder tumbler type locks with spring loaded door pulls.
- 43 iii. Locks keyed alike.
- 44 iv. Rust inhibiting primer, baked enamel finish.
- 45 v. Dead front safety type.

- 1 vi. Concealed hinges and trim clamps..
- 2 vii. Circuit Directory:
- 3 viii. Suitable for complete descriptions.
- 4 ix. Clear plastic cover.
- 5 8. Typewritten card inside panel door.
- 6 9. Special features as shown on Drawings.
- 7 10. Code gauge steel.
- 8 11. Engraved laminated nameplate in accordance with Section 26 05 00.

9 2.14 MOLDED CASE CIRCUIT BREAKERS

- 10 A. Manufacturers:
- 11 1. Square D
- 12 B. Permanent Trip Circuit Breakers:
- 13 1. Lighting Panel Circuit Breakers:
- 14 a. Thermal and magnetic protection.
- 15 b. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
- 16 c. Bolt-on type unless otherwise noted on Drawings.
- 17 d. Quick make and break toggle action.
- 18 e. Handle trip indication.
- 19 f. Handle position indication, On, Off, and Tripped centered.
- 20 g. UL listed for type of wire specified.
- 21 h. UL listed short circuit rating (integrated equipment rating).
- 22 i. Up to 240 v: 10,000 RMS symmetrical amp minimum.
- 23 ii. Up to 480 v: 14,000 RMS symmetrical amp minimum.
- 24 i. UL SWDL switching duty on 120 v. circuits for switched circuits.
- 25 j. Switch neutral common trip per NEC 514-5 for fuel pumps.
- 26 2. Power Panel Circuit Breakers:
- 27 a. Thermal and magnetic protection.
- 28 b. Magnetic protection only in combination with motor starters and motor circuit
- 29 protectors (MCP).
- 30 c. Single magnetic trip adjustment.
- 31 d. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
- 32 e. Push-to-trip test button.
- 33 f. Bolt-on type.
- 34 g. Quick make and break toggle action.
- 35 h. Handle trip indication.
- 36 i. Handle position indication, On, Off, and Tripped centered.
- 37 j. UL listed for type of wire specified.
- 38 k. UL listed short circuit rating (integrated equipment rating).
- 39 i. Up to 240 v: 10,000 RMS symmetrical amp minimum.
- 40 ii. Up to 480 v: 14,000 RMS symmetrical amp minimum.

41 2.15 GROUND-FAULT CIRCUIT INTERRUPTER RECEPTACLES (GFCI)

- 42 A. Ratings:
- 43 1. 120 vac.
- 44 2. 20 amp.

- 1 B. Tripping Requirement:
- 2 1. UL Class A.
- 3 C. Construction:
- 4 1. Shallow depth.
- 5 2. Line and load terminal screws.
- 6 3. Noise suppression.
- 7 4. Feed through.
- 8 5. Standard duplex wall plates shall fit.
- 9 6. NEMA 5-20R configuration.
- 10 D. Meet requirements of UL 943 ground-fault circuit interrupters.

11 2.16 GROUNDING AND BONDING

- 12 A. Products: Of types indicated and of sizes and ratings to comply with NEC. Where types, sizes,
- 13 ratings, and quantities indicated are in excess of NEC requirements, more stringent requirements and
- 14 greater size, rating, and quantity indications govern.
- 15 B. Conductor Materials: Copper.
- 16 C. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including
- 17 stranding.
- 18 D. Equipment Grounding Conductor: Green insulated.
- 19 E. Grounding Electrode Conductor: Stranded cable.
- 20 F. Bare Copper Conductors:
- 21 1. Solid Conductors: ASTM B3.
- 22 2. Assembly of Stranded Conductors: ASTM B8.
- 23 3. Tinned Conductors: ASTM B33.
- 24 G. Ground Bus: Bar annealed copper bars of rectangular cross section.
- 25 H. Braided Bonding Jumpers: Copper tape, braided No. 30 gage bar copper wire, terminated with copper
- 26 ferules.
- 27 I. Bonding Strap Conductor/Connectors: Soft copper, 0.05 inches thick and 2 inches wide, except as
- 28 indicated.
- 29 J. Connector Products
- 30 1. General: Listed and labeled as grounding connectors for materials used.
- 31 2. Pressure Connectors: High-conductivity-plated units.
- 32 3. Bolted Clamps: Heavy-duty units listed for application.
- 33 4. Exothermic Welded Connections: Provide in kit form and select for specific types, sizes, and
- 34 combinations of conductors and other items to be connected.

35 PART 3 - EXECUTION

36 3.01 GENERAL

- 37 A. Install products in accordance with NEC, manufacturer's instructions, applicable standards, and
- 38 recognized industry practices to ensure products serve intended function.

39 3.02 CONDUITS AND CONDUIT FITTINGS

- 40 A. Complete conduit installation prior to installing cables.
- 41 B. Unless specifically indicated otherwise on Drawings, use rigid galvanized steel conduit for general
- 42 wiring.

- 1 C. Provide watertight conduit system where installed in wet places, underground or where buried in
2 masonry or concrete.
- 3 D. EMT conduit may be used for conduit sizes up to 4 inches.
- 4 E. Conduit shall be run concealed except exposed surface conduit may be installed where noted on
5 Drawings or where concealment found to be impractical or impossible, and only with approval of
6 ENGINEER.
- 7 F. Continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes.
- 8 G. Enter and secure to boxes ensuring electrical continuity from point of service to outlets.
- 9 H. Conduit runs extending through areas of different temperature or atmospheric conditions or partly
10 indoors and partly outdoors shall be sealed, drained, and installed in manner preventing drainage of
11 condensed or entrapped moisture into cabinets, motors or equipment enclosures.
- 12 I. Run conduits within concrete structures parallel to each other and spaced on center of at least three
13 times conduit trade diameter with minimum 2-inch concrete covering. Conduits over 1 inch may not
14 be installed in slab without approval of ENGINEER.
- 15 J. Run exposed conduits parallel to or at right angles with lines of building.
- 16 K. Route conduit runs above suspended acoustical ceilings not interfering with tile panel removals.
- 17 L. Secure conduit in-place with not less than 1 malleable corrosionproof alloy strap or hanger per 8 feet
18 of conduit.
- 19 1. Do not use perforated strapping.
- 20 M. Connections to Motors and Equipment Subject to Vibration:
- 21 1. Flexible steel conduit not over 3 feet long or where exposed in mechanical and utility areas and
22 not subjected to moisture, dirt, and fumes.
- 23 2. Liquidtight flexible conduit not over 3 feet long where exposed in finished areas or where
24 subject to moisture, dirt, fumes, oil, corrosive atmosphere, exposed or concealed, with
25 connectors to ensure liquidtight, permanently grounded connection. Locate where least subject
26 to physical abuse.
- 27 N. Use double lock nuts and insulated bushings with threads fully engaged.
- 28 O. Connectors at fixture bodies and boxes shall be rigidly secured with galvanized lock nut and bushing.
- 29 P. Cap conduits after installation to prevent entry of debris.
- 30 Q. Install conduit expansion fittings complete with bonding jumper in following locations.
- 31 1. Conduit runs crossing structural expansion joint.
- 32 2. Conduit runs attached to two separate structures.
- 33 3. Conduit runs where movement perpendicular to axis of conduit may be encountered.
- 34 R. Install 4 feet-0 inch to 6 feet-0 inch flexible steel conduit drops from independent junction box
35 mounted above ceiling and accessible from below ceiling to recessed ceiling mounted equipment.
36 Allow for positioning of equipment to tile increments.
- 37 S. Negotiate beams and changes in ceiling heights with LB conduit fittings on outside corners and ells
38 on inside corners. Arrange bends and offsets in parallel conduits to present neat symmetrical
39 appearance.
- 40 T. In precast areas, run conduits in insulation space or in floor topping without crossing conduits, using
41 3/4 in. maximum conduit size.
- 42 U. Core drill through reinforced concrete with approval of ENGINEER.
- 43 V. Split, crushed or scarred conduit not acceptable.
- 44 W. Do not route over boiler, incinerator or other high temperature equipment.

1 X. Flexible metal conduit can only be used for final connections to motors, transformers, or to light
2 fixtures above suspended ceilings.

3 3.03 SURFACE METAL RACEWAY

4 A. Mount to surface with No. 8 flathead fasteners or approved support clips.

5 B. Do not pinch wires.

6 C. Remove metal burrs and sharp edges.

7 D. Provide bushing.

8 E. Install in accordance with manufacturer's recommendations.

9 F. Provide covers where two lengths come together.

10 3.04 WIRE AND CABLE

11 A. Run wire and cable in conduit unless otherwise indicated on Drawings.

12 B. On branch circuits, use standard colors.

13 C. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with 2 half-lap layers of
14 vinyl plastic electrical tape and finish wrap of color coding tape, where required by code.

15 D. Run ground wire with power circuits; conduit shall not be grounding path.

16 E. Color Coding: Conductors for lighting and power wiring as indicated below.

17	<u>Phase</u>	<u>208/120v</u>	<u>480/277v</u>
18	A	Black	Brown
19	B	Red	Orange
20	C	Blue	Yellow
21	Neutral	White	Gray
22	Ground	Green	Green

23 3.05 BOXES

24 A. Install knockout closures to cap unused knockout holes where blanks have been removed.

25 B. Locate boxes to ensure accessibility of electrical wiring.

26 C. Secure boxes rigidly to subsurface upon which being mounted or solidly embed boxes in concrete or
27 masonry. Do not support from conduit.

28 D. Do not burn holes, use knockout punches or saw.

29 E. Provide outlet box accessories as required for each installation such as mounting brackets, fixture
30 study, cable clamps, and metal straps for supporting outlet boxes compatible with outlet boxes being
31 used and meeting requirements of individual wiring situations.

32 F. Location of outlets and equipment shown on Drawings is approximate. Verify exact location.

33 G. Minor modification in location of outlets and equipment is considered incidental up to distance of 10
34 feet with no additional compensation, provided notification of modification is given prior to roughing
35 in of outlet.

36 H. Flush outlets shall have edges or plaster flush with finished wall or ceiling surfaces so plates can be
37 drawn tightly to wall or ceiling surfaces.

38 I. Mounting heights:

39 1. Shall conform to ADA guidelines.

40 2. In general, unless otherwise shown on Drawings:

41 a. Switches: 48 inches above floor to top of box.
42

- 1 b. AC Receptacles and Telephone Outlets: 15 inches above floor to bottom of box or 6
2 inches above counters, counter backsplashes in finished areas; 48 inches to top of box
3 above floor in unfinished areas.
- 4 c. Wall Bracket Lighting Fixtures: 8 inches above mirrors or 6 feet-6 inches above floor.
- 5 d. Pushbuttons: 48 inches above floor to top of box.
- 6 e. Motor Starters and Disconnect Switches: 60 inches above floor.
- 7 i. Thermostats: 48 inches above floor.
- 8 f. Bells and Horns: 8 feet-0 inches above floor.
- 9 g. Clocks: 8 ft.-0 inches above floor.
- 10 h. Fire Alarm visual signals 80" above floor.
- 11 i. Emergency Battery Units: 8 ft. - 0 inches above floor or 12" below ceiling.
- 12 J. Do not install boxes back to back or through wall. Offset outlet boxes on opposite sides of wall,
13 minimum 12 inches.
- 14 K. Where emergency switches occur adjacent to normal light switches, install in separate boxes in
15 accordance with NEC and device plate color coding separation.
- 16 L. Light Fixture Outlet Boxes:
- 17 1. Securely mount with approved type bar hangers spanning structural members to support
18 weight of fixture.
- 19 2. Do not support from conduit.
- 20 3. Equip with 3/8-inches fixture stud and tapped fixture ears.
- 21 3.06 FIRE RATED THROUGH FLOOR FITTINGS
- 22 A. None required.
- 23 3.07 WIRING DEVICES
- 24 A. Do not install devices until wiring is complete.
- 25 B. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or
26 otherwise. Make circuit connections by using wire connectors and pigtails.
- 27 C. Install gasket plates for devices or system components having light emitting features such as switch
28 with pilot light and dome lights. Where installed on rough textured surfaces, seal with black self-
29 adhesive polyfoam.
- 30 D. Ground receptacles with insulated green ground wire from device ground screw to bolted outlet box
31 connection or as shown on Drawings.
- 32 E. Wrap wiring devices with insulating tape.
- 33 F. Install emergency switches which occur adjacent to normal light switches in separate boxes to
34 maintain systems isolation in accordance with NEC.
- 35 3.08 OVERCURRENT PROTECTIVE DEVICES.
- 36 A. Install fuses just prior to energizing equipment.
- 37 B. Locate circuit breakers as shown on Drawings.
- 38 C. Install GFCI receptacles as required by NEC.
- 39 3.09 PANELBOARDS
- 40 A. Flush or surface mount as specified on Drawings and schedules.
- 41 B. Support panel cabinets independently to structure with no weight bearing on conduits.
- 42 C. Install recessed Panelboards to allow cover to be drawn tight against wall to provide neat appearance.

- 1 D. Install panelboards so top breaker is not higher than 6 feet-0 inches above floor.
- 2 E. Adjacent panel cabinets shall be same size and mounted in horizontal alignment.
- 3 F. Install typewritten directory in each panelboard, accurately indicating rooms or equipment being
- 4 served after final circuit changes have been made to balance circuit loads.
- 5 G. Install four spare 1 inch conduits from top of each flush mounted panelboard to area above ceiling for
- 6 future use. On flush mounted panelboards located on first and higher level floors, provide two spare 1
- 7 inch conduits from bottom of panelboard to ceiling area of floor below for future use.

8 3.10 GROUNDING AND BONDING

- 9 A. Application
- 10 1. Equipment Grounding Conductor Application: Comply with NEC Article 250 for sizes and
- 11 quantities of equipment grounding conductors, except where larger sizes or more conductors
- 12 are indicated.
- 13 a. Install separate insulated equipment grounding conductors with circuit conductors.
- 14 Raceway may be used as equipment ground conductor where feasible in non-hazardous
- 15 areas and permitted by NEC for lighting circuits. Install insulated equipment ground
- 16 conductor in nonmetallic raceways unless designated for telephone or data cables.
- 17 B. Installation
- 18 1. General: Ground electrical systems and equipment in accordance with NEC requirements
- 19 except where Drawings or Specifications exceed NEC requirements.

20 3.11 FIELD QUALITY CONTROL

- 21 A. Control Circuits, Branch Circuits, Feeders, Motor Circuits, and transformers:
- 22 1. Megger check to phase-to-phase and phase-to-ground insulation levels.
- 23 a. Do not megger check solid state equipment.
- 24 2. Continuity.
- 25 3. Short circuit.
- 26 4. Operational check.
- 27 B. Wiring Devices:
- 28 1. Test receptacles with Hubbell 5200, Woodhead 1750 or equal tester for correct polarity, proper
- 29 ground connection, and wiring faults.

30 3.12 ADJUSTMENT AND CLEANING

- 31 A. Circuit Breakers:
- 32 1. Adjustable settings shall be set to provide selective coordination, proper operation, and
- 33 compliance with NEC.
- 34 B. Restore damaged areas on PVC jacketed rigid conduit with spray type touch-up coating compound or
- 35 as directed by manufacturer.
- 36 C. Pull cleaning plug through conduits to clear of dirt, oil, and moisture.

37 END OF SECTION 26 20 00

SECTION 27 10 00

TELECOMMUNICATIONS DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 SCOPE

- A. The basic scope of this project is as follows:
 - 1. Extend fiber optic cable and copper cable from the telecom room in the Glacier Grill building to the new Restroom Building.
 - 2. Provide new cables and patch panels within the Restroom Building.
 - 3. Provide all certification and testing of the equipment and cabling as required.
- B. Section Includes: Equipment, materials, labor, and services to provide telephone and data distribution system including, but not limited to:
 - 1. Raceway and boxes
 - 2. Telephone and data cabling terminations
 - 3. Telecommunications outlets
 - 4. Terminal blocks/cross-connect systems
 - 5. System testing
 - 6. Documentation and submissions
- C. 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.
- D. 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.

1.02 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

- 1 g. ANSI/TIA/EIA-526-7 -- Measurement of Optical Power Loss of Installed Single-
- 2 Mode Fiber Cable Plant
- 3 h. ANSI/TIA/EIA-526-14A -- Measurement of Optical Power Loss of Installed
- 4 Multimode Fiber Cable Plant
- 5 i. ANSI/TIA/EIA-758(A) -- Customer-Owned Outside Plant Telecommunications
- 6 Cabling Standard
- 7 B. Install cabling in accordance with the most recent edition of BICSI® publications:
- 8 1. BICSI -- Telecommunications Distribution Methods Manual
- 9 2. BICSI -- Cabling Installation Manual
- 10 3. BICSI -- LAN Design Manual
- 11 4. BICSI -- Customer-Owned Outside Plant Design Manual
- 12 C. Federal, state, and local codes, rules, regulations, and ordinances governing the work, are as fully part
- 13 of the specifications as if herein repeated or hereto attached. If the contractor should note items in the
- 14 drawings or the specifications, construction of which would be code violations, promptly call them to
- 15 the attention of the owner's representative in writing. Where the requirements of other sections of the
- 16 specifications are more stringent than applicable codes, rules, regulations, and ordinances, the
- 17 specifications shall apply.

18 1.03 PERMITS, FEES, AND CERTIFICATES OF APPROVAL

- 19 A. As prerequisite to final acceptance, supply to the owner certificates of inspection from an inspection
- 20 agency acceptable to the owner and approved by local municipality and utility company serving the
- 21 project.

22 1.04 SYSTEM DESCRIPTION

- 23 A. Telecommunications cabling system generally consists of one telecommunications outlet in each
- 24 workstation, wall telephones in common and mechanical areas and telecommunications rooms (TRs)
- 25 located on each floor.
- 26 B. The typical work area consists of a single-gang plate with two standards compliant work area outlets.
- 27 1. Each work area outlet consists of one (1) four-pair data Category 6 cable or above, installed
- 28 from work area outlet to the TR. Terminate data cables on rack mounted modular patch panels
- 29 located in the appropriate TR.

30 1.05 SUBMITTALS

- 31 A. Submit to the engineer/designer shop drawings, product data (including cut sheets and catalog
- 32 information), and samples required by the contract documents. Submit shop drawings, product data,
- 33 and samples with such promptness and in such sequence as to cause no delay in the work or in the
- 34 activities of separate contractors. The engineer/designer will indicate approval of shop drawings,
- 35 product data, and samples submitted to the engineer by stamping such submittals "APPROVED" with
- 36 a stamp. Submitted shop drawings shall be initialed or signed by the contractor, showing the date and
- 37 the contractor's legitimate firm name.
- 38 1. By submitting shop drawings, product data, and samples, the contractor represents that he or
- 39 she has carefully reviewed and verified materials, quantities, field measurements, and field
- 40 construction criteria related thereto. It also represents that the contractor has checked,
- 41 coordinated, and verified that information contained within shop drawings, product data, and
- 42 samples conform to the requirements of the work and of the contract documents. The
- 43 engineer/designer remains responsible for the design concept expressed in the contract
- 44 documents as defined herein.
- 45

- 1 2. The engineer's/designer's approval of shop drawings, product data, and samples submitted by
2 the contractor shall not relieve the contractor of responsibility for deviations from requirements
3 of the contract documents, unless the contractor has specifically informed the
4 engineer/designer in writing of such deviation at time of submittal, and the engineer/designer
5 has given written approval of the specific deviation. The contractor shall continue to be
6 responsible for deviations from requirements of the contract documents not specifically noted
7 by the contractor in writing, and specifically approved by the engineer in writing.
- 8 3. The engineer's/designer's approval of shop drawings, product data, and samples shall not
9 relieve the contractor of responsibility for errors or omissions in such shop drawings, product
10 data, and samples.
- 11 4. The engineer's/designer's review and approval, or other appropriate action upon shop
12 drawings, product data, and samples, is for the limited purpose of checking for conformance
13 with information given and design concept expressed in the contract documents. The
14 engineer's/designer's review of such submittals is not conducted for the purpose of
15 determining accuracy and completeness of other details such as dimensions and quantities, or
16 for substantiating instructions for installation or performance of equipment or systems, all of
17 which remain the responsibility of the contractor as required by the contract documents. The
18 review shall not constitute approval of safety precautions or of construction means, methods,
19 techniques, sequences, or procedures. The engineer's/designer's approval of a specific item
20 shall not indicate approval of an assembly of which the item is a component.
- 21 B. Perform no portion of the work requiring submittal and review of shop drawings, product data, or
22 samples, until the engineer/designer has approved the respective submittal. Such work shall be in
23 accordance with approved submittals.
- 24 C. Submit shop drawings, product data, and samples as a complete set within thirty (30) days of award of
25 contract.
 - 26 1. For initial submission and for resubmission required for approval, submit four (4) copies of
27 each item. The engineer/designer will only return two copies. Make reproductions as required
28 for your use and distribution to subcontractors.
 - 29 2. Illegible submittals will not be checked by the engineer.
- 30 D. General: Submit the following:
 - 31 1. Bill of materials, noting long lead time items
 - 32 2. Optical loss budget calculations for each optical fiber run
 - 33 3. Project schedule including all major work components that materially affect any other work on
34 the project
- 35 E. Shop drawings: Submit the following:
 - 36 1. Backbone (riser) diagrams.
 - 37 2. System block diagram, indicating interconnection between system components and
38 subsystems.
 - 39 3. Interface requirements, including connector types and pin-outs, to external systems and
40 systems or components not supplied by the contractor.
 - 41 4. Fabrication drawings for custom-built equipment.
- 42 F. Product Data -- Provide catalog cut sheets and information for the following:
 - 43 1. Wire and cable
 - 44 2. Outlets, jacks, faceplates, and connectors
 - 45 3. All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings
 - 46 4. Terminal blocks and patch panels
 - 47

- 1 G. Project record drawings:
- 2 1. Submit project record drawings at conclusion of the project and include:
- 3 a. Approved shop drawings
- 4 b. Plan drawings indicating locations and identification of work area outlets, nodes,
- 5 telecommunications rooms (TRs), and backbone (riser) cable runs
- 6 c. Telecommunications rooms (TRs) and equipment room (ER and/or MC) termination
- 7 detail sheets.
- 8 d. Cross-connect schedules including entrance point, main cross-connects, intermediate
- 9 cross-connects, and horizontal cross-connects.
- 10 e. Labeling and administration documentation.
- 11 f. Warranty documents for equipment.
- 12 g. Copper certification test result printouts and diskettes.
- 13 (a.) Optical fiber power meter/light source test results.

14 1.06 QUALITY ASSURANCE

- 15 A. The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this
- 16 type and size.
- 17 B. Upon request by the engineer/designer, furnish a list of references with specific information regarding
- 18 type of project and involvement in providing of equipment and systems.
- 19 C. Equipment and materials of the type for which there are independent standard testing requirements,
- 20 listings, and labels, shall be listed and labeled by the independent testing laboratory.
- 21 D. Where equipment and materials have industry certification, labels, or standards (i.e., NEMA -
- 22 National Electrical Manufacturers Association), this equipment shall be labeled as certified or
- 23 complying with standards.
- 24 E. Material and equipment shall be new, and conform to grade, quality, and standards specified.
- 25 Equipment and materials of the same type shall be a product of the same manufacturer throughout.
- 26 F. Subcontractors shall assume all rights and obligations toward the contractor that the contractor
- 27 assumes toward the owner and engineer/designer.

28 1.07 WARRANTY

- 29 A. Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and
- 30 workmanship for a period of not less than fifteen (15) years from date of acceptance by the owner.
- 31 The owner shall deem acceptance as beneficial use.
- 32 B. Transfer manufacturer's warranties to the owner in addition to the General System Guarantee. Submit
- 33 these warranties on each item in list form with shop drawings. Detail specific parts within equipment
- 34 that are subject to separate conditional warranty. Warranty proprietary equipment and systems
- 35 involved in this contract during the guarantee period. Final payment shall not relieve you of these
- 36 obligations.

37 1.08 DELIVERY, STORAGE, AND HANDLING

- 38 A. Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and
- 39 misalignment. Coordinate with the owner for secure storage of equipment and materials. Do not
- 40 store equipment where conditions fall outside manufacturer's recommendations for environmental
- 41 conditions. Do not install damaged equipment; remove from site and replace damaged equipment
- 42 with new equipment.
- 43

1 1.09 SEQUENCE AND SCHEDULING

- 2 A. Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing
3 for conformance to specific job completion dates. As a minimum, dates are to be provided for bid
4 award, installation start date, completion of station cabling, completion of riser cabling, completion of
5 testing and labeling, cutover, completion of the final punch list, start of demolition, owner acceptance,
6 and demolition completion.

7 1.10 USE OF THE SITE

- 8 A. Use of the site shall be at the owner's direction in matters in which the owner deems it necessary to
9 place restriction.
- 10 B. Access to building wherein the work is performed shall be as directed by the owner.
- 11 C. The owner will occupy the premises during the entire period of construction for conducting his or her
12 normal business operations. Cooperate with the owner to minimize conflict and to facilitate the
13 owner's operations.
- 14 D. Schedule necessary shutdowns of plant services with the owner, and obtain written permission from
15 the owner. Refer to article - CONTINUITY OF SERVICES herein.
- 16 E. Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and
17 operations of the owner.

18 1.11 CONTINUITY OF SERVICES

- 19 A. Take no action that will interfere with, or interrupt, existing building services unless previous
20 arrangements have been made with the owner's representative. Arrange the work to minimize
21 shutdown time.
- 22 B. Owner's personnel will perform shutdown of operating systems. The contractor shall give three (3)
23 days' advance notice for systems shutdown.
- 24 C. Should services be inadvertently interrupted, immediately furnish labor, including overtime, material,
25 and equipment necessary for prompt restoration of interrupted service.

26 PART 2 - PRODUCTS

27 2.01 MANUFACTURERS

- 28 A. Hubbell, Ortronics, Panduit
- 29 1. Or any other approved equivalent manufacturer that meets the performance requirements of
30 this specification. Category 6 performance is standard.
- 31 2. Contractor shall be a certified installer.
- 32 B. Berk-Tek
- 33 C. Belden
- 34 D. Mohawk
- 35 E. Commscope
- 36 F. Superior Essex
- 37 G. Optical Cable Corporation

38 2.02 FABRICATION

- 39 A. Fabricate custom-made equipment with careful consideration given to aesthetic, technical, and
40 functional aspects of equipment and its installation.
- 41

- 1 2.03 SUITABILITY
- 2 A. Provide products that are suitable for intended use, including, but not limited to environmental,
3 regulatory, and electrical.
- 4 2.04 STATION CABLE
- 5 A. VOICE TELECOMMUNICATIONS STATION CABLE
- 6 1. Solid copper, 24 AWG, 100 W balanced twisted-pair (UTP) Category 6 cables with four
7 individually twisted-pairs, which meet or exceed the mechanical and transmission performance
8 specifications in ANSI/TIA/EIA-568-B.2 up to 250 MHz.
9 a. Listed Type CMP (as required in the NEC 2005).
- 10 B. DATA STATION CABLE (Copper)
- 11 1. Solid copper, 24 AWG, 100 W balanced twisted-pair (UTP) Category 6 cables with four
12 individually twisted-pairs, which meet or exceed the mechanical and transmission performance
13 specifications in ANSI/TIA/EIA-568-B.2 up to 250 MHz.
14 a. Listed Type CMP (as required in the NEC 2005).
- 15 2.05 WORK AREA OUTLETS
- 16 A. VOICE/DATA WORK AREA OUTLETS (Copper only)
- 17 1. Single-gang stainless steel mounting plate with four (4) openings containing the following
18 devices:
19 a. Voice Outlet - 8-pin modular, Category 6, unkeyed, white, pinned to T568A standards.
20 b. Data Outlet - 8-pin modular, Category 6, unkeyed, blue, pinned to T568A standards.
21 2. The device color of outlets and jacket color for cabling that will be used on the project shall be
22 coordinated with the Dane County Information Technology (IT) Department prior to the
23 beginning of any work. It is intended that the Dane County standard being maintained.
- 24 B. WALL VOICE OUTLETS
- 25 1. Single-gang stainless steel faceplate with six-conductor jack and wall telephone mounting lugs
- 26 C. DATA ONLY WORK AREA OUTLET
- 27 1. Single-gang faceplate with 8-pin modular, category 6, unkeyed, blue data jack, pinned to
28 T568A standards
- 29 D. VOICE ONLY WORK AREA OUTLET
- 30 1. Single-gang faceplate with 8-pin modular, category 6, unkeyed, white telephone jack, pinned
31 to T568A standards
- 32 2.06 PATCH PANELS
- 33 A. 19 in. rack mountable, 24-port 8-pin modular to insulation displacement connector (IDC) meeting
34 Category 6 performance standards, and pinned to either T568 (A or B) standards. Typical examples of
35 IDC connections are the 110, BIX, and Krone.
- 36 2.07 BACKBONE FIBER OPTIC CABLE
- 37 A. General
- 38 1. Cables shall incorporate Optical fibers meeting the specifications detailed in the sub-section(s)
39 below. Backbone Fiber Optic Cable sizing (fiber count) shall be per Project Drawings.
- 40 B. Duct Type Fiber Optical Cable
- 41 1. This cable shall be suitable for installation in underground duct and in innerduct. (Innerduct
42 may be installed in underground duct or supported on walls.)
43 2. Cable shall be a Loose Buffer design.

- 1 3. Cable materials shall be all dielectric (no conductive material).
- 2 4. Cable shall incorporate a blocking material, swellable yarn, or other means to prevent the
- 3 incurison of water into the cable.
- 4 5. Cable Jacket:
- 5 a. Cable Jacket shall be Polyethylene (PE) and free of holes, splits, and blisters. The
- 6 cable jacket shall be marked with the manufacturer's name, words identifying the
- 7 cable type (e.g. "Optical Cable" or "Fiber Optic Cable"), year of manufacture, and
- 8 sequential length markings. The actual length of the cable shall be within -0/+1% of
- 9 the length markings. The marking shall be in a contrasting color to the cable jacket.
- 10 6. Temperature Range:
- 11 a. Storage: -40° to +70°C (no irreversible change in attenuation)
- 12 Operating -40° to +70°C
- 13 Installation -30° to +70°C
- 14 b. Humidity Range: 0 to 100%
- 15 c. Maximum Tensile Strength:
- 16 During Installation: 2700 Newton (600 lb. force) (no irreversible change in
- 17 attenuation)
- 18 d. Long Term: 890 N (200 lb. force)
- 19 e. Bending Radius:
- 20 During Installation: 20 times cable diameter
- 21 No Load: 10 times cable diameter
- 22 C. Optical Fiber Specifications - Backbone Cable
- 23 1. General
- 24 a. The fiber count in each cross-section will vary. For quantities and other design
- 25 information, refer to the Project Drawings.
- 26 b. All optical fibers shall be sufficiently free of surface imperfections and inclusions to
- 27 meet the optical, mechanical, and environmental requirements of this specification.
- 28 Factory optical fiber splices are not allowed.
- 29 c. All fibers shall have been subjected to a minimum tensile proof test by the fiber
- 30 manufacturer equivalent to 100-kpsi.
- 31 d. All fibers in each cable shall be guaranteed to meet the stated specifications.
- 32 2. Multi-mode Optical Fibers (50-micron core) LASER-Optimized
- 33 a. Fiber Type:
- 34 i. Multi-mode; doped silica core surrounded by a concentric glass cladding.
- 35 ii. ISO/IEC type OM4
- 36 iii. Fiber shall be meet requirements of TIA-492AAAC Detail Specification for
- 37 850 nm LASER-Optimized, 50/125 µm, Class 1a Graded-Index Multimode
- 38 Optical Fibers.
- 39 b. Fiber Coating Diameter:
- 40 i. 250 µm (nominal) primary coating; 900 µm (nominal) secondary coating where
- 41 tight buffer cable design is specified.
- 42 ii. All coatings shall be mechanically strippable without damaging the optical fiber.
- 43 c. Attenuation (max. @ 23±5 °C; Backbone; dB/km):
- 44 i. @ 850 nm 3.5
- 45 ii. @ 1300 nm 1.5
- 46 d. Bandwidth (min.; MHz*km):
- 47 i. OFL 1500 @ 850 nm; 500 @ 1300 nm

- 1 ii. EMB 2000 @ 850 nm
2 e. No multi-mode optical fiber shall show a point discontinuity greater than 0.2 dB at the
3 specified wavelengths. Such a discontinuity or any discontinuity showing a reflection
4 at that point shall be cause for rejection of that fiber by the Owner.

5 2.08 FIBER OPTIC PATCH PANEL

6 A. Fiber Optic Connector

- 7 1. The Optical Connector shall be LC-type.
8 2. The connector ferrule shall be ceramic or glass-in-ceramic. The optical fiber within the
9 connector ferrule shall be secured with an adhesive or mechanical process to prevent pistoning
10 and other movement of the fiber strand.
11 3. The use of connector designs that feature a pre-cleaved fiber stub and factory polished
12 connector assembly are acceptable. Acceptable means for mating the cabled fiber with the
13 fiber stub include mechanical and fusion splice methods.
14 4. The Connector Body shall be a Composite material.
15 5. The attenuation per mated pair shall not exceed the following values:
16 a. Multimode 0.75 dB
17 b. Single-mode 0.75 dB
18 c. Mated pair attenuation shall include in-connector stub splice or splice used to splice
19 pigtail to backbone cable.
20 d. These values shall hold throughout the Cable System. Connectors shall sustain a
21 minimum of 200 mating cycles per EIA/TIA-455-21 without violating specifications.
22 6. The connector shall meet the mechanical performance criteria of the applicable EIA/TIA-455
23 Fiber Optic Test Procedures (FOTP).
24 7. Color of Connector Body or strain-relief boot LC Connector shall indicate fiber type as
25 follows:
26 a. Multimode (50-micron; LASER-optimized) OM4 – Aqua

27 B. Enclosure and Adapter Panels

- 28 1. All terminated fibers shall be mated to Duplex LC Adapters. Adapters shall be mounted on a
29 panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to
30 accommodate a changing variety of connector types.
31 2. Color of Adapter (all except ST-type) shall indicate fiber type as follows:
32 a. Multimode (50-micron; LASER-optimized) OM4 – Aqua
33 3. Fiber Optic Patch Panels shall be rack-mounted.
34 4. Fiber Optic Patch Panel enclosure shall be sized to accommodate the total fiber count to be
35 installed at each location as defined in the specifications and drawings - including those not
36 terminated (if applicable).
37 5. Unit height shall be 2 RU minimum to simplify access.
38 6. Fiber Optic Patch Panel shall be enclosed assemblies affording protection to the cable
39 subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or
40 retractable front cover designed to protect the connector couplings and fiber optic jumpers.
41 7. The patch panel enclosure shall provide for strain relief of incoming cables and shall
42 incorporate radius control mechanisms to limit bending of the fiber to the manufacturer's
43 recommended minimums or 1.2", whichever is larger.
44 8. Access to the inside of the patch panel enclosure during installation shall be from the front
45 and/or rear. Panels that require any disassembly of the cabinet to gain entry will not be
46 accepted.
47

- 1 9. All Fiber Optic Patch Panels shall provide protection to both the “facilities” and “user” side of
2 the coupling. The patch panel enclosure shall be configured to require front access only when
3 patching. The incoming cables (e.g. Backbone, Riser, etc.) shall not be accessible from the
4 patching area of the panel. The enclosure shall provide a physical barrier to access of such
5 cables.
- 6 10. Where termination is to include splicing of factory-terminated cable assemblies, Patch Panel
7 enclosure shall be sized adequately to accommodate the required splice hardware and fiber
8 slack. Alternately, a separate enclosure may be used. The splice hardware shall not be
9 accessible from the "user" side of the enclosure. Refer to Part 3 article “Splicing Procedure –
10 Fiber Optic” for installation and performance requirements.
- 11 C. Fiber Optic Cable Installation
- 12 1. Provide cable slack in each Backbone fiber optic cable. This slack is exclusive of the length of
13 fiber that is required to accommodate termination requirements and is intended to provide for
14 cable repair and/or equipment relocation.
- 15 a. Store cable slack in a fashion as to protect it from damage and be secured in the
16 termination enclosure or a separate enclosure designed for this purpose. Multiple
17 cables may share a common enclosure. Slack required in the various subsystems is as
18 follows:
- 19 b. Backbone Intra-Building: A minimum of 5-meters (approx. 15-feet) of slack cable
20 (each cable) shall be coiled and secured at one (1) end - preferably at the Entrance
21 Room and/or Main Equipment Room. Cable slack installed other than at each end of
22 cable run shall not be allowed.

23 2.09 BUILDING ENTRANCE TERMINAL

- 24 A. Provide a listed primary protector on all inter-building backbone copper pairs.
- 25 B. Bond Building Entrance Terminals (BET) to an approved ground using a #6 AWG solid copper
26 conductor.
- 27 C. If a special tool is required to open the BET housing, provide (1) tool for each BET location. Turn
28 over as “miscellaneous materials” to DFD Construction Representative at completion of the work.
- 29 D. Cable Termination - Fiber Optic
- 30 1. Provide Fiber Optic Patch Panels configured with connector couplings (sleeves, bulkheads,
31 etc.) adequate to accommodate the number of fibers to be terminated.
- 32 2. Terminate all optical fibers using the specified connector type.
- 33 3. Mate all terminated fibers to couplings mounted on patch panels. Couplings shall be mounted
34 on a panel that, in turn, snaps into the housing assembly. Any unused panel positions shall be
35 fitted with a blank panel inhibiting access to the fiber optic cable from the front of the housing.
- 36 4. Provide and organize couplers as follows:
- 37 a. Fibers from multiple locations may share a common enclosure. They must, however,
38 be segregated on the connector panels and clearly identified.
- 39 b. Connectors from different location shall never share a common coupling panel.
- 40 c. Segregate Multi-mode and single mode optical fibers (where applicable) on the panels
41 as to clearly identify the distinction between the fiber types.
- 42 d. Install Duplex Couplers (where applicable) with polarity (e.g. keyway orientation) on
43 each end opposite that of the other end (i.e. A-B, A-B... on one end and B-A, B-A... on
44 the other). Polarity shall be per TIA/EIA-568-B.1, section 10.3.2. Refer to that
45 standard for further detail.
- 46 e. Position optical fibers consecutively and mapped "position for position" between patch
47 panels. There shall be no transpositions in the cabling.
- 48 5. Fit all couplings with a dust cap.

- 1 6. Provide slack in each fiber as to allow for future re-termination in the event of connector or
2 fiber end-face damage. Adequate slack shall be retained to allow termination at a 30" high
3 workbench positioned adjacent to the termination enclosure(s). A minimum of 1-meter (~39")
4 of slack shall be retained regardless of panel position relative to the potential work area.
- 5 7. Where "Loose Buffered" cables are installed, the 250- μ m coated fibers contained in these
6 cables may be terminated either by 1) splicing of factory terminated cable assemblies
7 ("pigtailed") or 2) the use of a "fan-out" kit. In the latter approach, individual fiber are to be
8 secured in a protective covering, an Aramid (e.g. Kevlar) reinforced tube for example, with
9 connectors mated to the resulting assembly. In both instances, the proposed termination
10 hardware shall incorporate a mechanism by which cable and sub-assemblies are secured to
11 prevent damage. Splicing shall be by the "fusion" method. Refer to Part 3 article "Splicing
12 Procedure – Fiber Optic" for installation and performance requirements.
- 13 8. Clean all fibers once mated to adapters and protect with dust cap. Follow manufacturer's
14 recommendations of cleaning technique and products.
- 15 E. Fiber Optic Cable
- 16 1. General
- 17 a. The fibers utilized in the installed cable shall be traceable to the manufacturer. Upon
18 request by the Owner, provide cable manufacturer's test report for each reel of cable
19 provided. These test reports shall include:
- 20 i. Manufacturer's on the reel attenuation test results at the specified wavelengths
21 for each optical fiber of each reel prior to shipment from the manufacturer.
- 22 ii. On-the-reel Bandwidth performance as tested at the factory.
- 23
- 24 2. Tests Prior to Installation
- 25 a. At Contractor discretion and at no additional cost to the Owner, Contractor may
26 perform tests deemed necessary by the Contractor to ensure integrity of any Owner
27 furnished optical fiber. Tests may range from a simple "flashlight test" to an OTDR of
28 each optical fiber of each cable reel prior to installation. Upon request, the contractor
29 shall supply this test data to the Engineer prior to installation.
- 30 3. Tests After Installation
- 31 a. Upon completion of cable installation and termination, test Fiber Optic cabling to
32 include:
- 33 i. Optical Attenuation ("Insertion Loss" Method)
- 34 ii. Verification of Link Integrity (OTDR)
- 35 4. Optical Attenuation Testing
- 36 a. Measure Optical Attenuation on all terminated optical fibers in both directions of
37 transmission using the "Insertion Loss" method. Measurement shall be inclusive of
38 the optical connectors and couplings installed at the system endpoints. Access Jumper
39 length (each end) shall be 1 to 5 meters (3.3 to 16.4 ft).
- 40 i. Test multimode fibers in accordance with ANSI/TIA-568-C.0 and EIA/TIA 526-
41 14A, Method B (one jumper reference) at 850 nm (nominal). Include Mandrel
42 per the standard.
- 43 b. Attenuation of optical fibers (all fiber types) shall not exceed the values calculated per
44 TIA-568-C.0.
- 45 i. Multimode fiber where cable length \leq 300-meters and includes no splices – 2.5
46 dB.
- 47 ii. Cable $>$ 300-meters or any cable containing splices – $2 * C + L * F + S$ dB
- 48 iii. Where C is the maximum allowable Connector Loss (in dB), L is the length of
49 the run (in kilometers) and F is the maximum allowable fiber loss (in dB/km). S
50 is the total splice loss (# of splices * max. attenuation per splice).

1 5. OTDR Testing

- 2 a. Document all fibers - in one direction of transmission using an Optical Time Domain
3 Reflectometer (OTDR).
- 4 b. *Exception:* Where cable includes splices, other than those at the termination, test in
5 both directions to confirm splice loss.
- 6 i. Test multimode fibers at 850 nm (nominal).
- 7 ii. Test single-mode fibers at 1310 nm (nominal).
- 8 c. OTDR(s) used in testing shall incorporate high-resolution optics optimized for viewing
9 of short cable sections. Set Pulse Width to shortest width usable and still obtain clean
10 trace.
- 11 d. Use jumpers of adequate length at both ends of cable under test to allow viewing of the
12 entire length of the cable, including the connectors at the launch and tail end.
- 13 e. OTDR traces revealing a point discontinuity greater than 0.2 dB in a multi-mode fiber,
14 or 0.1 dB in a single mode fiber at any of the tested wavelengths or any discontinuity
15 showing a reflection at that point shall be a valid basis for rejection of that fiber by the
16 Owner. The installation of that cable shall be reviewed in an effort to remove any
17 external stress that may be causing the fault. If such efforts do not remove the fault,
18 that cable and the associated terminations shall be replaced at the expense of the
19 contractor.

20 PART 3 - EXECUTION

21 3.01 PRE-INSTALLATION SITE SURVEY

- 22 A. Prior to start of systems installation, meet at the project site with the owner's representative and
23 representatives of trades performing related work to coordinate efforts. Review areas of potential
24 interference and resolve conflicts before proceeding with the work. Facilitation with the General
25 Contractor will be necessary to plan the crucial scheduled completions of the equipment room and
26 telecommunications closets.
- 27 B. Examine areas and conditions under which the system is to be installed. Do not proceed with the
28 work until satisfactory conditions have been achieved.
- 29 C. The contractor shall be responsible for meeting with the Owner's (Dane County) Information
30 Technology staff prior to the start of any installation to coordinate the work to be installed as part of
31 this project. It is the design intent to maintain any cabling or installation standards that are currently
32 in use by Dane County.
- 33 1. Failure to perform this meeting may cause work to be removed and reinstalled if not deemed
34 acceptable by Dane County.

35 3.02 HANDLING AND PROTECTION OF EQUIPMENT AND MATERIALS

- 36 A. Be responsible for safekeeping of your own and your subcontractors' property, such as equipment and
37 materials, on the job site. The owner assumes no responsibility for protection of above named
38 property against fire, theft, and environmental conditions.

39 3.03 PROTECTION OF OWNER'S FACILITIES

- 40 A. Effectively protect the owner's facilities, equipment, and materials from dust, dirt, and damage during
41 construction.
- 42 B. Remove protection at completion of the work.
- 43

1 3.04 INSTALLATION

- 2 A. Receive, check, unload, handle, store, and adequately protect equipment and materials to be installed
3 as part of the contract. Store in areas as directed by the owner's representative. Include delivery,
4 unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required,
5 interconnecting wiring of system components, equipment alignment and adjustment, and other related
6 work whether or not expressly defined herein.
- 7 B. Install materials and equipment in accordance with applicable standards, codes, requirements, and
8 recommendations of national, state, and local authorities having jurisdiction, and National Electrical
9 Code® (NEC) and with manufacturer's printed instructions.
- 10 C. Adhere to manufacturer's published specifications for pulling tension, minimum bend radii, and
11 sidewall pressure when installing cables.
- 12 1. Where manufacturer does not provide bending radii information, minimum-bending radius
13 shall be 15 times cable diameter. Arrange and mount equipment and materials in a manner
14 acceptable to the engineer and the owner.
- 15 D. Penetrations through floor and fire-rated walls shall utilize intermediate metallic conduit (IMC) or
16 galvanized rigid conduit (GRC) sleeves and shall be firestopped after installation and testing, utilizing
17 a firestopping assembly approved for that application.
- 18 E. Install station cabling to the nearest telecommunications room (TR), unless otherwise noted.
- 19 F. Installation shall conform to the following basic guidelines:
- 20 1. Use of approved wire, cable, and wiring devices
21 2. Neat and uncluttered wire termination
- 22 G. Attach cables to permanent structure with suitable attachments at intervals of 48 to 60 inches.
23 Support cables installed above removable ceilings.
- 24 H. Install adequate support structures for 10 foot of service slack at each TR.
- 25 I. Support riser cables every three (3) floors and at top of run with cable grips.
- 26 1. Limit number of four-pair data riser cables per grip to fifty (50)
- 27 J. Install cables in one continuous piece. Splices shall not be allowed except as indicated on the
28 drawings or noted below:
- 29 K. Provide overvoltage protection on both ends of cabling exposed to lightning or accidental contact with
30 power conductors.

31 3.05 GROUNDING

- 32 A. Grounding shall conform to ANSI/TIA/EIA 607(A) - Commercial Building Grounding and Bonding
33 Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and
34 manufacturer's grounding requirements as minimum.
- 35 B. Bond and ground equipment racks, housings, messenger cables, and raceways.
- 36 C. Connect cabinets, racks, and frames to single-point ground which is connected to building ground
37 system via #6 AWG green insulated copper grounding conductor.

38 3.06 LABELING

- 39 A. Labeling shall conform to ANSI/TIA/EIA-606(A) standards. In addition, provide the following:
- 40 1. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
41 2. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in
42 the following locations:
- 43 a. Inside receptacle box at the work area.
44 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.

Category 6 Test Parameters:

Frequency Mhz	Category 6 Cable Permanent Link Test					
	TIA/EIA 568B.2-1 Insertion Loss	TIA/EIA 568B.2-1 NEXT	TIA/EIA 568B.2-1 PSNEXT	TIA/EIA 568B.2-1 ELFEXT	TIA/EIA 568B.2-1 PSELFEXT	TIA/EIA 568B.2-1 Return Loss
	Attenuation Max. dB	Worst Pair to Pair dB	Worst Case Loss dB	Worst Pair to Pair Loss DB	Loss 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

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- 1 C. Propagation Delay
- 2 1. The maximum propagation delay determined in accordance with the ANSI/TIA/EIA –568B.2
- 3 for a Permanent Link configuration shall be less than 498-ns measured at 10MHz. (Note: In
- 4 determining the permanent link propagation delay, the propagation delay contribution of
- 5 connecting hardware is assumed to not exceed 2.5 ns from 1 MHz to 250MHz).
- 6 D. Delay Skew
- 7 1. For all frequencies from 1 MHz to 250 MHz, Category 6 cable propagation delay skew shall
- 8 not exceed 44ns/100m at 20 degrees C, 40 degrees C, and 60 degrees C. In addition, the
- 9 propagation delay skew between all pairs shall not vary more than +/- 10ns from the measured
- 10 value at 20 degrees C when measured at 40 degrees C and 60 degrees C. Compliance shall be
- 11 determined using a minimum 100m of cable.
- 12 E. In order to establish testing baselines, cable samples of known length and of the cable type and lot
- 13 installed shall be tested. The cable may be terminated with an 8-position Category 6 Modular plug (8-
- 14 pin) to facilitate testing. Net Propagation Velocity (NPV) and nominal attenuation values shall be
- 15 calculated based on this test and be utilized during the testing of the installed cable plant. This
- 16 requirement can be waived if NPV data is available from the cable manufacturer for the exact cable
- 17 type under test.
- 18 F. In the event results of the tests are not satisfactory, the Contractor shall make adjustments,
- 19 replacement and changes as are necessary, and shall then repeat the test or tests which disclosed faulty
- 20 or defective material, equipment or installation method, and shall make additional tests as the
- 21 Engineer deems necessary at no additional expense to the project or user agency.
- 22 G. Where any portion of system does not meet the specifications, correct deviation and repeat applicable
- 23 testing at no additional cost to the owner.

24 3.08 FIELD QUALITY CONTROL

- 25 A. Employ job superintendent or project manager during the course of the installation to provide
- 26 coordination of work of this specification and of other trades, and provide technical information when
- 27 requested by other trades. This person shall maintain current RCDD® (Registered Communications
- 28 Distribution Designer) registration and shall be responsible for quality control during installation,
- 29 equipment set-up, and testing.
- 30 B. At least 30 percent of installation personnel shall be BICSI Registered Telecommunications Installers.
- 31 Of that number, at least 15 percent shall be registered at the Technician Level, at least 40 percent shall
- 32 be registered at the Installer Level 2, and the balance shall be registered at the Installer Level 1.
- 33 C. Installation personnel shall meet manufacturer’s training and education requirements for
- 34 implementation of extended warranty program.

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36 END OF SECTION 27 10 00
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SECTION 31 23 00

FOUNDATION EXCAVATING AND BACKFILLING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The General and Supplementary Conditions of the Construction Contract and Division 1 - General Requirements apply to the work specified in this section.
- B. This section shall include, but is not limited to the following foundation, excavating and backfilling within five feet of the building perimeter.
 - 1. Removal of all unacceptable soil.
 - 2. Furnish and install acceptable fill as specified herein and on the drawings.
 - 3. Prepare subgrade for footings and slab on grade.
- C. The following items are not a part of this specification:
 - 1. Utility trenching and related backfilling outside the building footprint.
 - 2. Subgrade for exterior walks and paving.
- D. Structural notes indicated on the drawings regarding foundation excavating and backfilling should be considered part of this specification.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified.
 - 1. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort. (56,000 ft-lbs/ft³)
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 4. ASTM D2922 – Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 5. ASTM D3017 – Standard Test Methods for Water Content of Soil and Rock in Place by Nuclear Method (Shallow Depth).

- 1 6. ASTM D4253 - Standard Test Methods for Maximum Index Density and
2 Unit Weight of Soils Using a Vibratory Table.
- 3 7. ASTM D4254 - Standard Test Method for Minimum Index Density and
4 Unit Weight of Soils and Calculation of Relative Density.
- 5 8. Geotechnical Engineering Report dated June 11, 1987, by Soils &
6 Engineering Services, Inc. on file with the Owner.

7 B. Comply with all applicable local, state and federal codes.

8 1.3 SUBMITTALS

9 A. Material Test Reports: Provide the Owner and Architect with the on-site material
10 test reports from the Inspection Agency indicating the interpreting test results for
11 compliance with this specification.

12 1.4 TESTING AND INSPECTION

13 A. Inspection and Testing:

14 1. The Owner shall employ an Inspection Agency to perform the duties and
15 responsibilities specified below.

16 2. Refer to architectural, civil, mechanical, and electrical specifications for
17 testing and inspection requirements of non-structural components.

18 3. Work performed on the premises of a fabricator approved by the building
19 official need not be tested and inspected per the table below. The
20 fabricator shall submit a certificate of compliance that the work as been
21 performed in accordance with the approved plans and specification to the
22 building official and the Architect and Engineer of Record.

23 4. Duties of the Inspection Agency:

24 a. Perform all testing and inspection required per the Testing and
25 Inspection Schedule indicated below.

26 b. Furnish inspection reports to the building official, the Owner, the
27 Architect, the Engineer of Record, and the General Contractor.
28 The reports what be completed and furnished within 48 hours of
29 inspected work.

30 c. Submit a final signed report stating whether the work requiring
31 Inspection was, to the best of the Inspection Agency's
32 knowledge in conformance with the approved plans and
33 specifications.

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5. Structural Component Testing and Inspection Schedule for 31 23 00 is as follows:

	Continuous	Periodic
Foundation Preparation		
Verify materials below footings are adequate to achieve the design bearing capacity		X
Verify excavations are extended to proper depth and have reached proper material.		X
Perform classification and testing of controlled fill materials.		X
Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill.	X	
Prior to placement of controlled fill, observe subgrade and verify that the site have been properly prepared.		X

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B. Minimum testing frequency and locations:

1. Laboratory Testing:

- a. Granular fill: One representative gradation test for each type of material.
- b. Cohesive soils: One representative moisture density test for each type of material used.
- c. Non-cohesive soils: One representative moisture density test for each type of material used.

2. Field Testing:

- a. The Inspector shall determine the location of testing.
- b. Testing of final utility trench backfill shall begin at a depth of 2 feet above the top of the pipe.
- c. In-place field density test and moisture content tests shall be performed as follows:
 - 1) Fills not within the influence of building foundations and slab on grade: Per civil specifications.
 - 2) Fills within the influence of building foundations and slab on grade, the following criteria shall apply: One test for each 8 inch vertical lift of compacted fill placed per 2,500 square feet of fill area (minimum of two tests per lift per structure for areas smaller than 5,000 square feet).
- d. Additional testing may be required by the Inspector if noncompliance or a change in conditions occurs.

1 e. If a test fails, the Contractor shall rework the material, recompact
2 and retest as necessary until specific compaction is achieved in
3 all areas of the trench. All costs associated with this work,
4 including retesting, shall be the responsibility of the Contractor.

5 1.5 PROTECTION

6 A. Contractor shall provide for design, permits and installation of all cribbing,
7 bracing, shoring and other methods required to safely retain earth banks and
8 excavations.

9 B. Notify the Architect immediately and discontinue work in affected area if
10 adjacent existing footings are encountered during excavation. Underpin other
11 adjacent structures that may be damaged by excavation work, including service
12 utilities and pipe chases.

13 C. Notify the Architect of unexpected subsurface conditions and discontinue work
14 in affected areas until notification to resume.

15 D. Protect benchmarks, existing structures, fences, sidewalks, paving, curbing, etc.,
16 from excavation equipment and vehicular traffic.

17 E. Maintain and protect above and below grade utilities that are to remain.

18 F. Provide temporary heating or protective insulating materials to protect subgrades
19 and foundations soils against freezing temperatures or frost during cold weather
20 conditions.

21 PART 2 - PRODUCTS

22 2.1 MATERIALS

23 A. General: Provide borrow soil materials when sufficient acceptable soil materials
24 are not available from excavations.

25 B. Acceptable soils shall comply with the following:

26 1. Meet ASTM D2487 soil classification groups GW, GP, GM, SW, SP,
27 SM or a combination of these group symbols;

28 2. Be free of rock or gravel larger than 3 inches in any dimension;

29 3. Be free of debris, waste, frozen materials, vegetation and other
30 deleterious materials;

31 4. Have a liquid limit less than 45 and a plasticity index less than 20.

32 5. Be approved by the Inspection Agency.

- 1 C. Unacceptable soils shall be defined as following:
- 2 1. ASTM D2487 soil classification groups GC, SC, ML, MH, CL, CH, OL,
- 3 OH, PT or a combination of these group symbols.
- 4 2. Unacceptable soils also to include acceptable soils not maintained within
- 5 2 percent of optimum moisture content at time of compaction.
- 6 D. Free-Draining Granular Fill: Free-draining granular fill shall comply with the
- 7 following:
- 8 1. Be a naturally or artificially graded mixture of natural or crushed gravel,
- 9 crushed stone.
- 10 2. Be clean and free of fines.
- 11 3. Comply with ASTM D2940.
- 12 4. Be uniformly graded as follows:

COARSE AGGREGATE GRADATIONS						
SIEVE SIZE - PERCENT PASSING						
Grade No.	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4
CA7	100	95 ± 5	-	45 ± 15	-	5 max

- 13 5. Be approved by the Inspection Agency.
- 14 E. Engineered Fill and Utility Base Course shall comply with the following:
- 15 1. Be a naturally or artificially graded mixture of natural or crushed gravel,
- 16 crushed stone, natural or crushed sand;
- 17 2. Comply with ASTM D2940;
- 18 3. Be uniformly graded as follows:

COARSE AGGREGATE GRADATIONS							
SIEVE SIZE - PERCENT PASSING							
Grade No.	1"	3/4"	3/8"	No. 4	No. 10	No. 40	No. 200
¾-Inch	100	95 – 100	50 – 90	35 – 70	15 – 55	10 – 35	5 - 15

- 19 4. Be approved by the Inspection Agency.
- 20 F. Material Applications: Provide and install material meeting with the above
- 21 requirements as follows:
- 22 1. General fill: Acceptable soils.

- 1 2. Backfill against basement and retaining walls: Free-draining granular
2 fill.
- 3 3. Backfill at over-excavated areas beneath footings: Engineered fill.
- 4 4. Sub-grade layer beneath slabs-on-grade: Refer to Drawings.

5 PART 3 - EXECUTION

6 3.1 PREPARATION

- 7 A. Identify and verify required lines, levels, contours and benchmark elevations for
8 the work are as indicated.
- 9 B. Protect plant life, lawns, other features and vegetation to remain as a portion of
10 the final landscaping.
- 11 C. Contractor shall provide for de-watering of excavations from surface water,
12 ground water or seepage.
- 13 D. Identify known underground utility locations with stakes and flags.

14 3.2 EXCAVATION

- 15 A. All excavations shall be safely and properly backfilled.
- 16 B. All abandoned footings, utilities and other structures that interfere with new
17 construction shall be removed.
- 18 C. All unacceptable material and organic material shall be removed from below all
19 proposed slabs-on-grade and the exposed natural soil shall be proof rolled and the
20 compaction verified by the soils testing firm prior to placing fill. Proof-roll with
21 a loaded tandem dump truck, loaded ready-mix truck, roller, or equivalent weight
22 vehicle. Materials exhibiting weakness, such as those exhibiting rutting or
23 pumping, shall be removed and replaced with acceptable compacted fill material.
- 24 D. Do not excavate within the 45-degree bearing splay of any adjacent foundations.
- 25 E. Remove lumped subsoil, boulders and rock up to 1/3 cubic yard (measured by
26 volume). Provide Owner with unit price per cubic yard for obstructions larger
27 than 1/3 cubic yard.
- 28 F. Outside 45-degree bearing splay of foundations, correct areas over excavated
29 with aggregate at no additional cost to the Owner.
- 30 G. Within the 45-degree bearing splay of foundations, correct areas over excavated
31 with 2000 psi concrete fill at no additional cost to the Owner. Notify the
32 Architect prior to performing such work.
- 33 H. Hand trim final excavation to remove all loose material.

- 1 I. Contractor shall form all dams and perform other work necessary for keeping the
2 excavation clear of water during the progress of the work and, at his own
3 expense, shall pump or otherwise remove all surface and perched water which
4 accumulates in the excavations. Perched water that cannot be de-watered in 48
5 hours of continuous pumping at a minimum rate of 60 g.p.m. in dry weather shall
6 be considered ground water.
- 7 J. Stockpile excavated material in the area designated and remove excess material
8 not being used, from the site.
- 9 3.3 BACKFILLING
- 10 A. Verify foundation perimeter drainage system is complete and has been inspected
11 prior to backfilling against foundation walls.
- 12 B. Support pipe and conduit during placement and compaction of bedding fill.
- 13 C. Systematically backfill to allow necessary time for natural settlement. Do not
14 backfill over porous, wet, spongy or frozen subgrade surfaces.
- 15 D. Backfill areas to contours and elevations with unfrozen materials.
- 16 E. Unless noted otherwise on the Drawings, make grade changes gradual.
- 17 F. Unless noted otherwise on the Drawings, slope grade away from the building a
18 minimum of 2 inches in 10 feet.
- 19 G. Contractor shall procure the approval of the subgrade from the Inspection
20 Agency prior to the start of any filling or bedding operations.
- 21 H. Place a minimum thickness of 24 inches of free-draining granular fill (CA-7)
22 against all retaining walls.
- 23 I. Do not begin any backfill operations against any concrete walls until the concrete
24 has achieved its specified strength.
- 25 J. Do not backfill against below grade walls without necessary bracing to support
26 the walls.
- 27 K. Place and mechanically compact granular fill in continuous layers not to exceed 6
28 inches compacted depth.
- 29 L. Employ a placement method that does not disturb or damage adjacent utilities,
30 vapor barriers, foundation perimeter drainage and foundation waterproofing.
- 31 M. All surplus fill materials are to be removed from the site.
- 32 N. Fill material stockpiles shall be free of unacceptable soil materials.
- 33 O. After work is complete, remove all excess stockpile material and repair stockpile
34 area to its original condition.

1 3.4 COMPACTION

2 A. Compact all fill that will support building footings or floor slabs to 95 percent of
3 the maximum dry density in accordance with ASTM D1557. For relative
4 cohesionless fill materials, where the percent passing the #200 sieve is less than
5 10 and the moisture density curve indicates only slight sensitivity to changing
6 moisture content, compaction requirements should be changed to 75 percent
7 relative density in accordance with ASTM D4253 and ASTM D4254.

8 B. Compact all fills that support paving and landscape per civil specifications.

9 3.5 FOUNDATIONS

10 A. Each footing excavation should be cleared of all obstructions and other organic
11 or deleterious materials.

12 B. Localized areas of unstable or unacceptable material may be discovered during
13 the stripping and excavation operation and may require over-excavation and
14 backfilling. The Inspection Agency shall be present during the proof rolling to
15 evaluate any localized areas and make recommendations regarding over-
16 excavation, backfilling and recompaction of these areas. Fill placement and
17 compaction shall be inspected and tested by the Inspection Agency.

18 C. Footing elevations shown on the Drawings designate a minimum depth of footing
19 where a safe soil bearing pressure is expected. Footings, piers and/or walls shall
20 be lowered or extended as required to reach soil meeting the design bearing
21 pressure. This work shall be performed under direct supervision of the Inspection
22 Agency.

23 D. All footing excavations shall be recompacted by hand-operated, vibratory
24 compaction equipment.

25 E. All excavation and recompacted surfaces shall be inspected and tested to a depth
26 of 2.0 feet below the excavated elevation by the Inspection Agency. Additional
27 field density tests should be performed for each one foot of fill material placed.
28 Any areas not in compliance with the compaction requirements should be
29 corrected and re-tested prior to placement of fill material.

30 F. For foundation areas where over excavation is performed, place and
31 mechanically compact Engineered fill material in continuous layers not to exceed
32 6 inches compacted depth.

33 3.6 SLAB-ON-GRADE

34 A. All disturbed areas after the clearing and stripping operation should be proof-
35 rolled and recompacted with a heavy vibratory drum roller (approved by the
36 Inspection Agency) in the static mode. The compactor should make a minimum
37 of 10 passes, with a minimum of one foot overlap of each pass. The compactor
38 speed should be less than 0.2 MPH.

- 1 B. The Inspection Agency shall monitor proof-rolling and compaction operations.
2 This area should then be tested for compaction to a depth of 2.0 feet below the
3 compacted surface prior to the placement of any structural fill material.
- 4 C. Refer to Drawings for required sub-grade preparation beneath slabs-on-grade.
- 5 3.7 UTILITY TRENCH BACKFILL (AT SLAB ON GRADE LOCATIONS)
- 6 A. Excavate and backfill utility trenches under wall footings as shown on the
7 Drawings
- 8 B. Place utility base course on subgrades free of mud, frost, snow, or ice.
- 9 C. Place and compact utility base course on trench bottoms and where indicated.
- 10 D. Lay underground utilities on 6" sand bedding, which meets the acceptable criteria
11 of Section 2.1,B.
- 12 E. Shape bedding course to provide continuous support for bells, joints, and barrels
13 of pipes and for joints, fittings, and bodies of conduits.
- 14 F. After connection joints are made, any misalignment can be corrected by tamping
15 the sand around the utilities.
- 16 G. Place and compact initial backfill of acceptable sand to a height of 6 inches over
17 the utility pipe or conduit in 6 inches layer meeting specified compaction
18 requirements.
- 19 H. Carefully compact initial backfill under pipe haunches and compact evenly up on
20 both sides and along the full length of utility piping or conduit to avoid damage
21 or displacement of piping or conduit.
- 22 I. Place and compact final backfill using acceptable soil to final subgrade elevation
23 meeting specified compaction requirements.
- 24 J. Backfill voids with acceptable soil while installing and removing shoring and
25 bracing.
- 26 K. Inspection Agency shall monitor and test compacted backfill to verify final
27 compaction meets the specified requirement.
- 28 3.8 TOLERANCES
- 29 A. Top surface of backfilling under paved areas: Plus or minus 1/2 inch from required
30 elevation.
- 31 B. Top surface of general backfilling: Plus or minus 1 inch from required elevation.

32 END OF SECTION

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SECTION 31 23 19

DEWATERING

PART 1 – GENERAL

1.1 DESCRIPTION

A. The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide for dewatering as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:

- General
- Sump Dewatering
- Operation
- Removal/Abandonment

1.2 RELATED WORK AND REQUIREMENTS

- A. Section 31 25 00 – Erosion Control
- B. Section 33 10 00 – Water Utilities
- C. Section 33 40 00 – Storm Drainage Utilities
- D. Applicable provisions of the General Conditions and Division 1 shall govern work under this section.

1.3 REFERENCES

- A. Wisconsin Administrative Code (WAC):
 - Chapter NR 141 – Monitoring Well Construction
 - Chapter NR 812 – Well Construction and Pump Installation
- B. Wisconsin Department of Natural Resources Technical Standards for Construction Site Erosion & Sediment Control (Technical Standards):
<http://dnr.wi.gov/topic/stormwater/standards/>

1.4 SUBMITTALS

- A. For sump dewatering in trenches or excavations, provide copies of sediment removal practice selection and discharge design calculations or information.
- B. Provide copies of all permits required for dewatering.
- C. Provide copies of daily monitoring and testing logs for dewatering practices as described in the DNR Dewatering Technical Standard.
- D. Provide copies of all borehole abandonment forms.

- 1 1.5 QUALITY ASSURANCE
- 2
- 3 A. Provide and submit a quality assurance program for maintaining erosion control and sediment control
- 4 practices. As work progresses through phases of the contract, submit copies of the updated quality
- 5 assurance program for erosion control and sediment removal practices.
- 6
- 7 1.6 PERMITS/FEES
- 8
- 9 A. Pay for and obtain all permits/approval required by state and federal regulations.
- 10
- 11 B. Necessary permits/approval may include, but are not limited to high capacity well approval under NR
- 12 812.09 and erosion control permits.
- 13
- 14 C. When installing by jetting methods, provide own water source. Do not use hydrants as water source
- 15 without permission from the Owner representative and/or local utility, as applicable. Obtain and pay
- 16 for any required hydrant use and permits.
- 17
- 18 1.7 SAFETY
- 19
- 20 A. Prevent public access to dewatering system components.
- 21
- 22 1.8 EROSION AND SEDIMENT CONTROL
- 23
- 24 A. Comply with the requirements of:
- 25
- 26 Section 31 25 00 – Erosion Control
- 27
- 28 B. Selection, installation, operation, and maintenance of erosion control and sediment removal measures
- 29 related to a dewatering system shall be done in accordance with the DNR Dewatering Technical
- 30 Standard or equivalent approved by the WDNR.
- 31
- 32 C. Upon installation of the dewatering system, immediately remove from the site any mud, sediment or
- 33 drilling fluid generated by jetting or rotary drilling operations.
- 34
- 35 D. When overland discharge of water is necessary, dissipate energy of water stream using nozzles,
- 36 deflectors, riprap or other methods. Avoid discharge into areas prone to flooding, sensitive areas or
- 37 exposed soil.
- 38
- 39 E. Inspect dewatering system daily for signs of erosion and eliminate cause of erosion.
- 40
- 41 1.9 ENVIRONMENTAL CONTAMINANTS
- 42
- 43 A. Monitor dewatering system discharge regularly for signs of chemicals or other environmental
- 44 contaminants.
- 45
- 46 B. If chemicals or environmental contaminants are observed, terminate dewatering system operation
- 47 immediately and contact the owner/architect/engineer.
- 48
- 49 C. Prevent introduction of contaminants into the soil or groundwater through the dewatering system.
- 50
- 51 1.10 NOISE POLLUTION

- 1
2 A. Provide mufflers, housing, berms and fencing as necessary to minimize noise pollution resulting from
3 dewatering system operation.
4

5 PART 2 – PRODUCTS

6
7 2.1 GENERAL

- 8
9 A. All deepwell and wellpoint dewatering equipment and well construction/abandonment materials shall
10 meet the requirements of NR 141 and NR 812.
11

12 PART 3 – EXECUTION

13
14 3.1 GENERAL

- 15
16 A. Comply with all local, state and federal regulations.
17
18 B. Coordinate installation of dewatering system with other contractors. Locate dewatering system
19 components in locations that do not interfere with site operations or other construction activities.
20
21 C. Pump groundwater at lowest rate necessary to dewater site as required to accommodate other sitework.
22

23 3.2 SUMP DEWATERING

- 24
25 A. Install collection sump in the low point of the excavation(s).
26
27 B. Provide filter material, trash screens and other devices around pump or intake to avoid pumping of
28 sediment. Provide sediment tanks, filters, and flocculants as required for sediment control. Inspect
29 discharge daily and install and maintain erosion control and sediment removal practices in accordance
30 with the Technical Standards.
31

32 3.3 OPERATION

- 33
34 A. Provide personnel, equipment and power necessary to maintain and operate the dewatering and
35 sediment control systems as required to complete construction at the site.
36
37 B. Do not discharge water containing sediment, debris or contaminants into the sanitary sewer system or
38 waters of the state.
39

40 3.4 REMOVAL/ABANDONMENT

- 41
42 A. Remove all dewatering system components immediately following use.
43
44 B. Clean receiving storm sewer system of any sediment or debris deposits resulting from dewatering
45 system operation.
46
47
48

49
END OF SECTION 31 23 19

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SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Excavation of trenches, pipe bedding, backfilling and compaction for water, storm drainage and sanitary sewerage utilities.

1.02 RELATED SECTIONS

- A. Section 01400 - Quality Control
- B. 31 23 19 Dewatering
- C. 33 10 00 Water Utilities
- D. 33 30 00 Sanitary Sewerage Utilities
- E. 33 40 00 Storm Drainage Utilities

1.03 REFERENCES

- A. ASTM C33-86 - Specification for Concrete Aggregate
- B. ASTM C136-84a - Method for Sieve Analysis of Fine and Coarse Aggregate
- C. ASTM D698-78 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.49-kg) Rammer and 12-in. (304.8 mm) Drop
- E. ASTM D1557-78 - Test Methods for Moisture-Density Relations of Soil-Aggregate Mixtures Using 10-lb. (4.54- kg) Rammer and 18-in. (457-mm) Drop
- F. ASTM D2487-85 - Classification of Soils for Engineering Purposes
- G. ASTM D2922-81 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- H. ASTM D3017-78 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- I. Standard Specifications for Sewer & Water Construction in Wisconsin, "Standard Specifications.

1.04 MEASUREMENT AND PAYMENT

- A. There shall be no separate measurement and payment for the work described in this section. This work will be considered incidental to the work of other sections.

PART 2 - PRODUCTS

2.01 GENERAL

- 1 A. Conform to requirements of Standard Specifications.
 2
 3 1. Where conflicts between this specification and the Standard Specifications exist,
 4 requirements of the Standard Specifications shall govern.
 5

6 2.02 BEDDING AND COVER MATERIALS

- 7
 8 A. Water Mains
 9
 10 1. Bedding and cover material shall conform to the Standard Specifications.
 11
 12 B. Sanitary Sewer
 13
 14 1. Bedding and cover material shall conform to the Standard Specifications.
 15
 16 C. Storm Sewer
 17
 18 1. Bedding and cover material shall conform to the Standard Specifications.
 19
 20

21 2.03 BASE MATERIAL

- 22
 23 A. Crushed Stone: Hard, durable particles of crushed stone or gravel substantially free from shale or
 24 lumps of clay or loam. When crushed stone base is required under sewer, water main or structures
 25 gradation shall meet the requirements of Type 1. When crushed stone base is required to affect
 26 soil stability or drainage it shall meet the gradation requirements of Type 2.
 27

28 Type 1: 1 1/2 Inch Crushed Stone

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
2 Inch	100
1 1/2 Inch	90-100
1 Inch	20-55
3/4 Inch	0-15
1/2 Inch	0-5

38 Type 2: 2 Inch Crushed Stone

<u>Sieve Size</u>	<u>Percent Passing By Weight</u>
2 1/2 Inch	100
2 Inch	90-100
1 1/2 Inch	35-70
1 Inch	0-15
1/2 Inch	0-5

50 2.04 BACKFILL

- 51
 52 A. Granular Backfill: Durable particles ranging from fine to coarse in a substantially uniform

1 combination. Sufficient fine material shall be present to fill all the voids of the coarse material.
2 Some fine clay or loam particles are desirable, but clay or loam lumps shall not be present.
3 Conform to the following gradation:
4

5 Granular Backfill

6	7	8
	<u>Sieve Size</u>	<u>Percent Passing</u>
		<u>By Weight</u>
9	3 Inch	100
10	2 Inch	95-100
11	No. 4	35-60
12	Finer than No. 200	5-15

- 13
- 14 B. Excavated Material: Natural soils classified in ASTM D2487 as Gravels (GW, GP GM and GC),
15 Sands (SW, SP, SM and SC) and Silts and Clays (ML and CL). Silts and Clays classified as OL,
16 MH, CH, OH, and PT are not acceptable unless specifically allowed by Engineer. Soil material
17 shall be free from vegetable or other organic matter, trash, debris, stones larger than three inches
18 and frozen material.
19

20 PART 3 - EXECUTION

21

22 3.01 GENERAL

- 23
- 24 A. Conform to requirements of Standard Specifications.
- 25
- 26 1. Where conflicts between this specification and the Standard Specifications exist,
27 requirements of the Standard Specifications shall govern.
28

29 3.02 EXAMINATION

- 30
- 31 A. Verify fill materials to be used are acceptable.
32

33 3.03 PREPARATION

- 34
- 35 A. Identify required lines, levels, contours and datum.
- 36
- 37 B. Maintain and protect existing utilities remaining, which pass through work area.
- 38
- 39 C. Protect plant life, lawns, and other features remaining as a portion of the final landscaping.
- 40
- 41 D. Protect bench marks, existing structures, shore protection structures and base materials, sidewalks,
42 paving and curbs from excavation equipment and vehicular traffic.
- 43
- 44 E. Protect above and below grade utilities which are to remain.
- 45
- 46 F. Strip topsoil and stockpile onsite for reuse.
- 47
- 48 G. When excavating across or within existing pavement, saw cut in neat straight lines.
49

50 3.04 DEWATERING

- 51
- 52 A. Refer to Section 31 23 19 – Dewatering.

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3.05 EXCAVATION

- A. Excavate subsoil to required depth and grade.
- B. Cut trenches sufficiently wide to enable installation of the utilities and allow inspection. Normal trench width below the top of the pipe shall be the nominal pipe diameter plus 24 inches. Do not undercut trench walls.
- C. Trench walls above the top of the pipe shall be as dictated by soil type and safety requirements. Provide shoring and bracing as required to maintain safe working conditions.
- D. Stockpile excavated material in area designated on site.

3.06 BEDDING

- A. Place bedding in trench before installing pipe.
- B. Support pipe during placement and compaction of bedding.
- C. Provide a minimum of 4 inches of bedding material under the pipe barrel and under the bell.
- D. Lightly consolidate the material so that it fills and supports the haunch area and encases the pipe to the limits shown on the Drawings.
- E. If excavation is carried deeper than six inches below the pipe barrel, backfill the excess depth with 1-1/2 inch crushed stone meeting the requirements of paragraph 2.04 of this section.
- F. After the pipe has been laid and jointed, place bedding materials by hand or equally careful means around the sides of the pipe and up to a level 12 inches above the pipe. Lightly consolidate the material.

3.07 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen materials.
- B. Do not backfill over wet, frozen or spongy subgrade surfaces.
- C. Granular Backfill: Place and compact materials in continuous layers not exceeding twelve (12) inches compacted depth.
- D. Natural Soil Backfill: Place and compact material in continuous layers not exceeding eight (8) inches compacted depth.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Remove surplus backfill material from site.
- G. Leave fill material stockpile areas completely free of excess fill materials.

3.08 TOLERANCES

- A. Top Surface of Backfilling: Under Paved Areas: Plus or minus 0.05 feet from required elevations.

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B. Top Surface of General Backfilling: Plus or minus 0.2 feet from required elevations.

3.09 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Section 01400.
- B. Density/moisture relationship will be determined in accordance with ASTM D1557 (Modified Proctor).
- C. Compaction testing will be performed in accordance with ASTM D2922 and ASTM D3017.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- E. Frequency of Tests:
 - 1. For trenches under paved areas - one test per 50 lineal feet of trench.
 - 2. For trenches under unpaved areas - one test per 100 lineal feet of trench.

3.10 COMPACTION SCHEDULE

- A. For paved areas compact to at least 95% of optimum density in accordance with ASTM D 1557.
- B. For unpaved areas compact to at least 85% of optimum density in accordance with ASTM D 1557.

3.11 MEASUREMENT AND PAYMENT

- A. Payment is based on Division 1.

END OF SECTION 31 23 33

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SECTION 31 25 00

EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Related Sections:

B. Measurement and Payment:

1. No measurement or additional payment will be made for the maintenance of items in this section.

1.02 REFERENCE STANDARDS

A. WDNR Construction Site Technical Standards

B. WDOT Standard Specifications for Highway and Structure Construction, Latest Edition

C. USDA-NRCS Wisconsin Field Office Technical Guide, Section IV

D. City of Madison Erosion Control Requirements.

1.03 SUBMITTALS

A. Provide manufacturer's data and WisDOT Product Acceptability List verification for silt fence, inlet protection and erosion mat for review and approval by Engineer prior to procurement.

B. Weekly inspections and inspections after every 0.5" rain storm are required to be prepared and maintained on site. Inspections shall include corrective actions taken. These shall be presented to any regulatory agency inspecting the site as requested.

C. Identify seed supplier and provide seed source, purity and germination specifications, for all seed mixes specified for installation in this section, to Engineer for approval prior to procurement.

1.04 QUALITY ASSURANCE

A. Inspect erosion control materials and supplies after delivery to verify that no damage has occurred.

B. The status of erosion control measures will be an item of discussion in every weekly construction meeting. All corrective actions required during construction meetings shall be accomplished within 3 working days of the meeting date.

1.05 WARRANTY

A. Work conducted under this section shall be subject to the one-year warranty provisions described in the General Conditions of contract

1.06 SEQUENCING AND SCHEDULING

- 1 A. The sequencing of project construction activities will be generally as described in the Instructions to
2 Bidders. The specific sequence for construction within a particular area shall be agreed upon with
3 Owner and Engineer prior to construction within that area.
4
5 B. All erosion control measures shall be completely installed for each construction area and approved by
6 Engineer before any other construction activity takes place.
7
8 C. Erosion matting is required to be placed on all slopes 4:1 or greater within 2 weeks of final grading.
9

10 PART 2 - PRODUCTS

11
12 2.01 MATERIALS

13
14 A. SILT FENCE

- 15
16 1. Silt fence shall be as specified in the WDNR Technical Standards 1056.
17
18 2. Fence shall be installed prior to any other site work.
19

20 B. EROSION CONTROL MAT

- 21
22 1. Erosion control mat shall be to the requirements of WDNR Technical Standards 1052 and
23 1053.

24 C. INLET PROTECTION

- 25
26 1. Inlet Protection shall be to the requirements of WDNR Technical Standards 1060.
27
28 2. Inlet Protection shall be provided within all manholes installed during construction.
29
30 3. Inlet Protection for existing manholes adjacent to the site shall be installed prior to any site
31 work commencing.
32

33 D. TEMPORARY SEED

- 34
35 1. Temporary seed shall be in accordance with WDNR Technical Standards 1059.
36

37 E. STONE ACCESS PADS

- 38
39 1. Shall be in accordance with WDNR Technical Standards 1057.
40
41 2. Stone for use in temporary access pads shall range in size from 2-inch to 6-inch diameter.
42
43 3. Pad shall be a minimum of 50 feet long.
44
45 4. Pad may not be required if the existing gravel and/or pavement remains in place during
46 construction at the entrance to the site.
47
48 5. All entrances to the site used by construction vehicles shall have a stone access pad.
49

50 F. MULCH
51

- 1 1. Shall be in accordance with WDNR Technical Standards 1058
2
3 2. Mulch proposed for use shall be clean straw, with no weed material or seeds, and shall be
4 approval Engineer before use.
5

6 G. FERTILIZER

- 7
8 1. Fertilizer shall be as specified in WIDOT, Section 629.3.1.2, Type A.
9

10 H. SOIL STABILIZER

- 11
12 1. Provide soil stabilizers that conform to the requirements of WisDOT's Product Acceptability
13 List (PAL) for Soil Stabilizers, Type B. Currently the only acceptable product is CFM2000
14 manufactured by CFM, Inc.
15
16 2. Soil stabilizer shall be a polyacrylamide (PAM) and calcium solution intended to reduce the
17 erodibility of bare soils during construction activities or to enhance the performance of
18 mulching on permanent slopes. Polyacrylamide Soil Stabilizer shall have proven abilities to
19 bond soil particles effectively increasing the soil particle size to 1.0 millimeter or larger. It
20 shall reduce the movement of soil through chemical bonding, increase the particle size thus
21 making silt fence more effective and increase the water absorption of the soil.
22
23 3. Soil stabilizers shall meet the same vegetative density and sediment loss standards as required
24 for erosion control mats.
25

26 PART 3 - EXECUTION

27
28 3.01 GENERAL

- 29
30 A. Perimeter erosion control practices shall be placed before any other construction activities take place.
31
32 B. Establish all heights and grades to properly execute work from benchmark established by others.
33
34 C. Contractor shall provide all surveys to accurately locate the construction on the site.
35
36 D. All erosion control measures shall be placed in accordance with the WDNR Technical Standards.
37
38 E. Erosion control shall be applied as is standard care in the construction industry and as site conditions
39 warrant.
40

41 3.02 EROSION CONTROL STRUCTURES

- 42
43 A. Runoff diversion berms shall be constructed of clean topsoil, 2 ft high, with 3H:1V side slopes, and
44 seeded and mulched immediately after installation.
45

46 3.03 SEEDING AND MULCHING

- 47
48 A. Temporary seeding shall be conducted as described in WDOT Standard Specifications 630.3.3, with
49 sowing using either Method A or Method B. Temporary seeding areas shall receive fertilizer at the
50 rate of 10 lbs. / 1000 sf.
51

- 1 B. Temporary seed shall receive mulch at the rate of 2500 lbs. / acre, and shall be crimped into the soil
2 using WDOT procedure 627.3.2.3.
3
4 C. Disturbed areas within the construction site shall be graded, prepared for seeding, and seeded to
5 conform to the following requirement for the maximum duration of bare-ground conditions:
6
7 1. Areas in the interior of the site that do not drain directly to wetlands and water courses: 30
8 days
9

10 3.04 SOIL STABILIZER

- 11 A. Use Soil Stabilizers on slopes 3H:1V or flatter as a short-term duration erosion control device.
12
13 B. Apply soil stabilizer to disturbed surfaces that will not be covered with crushed stone base course.
14
15 C. Place with conventional hydraulic seeding equipment or by dry spreading in accordance with
16 manufacturer's instructions.
17
18 1. Place material so that direct contact with the soil is ensured.
19
20 2. Application rates shall be as recommended by the manufacturer and shall meet the approval
21 of the Engineer. Application rates are generally 20 lbs./acre.
22
23

24 3.05 MAINTENANCE AND CLEANUP

- 25
26 A. The erosion control system shall be maintained throughout the duration of the construction project, in
27 accordance with the procedures the WDOT Standard Specifications section 628.3.4.2.
28
29 B. The erosion control system shall be inspected immediately after each rainfall of more than 0.5 inch,
30 and daily during prolonged rainfall. All inspections shall be reported to the Owner in the weekly
31 erosion control system report.
32
33 C. Accumulated sediment within the erosion control system shall be removed before one-half of the
34 storage capacity of the erosion control measure is used, or as specified by the Engineer.
35
36 D. The erosion control system shall be removed following construction site stabilization and any damage
37 done to the site by the removal repaired.
38
39
40

END OF SECTION 31 25 00

SECTION 32 12 00

FLEXIBLE PAVING

PART 1 - GENERAL

1.1 RELATED

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

1.2 SUMMARY

- A. This Section includes provisions for hot-mixed asphalt paving and pavement marking for the proposed development.
- B. Provide hot-mix asphalt pavement according to the materials, workmanship, and other applicable requirements of the Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, Latest Edition (DOT), and City of Madison/Dane County requirements.
- C. Related Sections: The following Divisions contain requirements that relate to this Section:

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Material Certificates signed by material producer and Contractor, certifying that each material item complies with or exceeds specified requirements.

1.4 MEASUREMENT AND PAYMENT

- A. Measurement and payment for hot-mixed asphalt pavement and related work specified herein shall be by unit price as shown in the contract documents. Work shall include all labor, equipment and materials related to hot-mix asphalt pavement.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mixed asphalt similar to that indicated for this Project and with a record of successful in-service performance.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver pavement marking materials to Project in original packages with seals unbroken and bearing the manufacturers labels.
- B. Store pavement marking materials in a clean, dry, protected location and within a temperature range required by the manufacturer.

1 1.7 SITE CONDITIONS

- 2
- 3 A. Weather Limitations: Apply prime and tack coats when ambient temperature is above 50° F and when
- 4 temperature has not been below 35° F for 12 hours immediately prior to application. Do not apply
- 5 when base is wet or contains an excess of moisture.
- 6
- 7 B. Construct hot-mixed asphalt surface course when atmospheric temperature is above 40° F and when
- 8 base is dry. Base course may be placed when air temperature is above 30° F and rising.
- 9
- 10 C. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface
- 11 temperature of 40° F and not exceeding 95° F.
- 12
- 13

14 PART 2 - PRODUCTS

15

16 2.1 MATERIALS - PAVEMENT

- 17
- 18 A. Pavement sections shall be in accordance with the Geotechnical Exploration Report.
- 19
- 20 B. General: Provide materials that comply with the following:
- 21
- | | |
|-----------------------------------|-------------------------------|
| 22 Bituminous upper layer | 1.50" (9.5 mm or 12.5 mm mix) |
| 23 Bituminous lower layer | 1.75" (12.5 mm or 19 mm mix) |
| 24 Dense graded base | Variable |
| 25 Stabilization Layer (Undercut) | Variable |
- 26

27 Refer to Geotechnical Exploration Report for specifications and additional information.

28

29 2.2 AUXILIARY MATERIALS

- 30
- 31 A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed,
- 32 complying with FS TT-P-1952, with drying time of less than 45 minutes. Contractor shall coordinate
- 33 color with owner.
- 34

35 PART 3 - EXECUTION

36

37 3.1 SURFACE PREPARATION

- 38
- 39 A. Contractor shall give Construction Coordinator 72 hours notice prior to installation of Asphalt
- 40 pavement to allow utility contractor to adjust manhole frames and valve boxes. Contractor shall
- 41 exercise care around all utility structures and shall be responsible for repair or replacement cost of
- 42 damaged valve boxes, manholes, etc.
- 43
- 44 B. General: Verify that the subgrade is dry and in suitable condition for paving.
- 45
- 46 C. Install drain tile within the subgrade, just below the granular base. Drain tile (4 extending radially
- 47 outward) should be located at each interior catch basin, extending radially outward 20-feet. Drain tile
- 48 should also extend along curb lines, 20 feet up the slope from the curb inlets. The drain tile should be
- 49 directly connected to the storm sewer manholes or catch basins.
- 50
- 51 D. Proof-roll prepared sub-base surface to check for unstable areas and areas requiring additional
- 52 compaction.

- 1
2 E. Notify Contractor of unsatisfactory conditions. Do not begin paving work until deficient sub-base
3 areas have been corrected and are ready to receive paving.
4
5 F. Herbicide Treatment: Remove loose material from compacted sub-base surface immediately before
6 applying herbicide treatment or prime coat. Do not disrupt compacted aggregates. Apply chemical
7 weed control agent in strict compliance with manufacturer's recommended dosages and application
8 instructions. Apply to compacted, dry sub-base prior to application of prime coat.
9
10 G. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces.
11 Remove and clean damaged surfaces.
12
13 G. Tolerances: Compact each course to produce the thickness indicated in Drawings within the following
14 tolerances:
15
16 0. Base Course: Plus or minus 1/2 inch.
17 1. Surface Course: Plus 1/4 inch, no minus.
18

19 3.2 PLACING HOT-MIX ASPHALT
20

- 21 A. General: Place hot-mixed asphalt mixture on prepared surface, spread, and strike off. Spread mixture
22 at minimum temperature of 250 deg F (121 deg C). Place areas inaccessible to equipment by hand.
23 Place each course to required grades, cross-section, and compacted thickness.
24
25 B. Pavement Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Engineer.
26 After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap
27 previous strips. Complete base course for a section before placing surface course.
28
29 C. Immediately correct surface irregularities in finish course behind paver. Remove excess material
30 forming high spots with shovel or lute.
31
32 D. Joints: Make joints between old and new pavements, or between successive days' work, to ensure
33 continuous bond between adjoining work. Construct joints to have same texture, density, and
34 smoothness as other sections of hot-mixed asphalt course. Clean contact surfaces and apply tack coat.
35

36 3.3 COMPACTION
37

- 38 A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive
39 displacement.
40
41 B. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
42
43 C. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints
44 and outside edge. Check surface after breakdown rolling and repair displaced areas by loosening and
45 filling, if required, with hot material and rerolling to required elevations.
46
47 D. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second
48 rolling until mixture has been evenly compacted to 92 percent of the reference maximum theoretical
49 density according to ASTM D 2041, but not less than 90 percent and not greater than 96 percent.
50
51 E. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks.
52 Continue rolling until roller marks are eliminated and course has attained 95 percent laboratory

1 density.

2
3 F. Edge shaping: While surface is being compacted and finished, trim edges of pavement for proper
4 alignment. Bevel edges while still hot with a smooth iron.

5
6 G. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out
7 such areas and fill with fresh, hot-mixed asphalt. Compact by rolling to specified surface density and
8 smoothness.

9
10 H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and
11 hardened.

12
13 I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.
14

15
16 3.4 PAVEMENT MARKING

17
18 A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with
19 Owner's Project Representative.

20
21 B. Allow paving to age for 30 days before starting pavement marking unless otherwise approved by
22 owner/architect.

23
24 C. Sweep and clean surface to eliminate loose material and dust.

25
26 D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with
27 uniform, straight edges. Apply at Manufacturer's recommended rates to provide a minimum wet film
28 thickness of 15 mils.

29
30 3.5. FIELD QUALITY CONTROL

31
32 A. General: Testing in-place hot-mixed asphalt courses for compliance with requirements for thickness
33 and surface smoothness will be done by Engineer. Repair or remove and replace unacceptable paving
34 as directed by Engineer.

35
36 B. Thickness: In-place compacted thickness tested in accordance with ASTM D 3549 shall be within the
37 specified thickness tolerances.

38
39 C. Surface Smoothness: Test finished surface of each hot-mixed asphalt course for smoothness, using
40 10-foot straightedge applied parallel with and at right angles to centerline of paved area. Surfaces will
41 not be acceptable if exceeding the following tolerances for smoothness:

- 42
43 1. Base Course Surface: 1/4 inch.
44 2. Wearing Course Surface: 3/16 inch.
45 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown.
46 Maximum allowable variance from template is 1/4 inch.

47
48 D. Check surface areas at intervals as directed by Engineer.
49

50
51 END OF SECTION 32 12 00

SECTION 32 13 13
CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Applicable provisions of Division 1 shall govern work under this Section.
- B. Geotechnical Exploration Report.
- C. Applicable sections of the Wisconsin Department of Transportation Standard Specifications for Highway and Structure Construction, Latest Edition (DOT).

1.2 DESCRIPTION OF WORK:

- A. Extent of Portland cement concrete paving is shown on drawings.
- B. Related sections:
 - 1. Concrete and related materials are specified in Division 3 Section for Cast-in-Place Concrete.
 - 2. Prepared subbase is specified in Division 31 Section for Earthwork.

1.3 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with local governing regulations if more stringent than herein specified.

1.4 SUBMITTALS:

- A. Furnish samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

1.5 JOB CONDITIONS:

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Utilize flagmen, barricades, warning signs and warning lights as required.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

- 1 1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2
3 2. Coat forms with a nonstaining form release agent that will not discolor or deface surface
4 of concrete.
5
6 B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A185.
7
8 1. Furnish in flat sheets, not rolls, unless otherwise acceptable to Architect.
9
10 C. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 40.
11
12 D. Fabricated Bar Mats: Welded or clip-assembled steel bar or rod mats, ASTM A 184. Use ASTM A
13 615, Grade 40 steel bars, unless otherwise indicated.
14
15 E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 40. Cut bars true to length with ends
16 square and free of burrs.
17
18 F. Metal Expansion Caps: Furnish for one end of each dowel bar in expansion joints. Design caps
19 with one end closed and a minimum length of 3 inches to allow bar movement of not less than 1
20 inch, unless otherwise indicated.
21
22 G. Hook Bolts: ASTM A 307, Grade A bolts, internally and externally threaded. Design hook bolt
23 joint assembly to hold coupling against pavement form and in position during concreting
24 operations, and to permit removal without damage to concrete or hook bolt.
25
26 H. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete
27 materials, admixtures, bonding materials, curing materials, and others as required.
28
29 I. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for
30 preformed expansion joint fillers and sealers.
31
32 J. Antispalling Compound: 50 percent (by volume) boiled linseed oil and 50 percent (by volume)
33 commercial grade kerosene or mineral spirits.
34
35 K. Curing and Sealing Compound: Conform to ASTM C 309, Type I (clear), Type II (white), Class
36 B, with 30 percent solids content minimum.
37
38 L. Epoxy Resin Grout: FS MMM-G-650.
39
40 2.2 CONCRETE MIX, DESIGN AND TESTING:
41
42 A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and
43 testing, and quality control, and as herein specified.
44
45 B. Design mix to produce standard-weight concrete consisting of Portland cement, aggregate,
46 air-entraining admixture and water to produce the following properties:
47
48 1. Compressive Strength: 4000 psi, minimum at 28 days.
49 2. Slump Range: 2 inch to 4 inch.
50 3. Air Content: 5 percent to 8 percent.
51
52 C. Pavement areas subjected to concentrated wheel loads (i.e., loading docks, dumpster pads, etc.)

1 should be constructed of Portland cement concrete. The slab should be a minimum of 5-in. thick
2 and should contain mesh reinforcement for crack control. The concrete shall be laid on a 4-in
3 depth of dense graded base.
4

5 PART 3 - EXECUTION

6 7 3.1 SURFACE PREPARATION:

- 8
9 A. Remove loose material from compacted subbase surface immediately before placing concrete.
10
11 B. Proof-roll prepared subbase surface to check for unstable areas and need for additional
12 compaction. Do not begin paving work until such conditions have been corrected and are ready to
13 receive paving.
14
15 C. A subgrade modulus of 100 pci should be used for concrete pavement design on proof-
16 rolled/recompacted clayey subgrades.
17

18 3.2 FORM CONSTRUCTION:

- 19
20 A. Set forms to required grades and lines, rigidly braced and secured. Install sufficient quantity of
21 forms to allow continuous progress of work and so that forms can remain in place at least 24 hours
22 after concrete placement.
23
24 B. Check completed formwork for grade and alignment to following tolerances:
25
26 1. Top of forms not more than 1/8 inch in 10 feet.
27 2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.
28
29 C. Clean forms after each use, and coat with form release agent as often as required to ensure
30 separation from concrete without damage.
31

32 3.3 REINFORCEMENT:

- 33
34 A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise
35 indicated.
36
37 B. Concrete pavement areas subject to wheel loads (i.e., loading docks, dumpster pads, etc.) should
38 contain mesh reinforcement for crack control.
39

40 3.4 CONCRETE PLACEMENT:

- 41
42 A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as
43 herein specified.
44
45 B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten
46 subbase if required to provide a uniform dampened condition at time concrete is placed. Do not
47 place concrete around manholes or other structures until they are at required finish elevation and
48 alignment.
49
50 C. Place concrete using methods which prevent segregation of mix. Consolidate concrete along face
51 of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint
52 assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and

1 consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint
2 devices.

- 3
- 4 D. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible.
5 If interrupted for more than 1/2-hour, place a construction joint.
- 6
- 7 E. When adjacent pavement lanes are placed in separate pours, do not operate equipment on concrete
8 until pavement has attained sufficient strength to carry loads without injury.
- 9
- 10 F. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them
11 flat and free of distortions. Straighten bends, kinks, or other irregularities or replace units as
12 required before placement. Set mats for a minimum 2 inch overlap to adjacent mats.
- 13
- 14 G. Place concrete in 2 operations; strike-off initial pour for entire width of placement and to the
15 required depth below finish surface. Lay fabricated bar mats immediately in final position. Place
16 top layer of concrete, strike-off and screed. Remove and replace portions of bottom layer of
17 concrete which has been placed more than 15 minutes without being covered by top layer.
- 18
- 19 H. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's
20 option. If machine placement is to be used, submit revised mix design and laboratory test results
21 which meet or exceed minimums specified. Machine placement must produce curbs and gutters to
22 required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results
23 are not acceptable, remove and replace with formed concrete as specified.

24

25 3.5 JOINTS:

- 26
- 27 A. General: Construct expansion, weakened-plane (contraction), and construction joints true-to-line
28 with face perpendicular to surface of concrete. Construct transverse joints at right angles to the
29 centerline, unless otherwise indicated.
- 30
- 31 B. When joining existing structures, place transverse joints to align with previously placed joints,
32 unless otherwise indicated.
- 33
- 34 C. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning
35 concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at
36 least 1/4 concrete thickness, as follows:
- 37
- 38 1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with
39 a recommended cutting tool and finishing edges with a jointer.
- 40 2. Sawed Joints: Form weakened-plane joints using powered saws equipped with
41 shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as
42 soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
- 43 3. Inserts: Use embedded strips of metal or sealed wood to form weakened-plane joints. Set
44 strips into plastic concrete and carefully remove strips after concrete has hardened.
- 45
- 46 D. Construction Joints: Place construction joints at the end of pours and at locations where placement
47 operations are stopped for a period of more than 1/2-hour, except where such pours terminate at
48 expansion joints.
- 49
- 50 1. Construct joints as shown or, if not shown, use standard metal keyway-section forms.
- 51 2. Where load transfer-slip dowel devices are used, install so that one end of each dowel bar
52 is free to move.

- 1
2 E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch
3 basins, manholes, inlets, structures, walks and other fixed objects, unless otherwise indicated.
4 Locate expansion joints at 50 foot on center for each pavement lane, unless otherwise indicated.
5
6 F. Extend joint fillers full-width and depth of joint, and not less than 1/2 inch or more than 1 inch
7 below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler
8 flush with finished concrete surface.
9
10 G. Furnish joint fillers in one-piece lengths for full width being placed, wherever possible. Where
11 more than one length is required, lace or clip joint filler sections together.
12
13 H. Protect top edge of joint filler during concrete placement with a metal cap or other temporary
14 material. Remove protection after concrete has been placed on both sides of joint.
15
16 I. Fillers and Sealants: Comply with the requirements of applicable Division 7 sections for
17 preparation of joints, materials, installation, and performance.
18

19 3.6 CONCRETE FINISHING:
20

- 21 A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand
22 methods only where mechanical floating is not possible. Adjust floating to compact surface and
23 produce uniform texture.
24
25 B. After floating, test surface for trueness with a 10 foot straightedge. Distribute concrete as required
26 to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.
27
28 C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and
29 round to 1/2 inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.
30
31 D. After completion of floating and when excess moisture or surface sheen has disappeared, complete
32 surface finishing, as follows:
33
34 1. Broom finish, by drawing a fine-hair broom across concrete surface, perpendicular to line
35 of traffic. Repeat operation if required to provide a fine line texture acceptable to
36 Architect.
37
38 2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a
39 stiff-bristled broom, perpendicular to line of traffic.
40
41 3. Burlap finish, by dragging a seamless strip of damp burlap across concrete, perpendicular
42 to line of traffic. Repeat operation to provide a gritty texture acceptable to Architect.
43
44 E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends
45 of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with
46 major defects, as directed by Architect.
47

48 3.7 CURING:
49

- 50 A. Protect and cure finished concrete paving, complying with applicable requirements of Division 3
51 sections. Use moist-curing methods for initial curing whenever possible. Do not use liquid
52 membrane-forming materials where antispalling treatment will be applied.

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- B. Antispalling Treatment: Apply compound to concrete surfaces no sooner than 28 days after placement. Apply to clean, dry concrete free of oil, dirt, and other foreign materials, in 2 sprayed applications. First application at rate of 40 square yards. per gallon; second application, 60 square yards per gallon. Allow complete drying between applications.

3.8 REPAIRS AND PROTECTIONS:

- A. Repair or replace broken or defective concrete, as directed by Architect.
- B. Drill test cores where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy resin grout.
- C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

END OF SECTION 32 13 13

SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Installation of building water service, accessories and fittings to extend the existing public system.
- B. Excavation, installation, bedding cover and backfill of water main facilities.
- C. Protecting existing utilities in and around the site of the work.
- D. Testing and sterilizing the new mains and services.
- E. Coordination of the work to allow inspection by City/County personnel.
- F. Adjustment of valve boxes and manholes prior to pavement operations.
- G. Provisions for future connections.

1.2 RELATED SECTIONS

- A. 31 23 33 Trenching and Backfilling
- B. 31 25 00 Erosion Control

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - 1. B 88 – Seamless Copper Water Tube
 - 2. D 1557 – Test for Moisture-Density Relations of Soils Using 10-lb (4.5 Kg) Rammer and 18-inch (457 mm) Drop (Modified Proctor)
 - 3. D 2487 – Classification of Soils for Engineering Purposes
 - 4. D 2922 – Tests for Density of Soil and Soil- Aggregate in Place by Nuclear Methods (Shallow Depth)
 - 5. D 3017 – Test for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- B. American Water Works Association (AWWA) latest edition.
 - 1. C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - 2. C105 American National Standards for Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids

- 1 A. General
- 2 1. Conform to the requirements of the Standard Specifications.
- 3 a. Where conflicts exist between the requirements of this section, the Standard
- 4 Specifications, the requirements of the Standard Specifications shall govern.
- 5 2. Provide materials and appurtenances that conform to the Standard Specifications
- 6 B. Ductile-Iron Water Pipe
- 7 1. Conform to Standard Specifications.
- 8 C. Polyethylene Wrap for Ductile Iron Pipe
- 9 1. Conform to Standard Specifications.
- 10 D. Valves and Valve Boxes
- 11 1. Conform to Standard Specifications.
- 12 E. Hydrants
- 13 1. Conform to Standard Specifications.
- 14 F. Materials for Service Lateral Installation
- 15 1. Conform to Standard Specifications.
- 16 G. Rigid Insulation
- 17 1. Provide four (4) inch thick minimum 25 psi High density polystyrene board as
- 18 manufactured by Dow Chemical Company or equal furnished in four (4) foot wide sheets.
- 19 H. Bedding and Cover
- 20 1. Provide bedding and cover materials in accordance with Standard Specifications.
- 21
- 22 I. Granular Backfill
- 23
- 24 1. Granular Backfill material shall conform to the requirements of the Standard
- 25 Specifications. The price for Granular Backfill shall include the cost of hauling and
- 26 disposing of the material unsuitable or not used for backfill. Excess excavated trench
- 27 material shall be transported and disposed on site in a location approved by the
- 28 Construction Coordinator. Trench excavation material cannot be cast into piles within the
- 29 roadway/parking lot.
- 30
- 31 J. Water and Sanitary Laterals, Lateral Materials, Stop Boxes
- 32
- 33 1. Granular Backfill material and installation shall conform to the requirements of the
- 34 Standard Specifications.
- 35
- 36 PART 3 - EXECUTION
- 37 3.1 GENERAL
- 38
- 39 A. Conform to the requirements of the Standard Specifications.
- 40 1. Where conflicts exist between the requirements of this section and the Standard
- 41 Specifications, the requirements of the Standard Specifications shall govern.

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3.2 EXAMINATION

- A. Verify that water main locations and features are as depicted on the drawings.

3.3 PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Protect plant life and existing structures, from excavating equipment and vehicular traffic.
- C. Verify location of utilities in the vicinity of the proposed water main construction by hand excavation.
- D. Protect benchmarks and all other survey monuments from damage or displacement. If a marker needs to be removed it shall be referenced by a Registered Surveyor and replaced, as necessary, by the same.
- E. Verify that materials to be used are acceptable and available in sufficient quantity to complete the work before closing valves to isolate water main to be relocated.

3.4 EXCAVATION AND BEDDING AND COVER

- A. Excavate pipe trench in accordance with 31 23 33 for the work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated.
- B. Form and place concrete for pipe thrust restraints at hydrants, tees and bends in accordance with AWWA M41. Place concrete to permit full access to pipe and pipe accessories.
- C. Shore, brace, and drain excavations as necessary to maintain them safe, secure, and free of water at all times.
- D. Maintain optimum moisture content of bedding and cover material to attain required compaction density.
- E. Cost for bedding and cover is to be considered incidental to the price bid for Water Main Construction.

3.5 INSTALLATION - PIPE

- A. Perform work in accordance with the requirements of Section 4.3.0 of the Standard Specifications.
 - 1. Where conflicts between the requirements of this section and the Standard Specification occur, the requirements of the Standard Specifications shall take precedence.
- B. Install ductile iron pipe and fittings in accordance with AWWA C600.
- C. Route pipe in straight line.
- D. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- E. Install access fittings to permit disinfection of water system.
- F. Encase pipe in polyethylene in accordance with the requirements of Section 4.4.4 of the Standard

1 Specifications.

- 2
- 3 G. Form and place concrete for thrust restraints at each elbow or change in direction of pipe main.
- 4
- 5 H. Establish elevations of buried piping to ensure final cover of no less than six and one-half (6.5)
- 6 feet.
- 7
- 8 I. Backfill trench in accordance with 31 23 33.
- 9
- 10 J. Joint laterals shall be constructed as indicated on plans. Construction of laterals shall include
- 11 immediate, complete restoration of existing pavement.
- 12

13 3.6 INSTALLATION - VALVES AND HYDRANTS

- 14
- 15 A. Set hydrant auxiliary valves on solid bearing.
- 16
- 17 B. Set valve box stabilizer on top of valve. Center and plumb valve box over valve. Set box cover
- 18 flush with finished grade.
- 19
- 20 C. Final adjustments on all valves are incidental to installation.
- 21

22 3.7 DISINFECTION OF WATER SYSTEM

- 23
- 24 A. Disinfect system in accordance with the Standard Specifications.
- 25
- 26 B. The cost for water system disinfection is incidental to the price bid for Water Main
- 27 Construction.
- 28

29 3.8 TESTING OF WATER SYSTEM

- 30
- 31 A. Perform hydrostatic pressure and leakage test on all pipe, fittings, services and joints in accordance
- 32 with AWWA C600.
- 33
- 34 B. The cost for water system testing is incidental to the price bid for Water Main Construction.
- 35

36 3.9 PROVISIONS FOR FUTURE CONNECTIONS

- 37
- 38 A. No future connections required.
- 39

40 END OF SECTION 33 10 00

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SECTION 33 30 00

SANITARY SEWERAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Sanitary sewer piping, fittings and accessories for sanitary sewer laterals.

1.2 RELATED SECTIONS

- A. 31 23 33 Trenching and Backfilling
- B. 31 25 00 Erosion Control

1.3 REFERENCES

- A. ASTM A48 - Gray Iron Castings
- B. ASTM A74 - Cast Iron Soil Pipe and Fittings
- C. ASTM C270 - Mortar for Unit Masonry
- D. ASTM C478 - Precast Reinforced Concrete Manhole Sections
- E. ASTM C564-88 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings
- F. ASTM D698-89 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.5kg) Rammer and 12-in. (304.8-mm) Drop
- G. ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
- H. ASTM D2564 - Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- I. ASTM D2661-89 - Acrylonitrile-Butadiene-Styrene (ABS) Plastic Drain, Waste, and Vent Pipe and Fittings
- J. ASTM D2665-89a - Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- K. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
- L. ASTM D2855 - Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- M. ASTM D3034 - Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- N. ASTM D3212-89 - Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- O. ASTM F402-80 - Safe Handling of Solvent Cements Used for Joining Thermoplastic Pipe and Fittings
- Q. AASHTO M-198 - Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Water tight Gaskets
- R. State of Wisconsin Administrative Code Chapter NR 110.
- S. Standard Specifications for Sewer & Water Construction in Wisconsin, Sixth Edition, hereafter referenced as the Standard Specifications.

1.4 QUALITY ASSURANCE

- A. The City of Madison/Dane County may inspect the work.

- 1 1. Provide coordination to assure that City inspectors observe all sanitary sewer main
2 installation work.
- 3 B. All costs related to retesting due to failures shall be paid for by the CONTRACTOR at no additional
4 expense to OWNER. Provide free access to site for testing activities.
- 5 1.5 SUBMITTALS
- 6 A. Conform to applicable sections of Division 1.
- 7 B. Provide product data for pipe and pipe accessories.
- 8 1.6 PROJECT RECORD DOCUMENTS
- 9 A. Submit documents under applicable provisions of Division 1.
- 10 B. Accurately record location of pipe runs, connections, manholes, rim elevations and invert elevations.
- 11
- 12 1.7 MEASUREMENT AND PAYMENT
- 13
- 14 A. Measurement and payment for sanitary sewer construction and related work specified herein shall be
15 by unit price as shown on the Bid Form. Work shall include all labor, equipment, and materials related
16 to sanitary sewer construction.
- 17
- 18 1. Lengths of sanitary sewer construction are from center of structure to center of structure.

19 PART 2 - PRODUCTS

- 20
- 21 2.1 GENERAL
- 22 A. Conform with requirements of Standard Specifications.
- 23 1. Where conflicts exist between the requirements of this specification and the Standard
24 Specifications, the requirements of the Standard Specifications shall govern.
- 25 2.2 SEWER PIPE MATERIALS
- 26 A. PVC
- 27 1. General: Refer to the Standard Specifications
- 28 2.3 BEDDING AND COVER
- 29 A. Provide bedding and cover material in accordance with the Standard Specifications and Section 31 23 33
30 Trenching and Backfilling.
- 31 2.4 CRUSHED STONE
- 32 A. Provide crushed stone base in accordance with the Standard Specifications and Section 31 23 33
33 Trenching and Backfilling
- 34 2.5 GRANULAR BACKFILL
- 35 A. Granular Backfill material shall conform to the requirements of the Standard Specifications. The price
36 for Granular Backfill shall include the cost of hauling and disposing of the material unsuitable or not
37 used for backfill. Excess excavated trench material shall be transported and disposed on site in a
38 location approved by the Construction Coordinator. Trench excavation material cannot be cast into
39 piles within the roadway/parking lot.
- 40

1 PART 3 - EXECUTION

2

3 3.1 GENERAL

4 A. Conform with requirements of the Standard Specifications.

5 1. Where conflicts exist between the requirements of this specification and the Standard
6 Specifications, the requirements of the Standard Specifications shall govern.

7 3.2 HANDLING OF MATERIALS

8 A. Handle materials with care to avoid damage. Do not dump materials. Remove all damaged or flawed
9 materials from the site.

10 B. Arrange for suitable sites for material storage.

11 3.3 LINES AND GRADE

12 A. Benchmarks and Construction Layout

13 1. Owner will provide vertical and horizontal control as shown on existing conditions drawings.

14 B. Contractor shall provide all materials, equipment and labor to maintain line and grade.

15 1. The laser beam method is the preferred method for controlling line and grade. Equipment
16 shall be operated in accordance with the manufacturer's instructions. A person who is
17 competent with the operation of the laser equipment shall be present at the jobsite
18 whenever it is being used.

19 2. Other methods of maintaining line and grade may be used.

20 3.4 UNSTABLE FOUNDATION

21 A. Remove undesirable material below the trench bottom, such as organic soils, which cannot support the
22 pipe.

23 B. Crushed stone base material will be paid for at the unit price bid or on the basis of a negotiated price if
24 there is no bid price. Payment for crushed stone base will be made only if the Owner's representative is
25 notified prior to its placement. Payment will not be made for crushed stone base used for dewatering the
26 trench.

27 3.5 LAYING OF PIPE

28 A. General: Refer to Standard Specifications.

29 B. Lay pipe uniformly to line and grade so that the finished sewer presents a uniform bore. Noticeable
30 variations from true alignment and grade will be sufficient cause for rejection of the work.

31 C. Commence at the lowest point and proceed to the upper end. Lay pipe with bell-end pointing up-grade.

32 D. Provide a minimum of six inches between the pipe wall and the trench wall.

33 E. Rest each pipe on the full length of its barrel.

34 F. Do not lay the next pipe until the previous pipe is back-filled sufficiently to prevent movement during
35 joining.

36 G. Keep water out of the pipe. Do not let water rise into or around the pipe until the trench is filled at least
37 one foot above the pipe.

38 H. When work is stopped for any reason, securely plug the end of the pipe.

39 I. Jointing: Assemble joints in accordance with the pipe manufacturer's instructions.

1 3.6 BEDDING AND COVER

- 2 A. Provide bedding and cover in accordance with the Standard Specifications and Section 31 23 33.
3 B. Bedding and cover is to be considered incidental to the price bid for Sanitary Sewer Construction.

4 3.7 OUTSIDE DROP

- 5 A. Provide an outside drop as indicated on the Drawings whenever a sewer pipe enters the manhole 24
6 inches or more above the spring line of the outgoing sewer.

7 3.8 TESTING

- 8 A. All sewers shall be mandrel tested, low pressure leakage tested and televised in accordance with Standard
9 Specifications. Perform tests under observation of OWNER. All testing shall be considered incidental to
10 the price bid for Sanitary Sewer Construction.
11

12 3.9 SEPARATION FROM WATERMAIN

13 A. Vertical Separation

- 14 1. When a sewer crosses over a water main, provide a minimum of 18 inches between the bottom
15 of the sewer and the top of the water main.
16 2. When a sewer crosses under a water main, provide a minimum of six inches between the bottom
17 of the water main and the top of the sewer.

18 B. Building sewers and water service pipe may be placed in the same trench if the following conditions are
19 met:

- 20 1. The sewer and water pipes are constructed concurrently.
21 2. The top of the sewer is a minimum of 12 inches below the bottom of the water pipe.
22 3. The water pipe is placed on a solid shelf excavated at one side of the common trench, or the
23 water pipe is installed at one side of the common trench with 12 inches of bedding material.
24 The cover material on the sewer pipe shall be placed to a depth of 12 inches above the pipe and
25 compacted prior to installing the water pipe. The water pipe and sewer pipe have a minimum of
26 30 inches of horizontal separation.

27
28
29

END OF SECTION 33 30 00

SECTION 33 40 00

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Storm sewer pipe, manholes and accessories.

1.2 RELATED SECTIONS

- A. 31 23 33 Trenching and Backfilling
- B. 31 25 00 Erosion Control

1.3 REFERENCES

- A. ASTM A615-89 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- B. ASTM C76-90 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe
- C. ASTM D698-91 - Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5-lb (2.5kg) Rammer and 12-in. (304.8-mm) Drop
- D. AASHTO M-198 - Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Water tight Gaskets
- E. Standard Specifications for Sewer and Water Construction in Wisconsin, "Standard Specifications".

1.4 REGULATORY AGENCIES

- A. The City of Madison/Dane County
- B. Department of Safety and Professional Services

1.5 SUBMITTALS

- A. Submit product data under applicable sections of Division 1.
- B. Submit product data for pipe and pipe accessories.

1.6 PROJECT RECORD DOCUMENTS

- A. Submit documents under applicable sections of Division 1.
- B. Accurately record location of pipe runs, connections, manhole rim elevations and invert elevations.

1.7 MEASUREMENT AND PAYMENT

- A. Measurement and payment for storm sewer construction and related work specified herein shall be by unit price as shown on the Bid Form. Work shall include all labor, equipment and materials related to storm sewer construction.

- 1. Lengths of storm sewer construction are from center of structure to center of structure.

PART 2 - PRODUCTS

2.1 SEWER PIPE MATERIALS

- 1 A. Reinforced Concrete
- 2 1. Pipe: Reinforced concrete pipe meeting requirements of ASTM C76 or ASTM C507.
3 Provide Class III unless indicated otherwise in the Specifications or on the Drawings.
- 4 2. Joints:
- 5 a. Circular Pipe: Tongue and groove meeting requirements of ASTM C443.
- 6 B. Polyvinyl Chloride (PVC)
- 7 1. Pipe: ASTM D3034, SDR 35,
8 2. Joints: ASTM F477, Gasketed joints.
- 9 C. High Density Polyethylene (HDPE)
- 10 1. Pipe: ASTM F402, N-12 Pipe and AASHTO M 252 and 294.
11 2. Joints: Bell and spigot
- 12 2.2 STORM AND SANITARY SEWER PRE-CAST MANHOLES AND INLETS
- 13 A. Frames, grates, and manhole lids shall be constructed and installed per the Standard Specifications for
14 Sewer and Water Construction in Wisconsin and are considered incidental to the price of the structure.
- 15 2.3 PRE-CAST STORM SEWER PIPE END SECTIONS AND WELDED GRATES
- 16
- 17 A. End Sections shall be pre-fabricated to fit on the specified pipe size and type.
- 18
- 19 2.4 BEDDING AND COVER MATERIAL
- 20
- 21 A. Provide bedding and cover material in accordance with the drawings and Section 31 23 33
22 Trenching and Backfilling.
- 23
- 24 B. Granular Backfill material shall conform to the requirements of the Standard Specifications and as
25 located elsewhere in this specification. The price for Granular Backfill shall include the cost of
26 hauling and disposing of the material unsuitable or not used for backfill.
- 27
- 28 2.5 CRUSHED STONE
- 29
- 30 A. Provide crushed stone base in accordance with the Standard Specifications and Section 31 23 33
31 Trenching and Backfilling.
- 32 PART 3 - EXECUTION
- 33
- 34 3.1 HANDLING OF MATERIALS
- 35 A. Handle materials with care to avoid damage. Do not dump or drop materials. Remove all damaged or
36 flawed materials from the site.
- 37 B. Arrange for suitable sites for material storage.
- 38 3.2 LINES AND GRADE
- 39 A. Benchmarks and Construction Layout
- 40 1. Engineer will provide vertical and horizontal control.
- 41 2. Contractor shall provide construction layout.

- 1 B. Contractor shall provide all materials, equipment and labor to maintain line and grade.
- 2 1. The laser beam method is the preferred method for controlling line and grade. Equipment shall
- 3 be operated in accordance with the manufacturer's instructions. A person who is competent with
- 4 the operation of the laser equipment shall be present at the jobsite whenever it is being used.
- 5 2. Grade boards may be used. Use straight and even-edged 2X6 boards nailed or clamped to
- 6 substantial stakes on either side of the trench. Use stout twill line fastened at the center of the
- 7 alignment, pulled sufficiently tight to remove any noticeable or measurable sag. Measure down
- 8 from the line to set the alignment of the pipe. Maintain a minimum of three boards at all times.
- 9 3. Banjo strings may be used only when approved by the Engineer.

10 3.3 UNSTABLE FOUNDATION

- 11 A. Remove undesirable material below the trench bottom, such as organic soils, which cannot support the pipe.
- 12 Replace the material with crushed stone meeting the requirements of Section 31 23 33 for 2-inch crushed stone
- 13 base material.
- 14 B. Crushed stone base material will be paid for at the unit price bid or on the basis of a negotiated
- 15 price if there is no bid price. Payment for crushed stone base will be made only if the Owner's representative is
- 16 notified prior to its placement. Payment will not be made for crushed stone base used for dewatering the trench.

17

18 3.4 LAYING OF PIPE

19

- 20 A. Lay pipe uniformly to line and grade so that the finished sewer presents a uniform bore. Noticeable variations
- 21 from true alignment and grade will be sufficient cause for rejection of the work.
- 22 B. Commence at the lowest point and proceed to the upper end. Lay pipe with bell-end pointing up-grade.
- 23 C. Provide a minimum of six inches between the pipe or box wall and the trench wall.
- 24 D. Rest each pipe on the full length of its barrel. Place box culvert sections on six inches of bedding
- 25 material.
- 26 E. Do not lay the next pipe until the previous pipe is back-filled sufficiently to prevent movement during joining.
- 27 F. Keep water out of the pipe. Do not let water rise into or around the pipe until the trench is filled at least one foot
- 28 above the pipe.
- 29 G. When work is stopped for any reason, securely plug the end of the pipe.
- 30 H. Pipe Jointing: Assemble joints in accordance with the pipe manufacturer's instructions.

31 3.5 BEDDING AND COVER

- 32 A. Use the following bedding sections as indicated in the Standard Specifications and Village Specifications.
- 33 B. Class C
- 34 1. Provide a minimum of six inches of bedding material under the pipe barrel and four inches under the bell.
- 35 Provide crushed stone bedding meeting requirements of Section 31 23 33. Spade or shovel-slice the
- 36 material so that it fills and supports the haunch area and encases the pipe to the limits. If excavation is
- 37 carried deeper than six inches below the pipe barrel, backfill the excess depth with 1 1/2 inch crushed
- 38 stone base material meeting requirements of Section 31 23 33.
- 39 2. After the pipe has been laid and jointed, place cover material by hand or equally careful means around the
- 40 sides of the pipe and up to a level twelve inches above the pipe. Provide cover material meeting the
- 41 requirements of Section 31 23 33.

1 For pipes 36 inches in diameter or larger, backfill material may be substituted for cover material. If
2 backfill material is used, the bedding material shall extend to the spring line of the pipe.

3 3.6 SEPARATION FROM WATER MAIN

4 A. Provide a minimum horizontal separation of ten feet when constructing parallel to the water main.

5 B. Vertical Separation

6 1. When a sewer crosses under a water main, provide a minimum of 12 inches between the bottom of
7 the water main and the top of the sewer.

8
9 2. When a sewer crosses over a water main, provide a minimum of 36 inches between the bottom of
10 the sewer and the top of the water main.

11
12 C. Excess excavated trench material shall be transported and disposed on site in a location approved by the
13 Construction Coordinator. Trench excavation material cannot be cast into piles within the roadway or
14 parking lot.

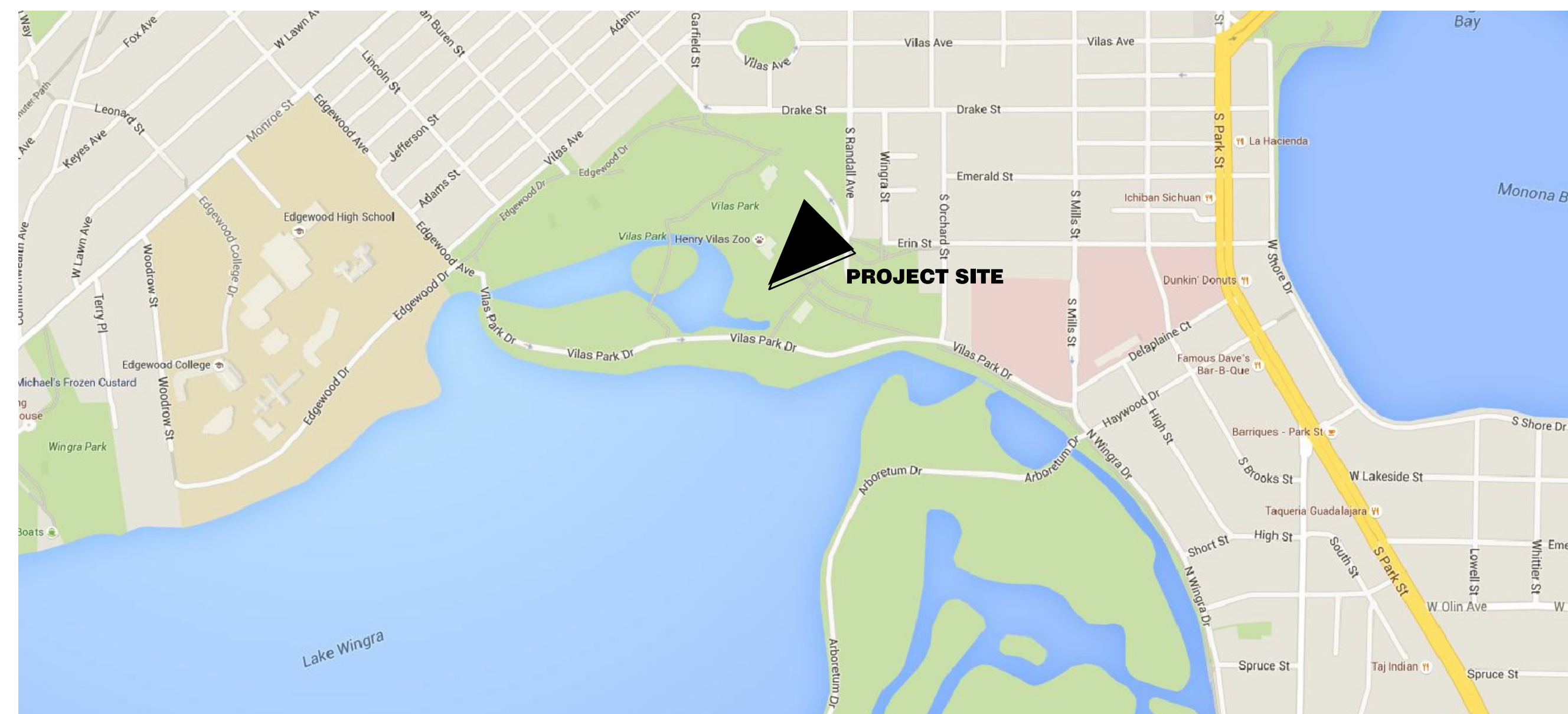
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16 END OF SECTION 33 40 00

NEW RESTROOM BUILDING HENRY VILAS ZOO 1246 VILAS PARK DRIVE MADISON, WISCONSIN

INDEX OF DRAWINGS

ABBREVIATIONS

ARCHITECTURAL SYMBOLS AND LEGEND



MADISON, WISCONSIN



- GENERAL**
G100 COVER SHEET AND INDEX OF DRAWINGS
- SITE**
C100 DEMO PLAN
C101 SITE PLAN
C200 GRADING AND EROSION CONTROL PLAN
C300 UTILITY PLAN
C400 DETAILS

- ARCHITECTURAL**
A100 EXTERIOR ELEVATIONS AND BUILDING SECTIONS
A200 FIRST FLOOR PLAN AND ROOF PLAN
A600 DETAILS
A601 DETAILS
- STRUCTURAL**
S100 FOUNDATION PLAN
S101 LOWER ROOF FRAMING PLAN AND DETAILS
S102 UPPER ROOF FRAMING PLAN
S300 STRUCTURAL DETAILS

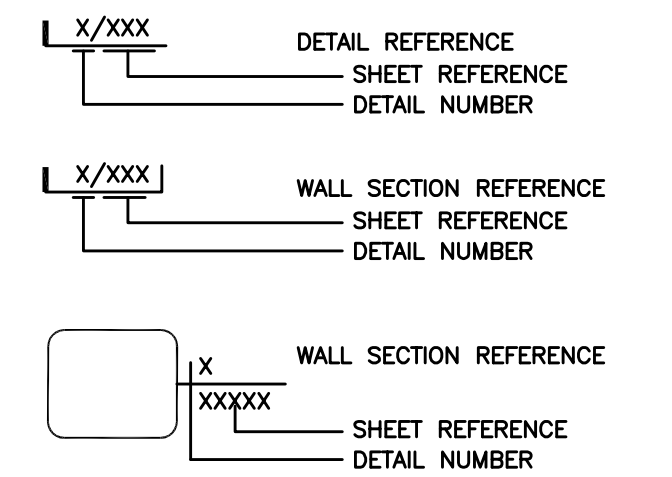
- PLUMBING**
P001 SYMBOLS, ABBREVIATIONS AND DETAILS - PLUMBING
P100 UNDERFLOOR PLAN - PLUMBING
P101 FLOOR PLAN - PLUMBING
P300 WASTE AND VENT RISER DIAGRAM - PLUMBING
P301 WASTE AND VENT RISER DIAGRAM - PLUMBING
P800 SCHEDULES- PLUMBING

- MECHANICAL**
M001 SYMBOLS, ABBREVIATIONS AND DETAILS - HVAC
M101 FLOOR PLAN - HVAC
M102 ROOF PLAN - HVAC
M400 SYSTEM SCHEMATIC - HVAC
M800 SCHEDULES - HVAC
M801 SCHEDULES - HVAC
M900 DETAILS - HVAC

- ELECTRICAL**
E000 ELECTRICAL SYMBOLS
E010 ELECTRICAL SITE PLAN
E100 FLOOR PLAN
E200 SCHEDULES

- ADA AMERICANS WITH DISABILITIES ACT
A.F.F. ABOVE FINISHED FLOOR
AL ALUMINUM
AP ACCESS PANEL
CF POLISHED CONCRETE RETROPLATE
CG CORNER GUARD
CJ CONTROL JOINT
CMU CONCRETE MASONRY UNIT
CONC CONCRETE
CPT CARPET
CT CERAMIC TILE
CUH CABINET UNIT HEATER
EJ EXPANSION JOINT
EWC ELECTRIC WATER COOLER
FD FLOOR DRAIN
FO FOUNDATION DRAIN SYSTEM FLUSHOUT
FRT FIRE TREATED
FX-# FIRE EXTINGUISHER AND TYPE
GWB GYPSUM WALL BOARD
HM HOLLOW METAL
MB MARKER BOARD
TB TACK BOARD
BB BULLETIN BOARD
M.O. MASONRY OPENING
N.I.C. NOT IN CONTRACT
O.F.C.I. OWNER FURNISHED CONTRACTOR INSTALLED
O.F.O.I. OWNER FURNISHED OWNER INSTALLED
OPP OPPOSITE
P.LAM. PLASTIC LAMINATE
REV REVERSE
RP RESILIENT PANEL
R.O. ROUGH OPENING
S.S. STAINLESS STEEL
TZO TERRAZZO
U.N.O. UNLESS NOTED OTHERWISE
VCT VINYL COMPOSITION TILE
WD WOOD
WP WATER PROOFING
WPT WORK POINT

MAJOR USE & OCCUPANCY CLASSIFICATION: B
CONSTRUCTION CLASSIFICATION: VB
BUILDING FOOTPRINT: 2950 SF



LEGEND (PROPOSED)

- DISTURBED AREA LIMIT LINE
- NEW BUILDING (FOR REFERENCE)
- SAWCUT LIMITS
- ASPHALT SURFACE REMOVAL AREA
- ASPHALT SURFACE AND BASE REMOVAL
- CONCRETE SURFACE REMOVAL
- CONCRETE SURFACE AND BASE REMOVAL
- EXISTING BUILDING REMOVAL
- TREE REMOVAL

NORTH

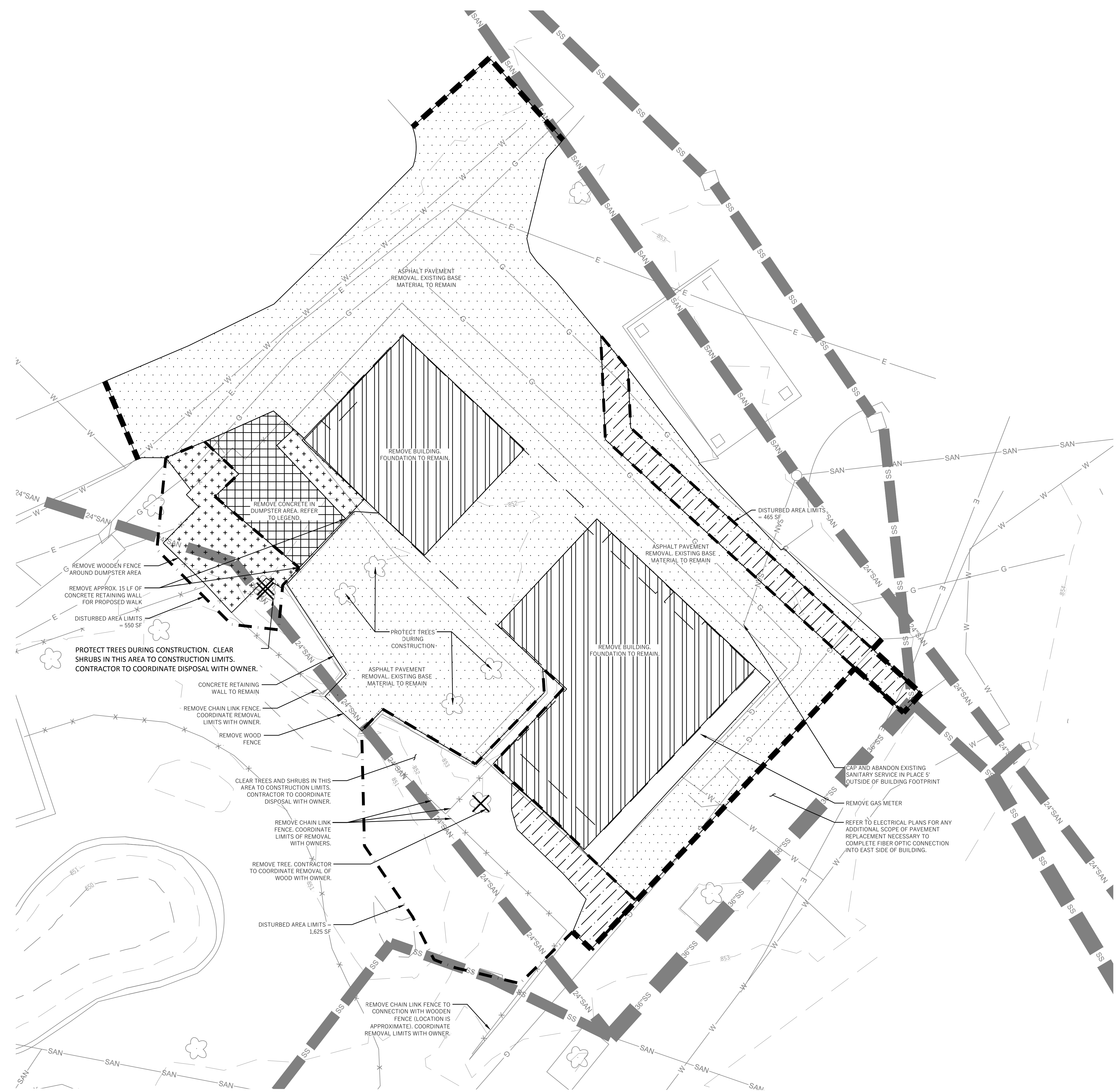
0' 5' 10' 15'
1" = 10' on 24"x36"
NTS on 11"x17"

GENERAL NOTES

- UNDERLYING SITE CONTOURS AND INFORMATION BASED ON TOPOGRAPHIC & UTILITY DATA AS PROVIDED TO MONTGOMERY ASSOCIATES. MONTGOMERY ASSOCIATES SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS THAT MAY ARISE AS A RESULT OF ERRONEOUS OR INCOMPLETE INFORMATION PROVIDED BY OTHERS. CONTRACTOR TO CONFIRM ALL ELEVATIONS, GENERAL DRAINAGE AND EARTHWORK REQUIREMENTS PRIOR TO CONSTRUCTION.
- THE BENCHMARK LOCATIONS ARE SHOWN FOR REFERENCE ONLY ON THIS PLAN. THE BENCHMARKS SHALL BE VALIDATED BY LICENSED LAND SURVEYOR PRIOR TO CONSTRUCTION. CONTRACTOR ASSUMES RISK ASSOCIATED WITH BENCHMARK ELEVATIONS UNTIL CONFIRMED.
- CONTRACTOR TO OBTAIN APPROPRIATE PERMITS FOR STREET OPENINGS & TO WORK WITHIN THE CITY'S LAND IF REQUIRED.
- MONTGOMERY ASSOCIATES SHALL BE HELD HARMLESS AND DOES NOT WARRANT ANY DEVIATIONS BY THE OWNER OR CONTRACTOR FROM THE APPROVED CONSTRUCTION PLANS THAT MAY RESULT IN DISCIPLINARY ACTIONS BY REGULATORY AGENCIES.
- IF ANY ERRORS, DISCREPANCIES, OR OMISSIONS WITHIN THE PLAN BECOME APPARENT, IT SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO CONSTRUCTION SO THAT CLARIFICATION OR REDESIGN MAY OCCUR.
- ALL MUNICIPAL UTILITY CONNECTIONS, WORK IN ROW, PUBLIC OUTLOTS AND PUBLIC EASEMENTS SHALL BE IN ACCORDANCE WITH CITY OF MADISON STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

DEMOLITION NOTES

- THIS PLAN INDICATES ITEMS ON THE SITE, NOT INCLUDING INTERNAL BUILDING DEMOLITION, INTENDED FOR DEMOLITION BASED ON THE CURRENT SITE DESIGN THAT HAVE BEEN IDENTIFIED BY A REASONABLE OBSERVATION OF THE EXISTING CONDITIONS THROUGH FIELD SURVEY RECONNAISSANCE. "DIGGER'S HOTLINE" LOCATION AND GENERAL "STANDARD OF CARE" THERE MAY BE ADDITIONAL ITEMS THAT CAN NOT BE IDENTIFIED BY A REASONABLE ABOVE GROUND OBSERVATION, WHERE NOT INCLUDED WITHIN THE FIELD SURVEY BY OTHERS, OF WHICH THE ENGINEER WOULD HAVE NO KNOWLEDGE OR MAY BE A PART OF ANOTHER DESIGN DISCIPLINE. IT IS THE CONTRACTOR'S / BIDDER'S RESPONSIBILITY TO REVIEW THE PLANS, INSPECT THE SITE AND PROVIDE HIS OWN DUE DILIGENCE TO INCLUDE IN HIS BID WHAT ADDITIONAL ITEMS, IN HIS OPINION, MAY BE NECESSARY FOR DEMOLITION. ANY ADDITIONAL ITEMS IDENTIFIED BY THE CONTRACTOR / BIDDER SHALL BE IDENTIFIED IN THE BID AND REPORTED TO THE OWNER AND ENGINEER OF RECORD. WYSER ENGINEERING TAKES NO RESPONSIBILITY FOR ITEMS ON THE PROPERTY THAT COULD NOT BE LOCATED BY A REASONABLE OBSERVATION OF THE PROPERTY OR OF WHICH THEY WOULD HAVE NO KNOWLEDGE.
- PRIOR TO CONSTRUCTION, THE CONTRACTOR IS RESPONSIBLE FOR:
 - EXAMINING ALL SITE CONDITIONS RELATIVE TO THE CONDITIONS INDICATED ON THE ENGINEERING DRAWINGS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE OWNER AND ENGINEER AND RESOLVED PRIOR TO THE START OF CONSTRUCTION.
 - VERIFYING UTILITY ELEVATIONS AND NOTIFYING OWNER AND ENGINEER OR ANY DISCREPANCIES. NO WORK SHALL BE PERFORMED UNTIL THE DISCREPANCIES ARE RESOLVED.
 - NOTIFYING ALL UTILITIES PRIOR TO THE REMOVAL OF ANY UNDERGROUND UTILITIES.
 - NOTIFYING THE OWNER, DESIGN ENGINEER AND LOCAL CONTROLLING MUNICIPALITY 48 HOURS PRIOR TO THE START OF CONSTRUCTION TO ARRANGE FOR APPROPRIATE CONSTRUCTION INSPECTION.
- CONTRACTOR IS SOLELY RESPONSIBLE FOR SITE SAFETY DURING THE CONSTRUCTION OF THESE IMPROVEMENTS.
- CONTRACTOR SHALL KEEP ALL STREETS AND ADJOINING SHARED ACCESS ROADWAYS FREE AND CLEAR OF ALL CONSTRUCTION RELATED DIRT, DUST AND DEBRIS.
- ALL TREES WITHIN THE CONSTRUCTION LIMITS SHALL BE REMOVED UNLESS SPECIFICALLY CALLED OUT FOR PROTECTION. ALL TREES TO BE REMOVED SHALL BE REMOVED IN THEIR ENTIRETY. STUMPS SHALL BE GROUND TO PROPOSED SUBGRADE.
- PERFORM TREE PRUNING IN ALL LOCATIONS WHERE PROPOSED PAVEMENT AND / OR UTILITY INSTALLATION ENCRACH WITHIN THE EXISTING DRIP LINE OF THE TREES TO REMAIN. ALL TRENCING WITHIN THE EXISTING DRIP LINE OF THE TREES TO REMAIN SHALL BE DONE RADIIALLY AWAY FROM THE TRUNK IF ROOTS IN EXCESS OF 1" DIAMETER ARE EXPOSED. ROOTS MUST BE CUT BY REPUTABLE TREE PRUNING SERVICE PRIOR TO ANY TRANSVERSE TRENCING.
- CONTRACTOR SHALL COORDINATE PRIVATE UTILITY REMOVAL / ABANDONMENT AND NECESSARY RELOCATIONS WITH RESPECTIVE UTILITY COMPANY. COORDINATION REQUIRED PRIOR TO CONSTRUCTION.
- ABANDONED / REMOVED ITEMS SHALL BE DISPOSED OF OFF SITE UNLESS OTHERWISE NOTED.
- THE CONTRACTOR SHALL INSTALL A PEDESTRIAN FENCE AROUND ALL EXCAVATIONS TO BE LEFT OPEN OVERNIGHT AS REQUIRED.
- CONTRACTOR TO REMOVE EXISTING UTILITY PIPE AND BACKFILL WITH SELECT FILL OR PROVIDE PIPE BACK-FILLING WITHIN BUILDING FOOTPRINT USING "LOW DENSITY CONCRETE / FLOWABLE FILL".
- GRANULAR BACKFILL MATERIALS ARE REQUIRED FOR FILL UNDER PROPOSED PAVED AREAS.
- RESTORATION OF THE EXISTING RIGHT-OF-WAYS AS NEEDED ARE CONSIDERED INCIDENTAL AND SHOULD BE PART OF THE COST OF THE UNDERGROUND IMPROVEMENTS, DEMOLITION AND REMOVAL. THIS INCLUDES, BUT IS NOT LIMITED TO, CURB & GUTTER, SIDEWALK, TOPSOIL, SEEDING AND MULCHING.
- ANY SANITARY SEWER, SANITARY SEWER SERVICES, WATER MAIN, WATER SERVICES, STORM SEWER, OR OTHER UTILITIES, WHICH ARE DAMAGED BY THE CONTRACTORS, SHALL BE REPAIRED TO THE OWNER'S SATISFACTION AT THE CONTRACTOR'S EXPENSE.
- ALL SITE SIGNAGE SHALL BE SALVAGED FOR REUSE AND SHALL BE THE PROPERTY OF THE OWNER IF REUSE IS NOT NECESSARY ON THIS PROJECT.



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BID DOCUMENTS

PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN



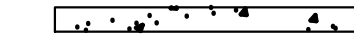
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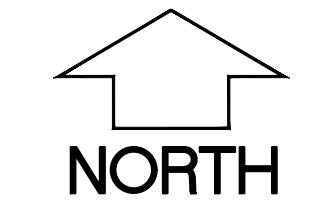
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C100

LEGEND (PROPOSED)

-  BUILDING FOOTPRINT
-  ASPHALT PAVEMENT
-  CONCRETE PAVEMENT



0' 5' 10' 15'
1" = 10' on 24"x36"
NTS on 11"x17"

GENERAL NOTES

1. UNDERLYING SITE CONTOURS AND INFORMATION BASED ON TOPOGRAPHIC & UTILITY DATA AS PROVIDED TO MONTGOMERY ASSOCIATES. MONTGOMERY ASSOCIATES SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS THAT MAY ARISE AS A RESULT OF ERRONEOUS OR INCOMPLETE INFORMATION PROVIDED BY OTHERS. CONTRACTOR TO CONFIRM ALL ELEVATIONS, GENERAL DRAINAGE AND EARTHWORK REQUIREMENTS PRIOR TO CONSTRUCTION.
2. THE BENCHMARK LOCATIONS ARE SHOWN FOR REFERENCE ONLY ON THIS PLAN. THE BENCHMARKS SHALL BE VALIDATED BY LICENSED LAND SURVEYOR PRIOR TO CONSTRUCTION. CONTRACTOR ASSUMES RISK ASSOCIATED WITH BENCHMARK ELEVATIONS UNTIL CONFIRMED.
3. CONTRACTOR TO OBTAIN APPROPRIATE PERMITS FOR STREET OPENINGS & TO WORK WITHIN THE CITY'S LAND IF REQUIRED.
4. MONTGOMERY ASSOCIATES SHALL BE HELD HARMLESS AND DOES NOT WARRANT ANY DEVIATIONS BY THE OWNER OR CONTRACTOR FROM THE APPROVED CONSTRUCTION PLANS THAT MAY RESULT IN DISCIPLINARY ACTIONS BY REGULATORY AGENCIES.
5. IF ANY ERRORS, DISCREPANCIES, OR OMISSIONS WITHIN THE PLAN BECOME APPARENT, IT SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO CONSTRUCTION SO THAT CLARIFICATION OR REDESIGN MAY OCCUR.
6. ALL MUNICIPAL UTILITY CONNECTIONS, WORK IN ROW, PUBLIC OUTLOTS AND PUBLIC EASEMENTS SHALL BE IN ACCORDANCE WITH CITY OF MADISON STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

SITE INFORMATION BLOCK:

SITE ADDRESS: 702 S RANDALL AVENUE
CONSTRUCTION SITE ACREAGE: 0.29 AC
USE OF PROPERTY: ZOO/PUBLIC RECREATION

EXISTING IMPERVIOUS SURFACE AREA: 11,260 SQ. FT.
ROOFTOP: 2,577 SQ. FT.
PAVED: 8,683 SQ. FT.

IMPERVIOUS SURFACE AREA AFTER IMPROVEMENTS: 10,580 SQ. FT.
ROOFTOP: 2,913 SQ. FT.
PAVED: 7,667 SQ. FT.

DISTURBANCE LIMITS: 2,640 SQ. FT.
IMPERVIOUS SURFACE AREA WITHIN DISTURBANCE LIMITS: 1,125 SQ. FT.
PERCENT IMPERVIOUS WITHIN DISTURBANCE LIMITS: 42.6%



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PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING SITE PLAN

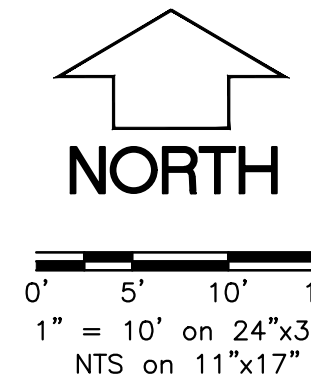
DATE 11/29/2016



C101

LEGEND (PROPOSED)

- BUILDING FOOTPRINT
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT
- PROPOSED STORM SEWER
- INLET PROTECTION
- SPOT GRADE
- DRAINAGE GRADE BREAK
- DRAINAGE ARROW



GENERAL NOTES

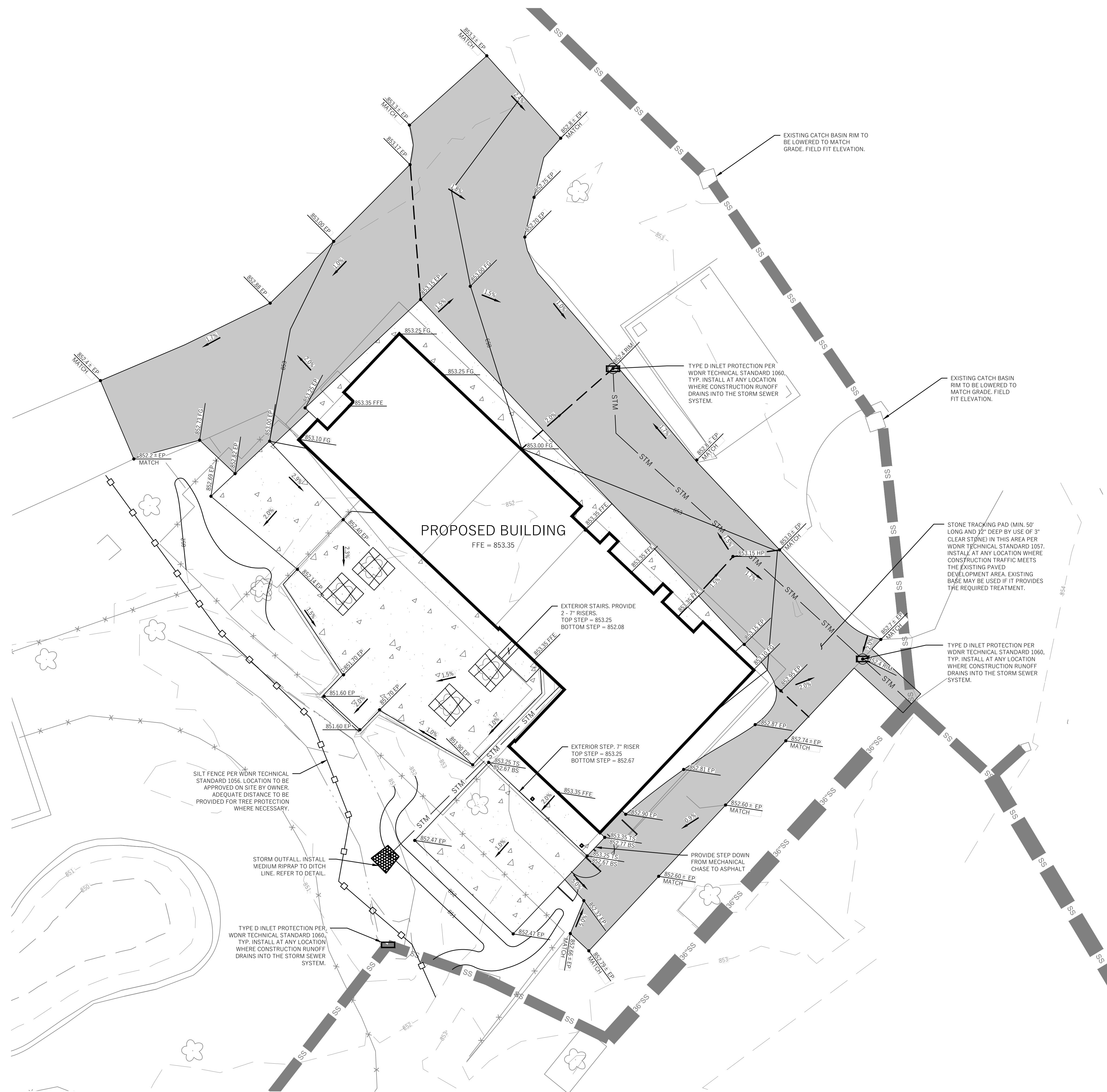
1. UNDERLYING SITE CONTOURS AND INFORMATION BASED ON TOPOGRAPHIC & UTILITY DATA AS PROVIDED TO MONTGOMERY ASSOCIATES. MONTGOMERY ASSOCIATES SHALL NOT BE HELD RESPONSIBLE FOR ANY ERRORS OR OMISSIONS THAT MAY ARISE AS A RESULT OF ERRONEOUS OR INCOMPLETE INFORMATION PROVIDED BY OTHERS. CONTRACTOR TO CONFIRM ALL ELEVATIONS, GENERAL DRAINAGE AND EARTHWORK REQUIREMENTS PRIOR TO CONSTRUCTION.
2. THE BENCHMARK LOCATIONS ARE SHOWN FOR REFERENCE ONLY ON THIS PLAN. THE BENCHMARKS SHALL BE VALIDATED BY LICENSED LAND SURVEYOR PRIOR TO CONSTRUCTION. CONTRACTOR ASSUMES RISK ASSOCIATED WITH BENCHMARK ELEVATIONS UNTIL CONFIRMED.
3. CONTRACTOR TO OBTAIN APPROPRIATE PERMITS FOR STREET OPENINGS & TO WORK WITHIN THE CITY'S LAND IF REQUIRED.
4. MONTGOMERY ASSOCIATES SHALL BE HELD HARMLESS AND DOES NOT WARRANT ANY DEVIATIONS BY THE OWNER OR CONTRACTOR FROM THE APPROVED CONSTRUCTION PLANS THAT MAY RESULT IN DISCIPLINARY ACTIONS BY REGULATORY AGENCIES.
5. IF ANY ERRORS, DISCREPANCIES, OR OMISSIONS WITHIN THE PLAN BECOME APPARENT, IT SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER PRIOR TO CONSTRUCTION SO THAT CLARIFICATION OR REDESIGN MAY OCCUR.
6. ALL MUNICIPAL UTILITY CONNECTIONS, WORK IN ROW, PUBLIC OUTLOTS AND PUBLIC EASEMENTS SHALL BE IN ACCORDANCE WITH CITY OF MADISON STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION.

CONSTRUCTION SITE EROSION CONTROL REQUIREMENTS

1. ALL EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE IMPLEMENTED IN ACCORDANCE WITH THE CURRENT WISCONSIN DEPARTMENT OF NATURAL RESOURCES (WDNR) EROSION AND SEDIMENT CONTROL TECHNICAL STANDARDS (dnr.wi.gov).
2. EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED PRIOR TO SITE DISTURBANCE.
3. ENGINEER / CITY OF MADISON HAS THE RIGHT TO REQUIRE CONTRACTOR TO IMPLEMENT ADDITIONAL EROSION CONTROL MEASURES AS NECESSARY. CONTRACTOR MUST NOTIFY THE VILLAGE OF MOUNT HOREB BUILDING INSPECTOR TWO (2) WORKING DAYS IN ADVANCE OF ANY SOIL DISTURBANCE ACTIVITIES.
4. EROSION AND SEDIMENT CONTROL PRACTICES SHALL BE INSPECTED ONCE PER WEEK AND FOLLOWING EACH RAINFALL EVENT. INSPECTION REPORTING SHALL BE IN ACCORDANCE WITH MUNICIPAL REQUIREMENTS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
5. IT IS THE CONTRACTOR'S RESPONSIBILITY TO MAINTAIN EROSION AND SEDIMENT CONTROL PRACTICES IN WORKING ORDER. EROSION CONTROL MEASURES SHALL BE REMOVED ONLY AFTER SITE CONSTRUCTION IS COMPLETE WITH ALL SOIL SURFACES HAVING AN ESTABLISHED VEGETATIVE COVER.
6. DEWATERING PRACTICES SHALL COMPLY WITH TECHNICAL STANDARD 1061.
7. DUST CONTROL SHALL BE MITIGATED IN ACCORDANCE WITH WDNR TECHNICAL STANDARD 1068.
8. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED IMMEDIATELY FOLLOWING FINAL GRADING ACTIVITIES.
9. SEED MIX AND RATE SHALL BE, AT A MINIMUM, IN ACCORDANCE WITH WDNR TECHNICAL STANDARD 1059.
10. CONTRACTOR TO PROVIDE SOLID LID OR METAL PLATE ON ALL OPEN MANHOLES DURING CONSTRUCTION TO MINIMIZE SEDIMENT FROM ENTERING THE STORM SEWER SYSTEM.
11. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING A COPY OF THE MUNICIPAL EROSION CONTROL PERMIT AND FOLLOWING ALL APPLICABLE REQUIREMENTS.

GRADING, SEEDING & RESTORATION NOTES

1. ALL GRADES SHOWN ARE FINAL FINISHED SURFACE GRADES.
2. AREAS TO BE SEEDED SHALL HAVE A MINIMUM 6 INCHES TOPSOIL UNLESS OTHERWISE NOTED.
3. RESTORATION SHALL OCCUR AS SOON AS PRACTICABLE AFTER THE DISTURBANCE, WITHIN 7 DAYS OF TOPSOILING.
4. AREAS NOT RESTORED WITH EROSION MATTING OR OTHER STABILIZATION MEASURES SHALL BE STABILIZED WITH MULCH.
5. APPLY ANIONIC POLYMER TO DISTURBED AREAS IF EROSION BECOMES PROBLEMATIC.
6. INSTALL EROSION CONTROLS ON THE DOWNSTREAM SIDE OF STOCKPILES AND PROVIDE TEMPORARY SEEDING ON STOCKPILES WHICH ARE TO REMAIN IN PLACE FOR MORE THAN 7 DAYS.
7. MULCH SHALL BE WEED-FREE STRAW AND SHALL BE INSTALLED AT THE RATE OF 2 TONS PER ACRE PER SECTION 627 OF "STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION" (WISDOT 2014)
8. PERMANENT SEEDING SHALL NOT OCCUR BETWEEN SEPTEMBER 15TH AND APRIL 15TH. ALTERNATE SEEDING/PLANTING METHODS AND/OR EROSION PROTECTION MAY BE NECESSARY FOR SEEDING/PLANTING THAT OCCURS DURING THAT TIME. COORDINATE WITH THE OWNER AS NECESSARY.
9. TEMPORARY STABILIZATION SHALL CONSIST OF ONE OR MORE OF THE FOLLOWING OPTIONS:
 - a. TEMPORARY SEEDING CONSISTING OF ANNUAL RYE GRASS APPLIED AT A RATE OF 1.5 LBS PER 1000 SQUARE FEET.
 - b. WISDOT PAL CLASS I TYPE B URBAN EROSION CONTROL MAT.
10. ALL SLOPES EXCEEDING 4:1 SHALL BE STABILIZED WITHIN 2-WEEK OF DISTURBANCE WITH TEMPORARY SEEDING AND CLASS I, TYPE B (URBAN) EROSION MATTING AND ALL DRAINAGE SWALES SHALL BE STABILIZED WITH CLASS II, TYPE B MATTING.



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PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING GRADING AND
EROSION
CONTROL
PLAN
DATE 11/29/2016

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0' 5' 10' 15'
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NTS on 11"x17"

LEGEND (PROPOSED)

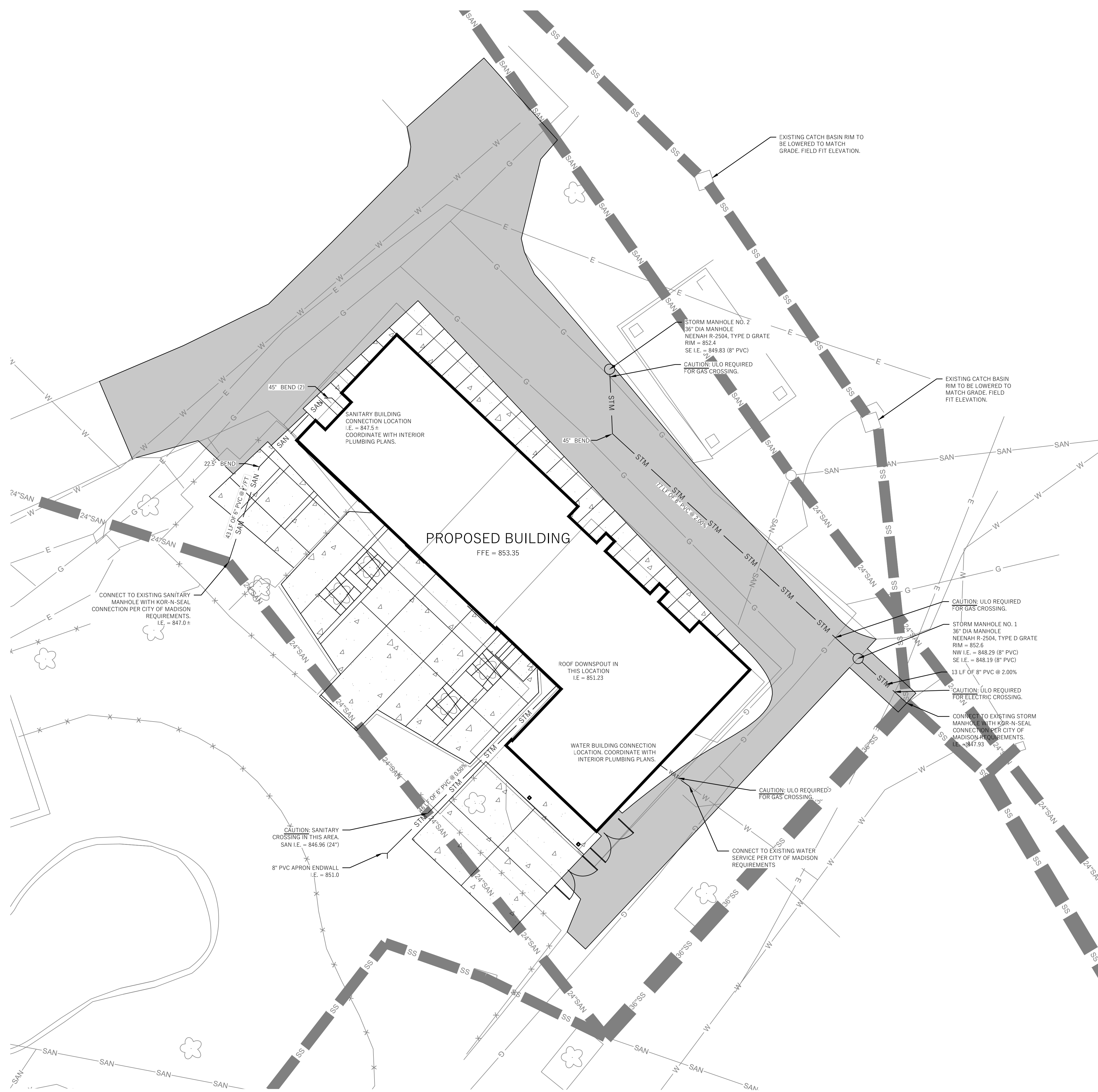
- BUILDING FOOTPRINT
- ASPHALT PAVEMENT
- CONCRETE PAVEMENT
- PROPOSED WATER MAIN
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER

GENERAL NOTES

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UTILITY NOTES

1. DIMENSIONS TAKE PRECEDENCE OVER SCALE. CONTRACTOR TO VERIFY ALL DIMENSIONS IN FIELD.
2. LENGTHS OF ALL UTILITIES ARE TO CENTER OF STRUCTURES OR FITTINGS AND MAY VARY SLIGHTLY FROM PLAN. LENGTHS SHALL BE VERIFIED IN THE FIELD DURING CONSTRUCTION.
3. CONTRACTOR SHALL VERIFY ALL ELEVATIONS, LOCATIONS, AND SIZES OF SANITARY, WATER AND STORM LATERALS AND CHECK ALL UTILITY CROSSINGS FOR CONFLICTS.
4. THE PROPOSED IMPROVEMENTS MUST BE CONSTRUCTED IN ACCORDANCE WITH ENGINEERING PLANS DESIGNED TO MEET ORDINANCES AND REQUIREMENTS OF THE MUNICIPALITY AND WISDOT, WISDPS, AND WDNR.
5. PRIOR TO CONSTRUCTION, THE CONTRACTOR IS RESPONSIBLE FOR:
 - EXAMINING ALL SITES CONDITIONS RELATIVE TO THE CONDITIONS INDICATED ON THE ENGINEERING DRAWINGS. ANY DISCREPANCIES ARE TO BE REPORTED TO THE ENGINEER AND RESOLVED PRIOR TO THE START OF CONSTRUCTION.
 - OBTAINING ALL PERMITS INCLUDING PERMIT COSTS, TAP FEES, METER DEPOSITS, BONDS, AND ALL OTHER FEES REQUIRED FOR PROPOSED WORK TO OBTAIN OCCUPANCY.
 - VERIFYING UTILITY ELEVATIONS AND NOTIFYING ENGINEER OF ANY DISCREPANCY. NO WORK SHALL BE PERFORMED UNTIL THE DISCREPANCY IS RESOLVED.
 - NOTIFYING ALL UTILITIES PRIOR TO THE INSTALLATION OF ANY UNDERGROUND IMPROVEMENTS.
 - NOTIFYING THE DESIGN ENGINEER AND MUNICIPALITY 48 HOURS PRIOR TO THE START OF CONSTRUCTION TO ARRANGE FOR APPROPRIATE CONSTRUCTION OBSERVATION.
9. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE ENGINEER WITH AS-BUILT CONDITIONS OF THE DESIGNATED IMPROVEMENTS IN ORDER THAT THE APPROPRIATE DRAWINGS CAN BE PREPARED. IF REQUIRED, ANY CHANGES TO THE DRAWINGS OR ADDITIONAL ITEMS MUST BE REPORTED TO THE ENGINEER AS WORK PROGRESSES.
10. ANY SANITARY SEWER, SANITARY SEWER SERVICES, WATER MAIN, WATER SERVICES, STORM SEWER, OR OTHER UTILITIES, WHICH ARE DAMAGED BY THE CONTRACTORS, SHALL BE REPAIRED TO THE OWNER'S SATISFACTION AT THE CONTRACTOR'S EXPENSE. NO BLASTING IS ALLOWED WITHIN 30 FEET OF EXISTING UTILITIES.
11. ALL PRIVATE INTERCEPTOR WATER MAIN AND WATER SERVICES SHALL BE INSTALLED WITH A 6' MINIMUM BURY. PROVIDE INSULATION ABOVE PIPES WITH LESS THAN 5' OF GROUND COVER.
12. GRANULAR BACKFILL MATERIALS ARE REQUIRED IN ALL UTILITY TRENCHES UNDER SIDEWALKS AND PROPOSED PAVED AREAS (UNLESS OTHERWISE SPECIFIED BY A GEOTECHNICAL ENGINEER). ALL UTILITY TRENCH BACKFILL SHALL BE COMPACTED PER SPECIFICATIONS. ALL PAVEMENT PATCHING SHALL COMPLY WITH THE CITY OF MADISON STANDARD SPECIFICATIONS. ADDITIONAL PAVEMENT MILLING AND OVERLAY MAY BE REQUIRED BY PERMIT.
13. CONTRACTOR SHALL NOTIFY THE MUNICIPAL PUBLIC WORKS DEPARTMENT A MINIMUM OF 48 HOURS BEFORE CONNECTING TO PUBLIC UTILITIES.
14. ALL NON-METALLIC BUILDING SEWER AND WATER SERVICES MUST BE ACCOMPANIED BY MEANS OF LOCATING UNDERGROUND PIPE TRACER WIRE VALVE BOXES SHALL BE INSTALLED ON ALL LATERALS AND AS INDICATED ON THESE PLANS.
15. ALL EXTERIOR CLEANOUTS SHALL BE PROVIDED WITH A FROST SLEEVE IN ACCORDANCE WITH SPS 382.34(5)(a)(b) AND SPS 384.30(2)(c).
16. ALL PRIVATE SANITARY BUILDING SEWER PIPE AND TUBING SHALL CONFORM TO SPS 384.30-3.
17. ALL PRIVATE STORM BUILDING PIPE AND TUBING SHALL CONFORM TO SPS 384.30-6.
18. ALL PRIVATE PIPE AND TUBING FOR WATER SERVICE SHALL CONFORM TO SPS 384.30-7.
19. ALL PRIVATE PIPE SHALL BE INSTALLED PER SPS 384.40-8 INCLUDING AT LEAST 8" OF HORIZONTAL DISTANCE BETWEEN WATER PIPING AND SANITARY SEWER FROM CENTER OF PIPE TO CENTER OF PIPE AND 6" OF SEPARATION BETWEEN STORM SEWER AND WATER PIPING.
20. THE CONTRACTOR SHALL ALLOW 10 WORKING DAYS FOR THE CONSTRUCTION OF GAS MAINS WHEN SCHEDULING THE WORK AND SHALL NOT RESTRICT ACCESS TO THE GAS MAIN CONTRACTOR OR OTHER UTILITY COMPANIES.
21. NO BLASTING SHALL OCCUR WITHIN 30 FEET OF ANY EXISTING UTILITIES
22. CONTRACTOR SHALL VERIFY AND COORDINATE ALL UTILITY CONNECTIONS WITH THE BUILDING PRIOR TO CONSTRUCTION.
23. THE CONTRACTOR SHALL CONDUCT HIS OPERATIONS SO AS TO BE IN CONFORMANCE WITH THE CITY EROSION CONTROL AND STORMWATER ORDINANCE AT ALL TIMES.



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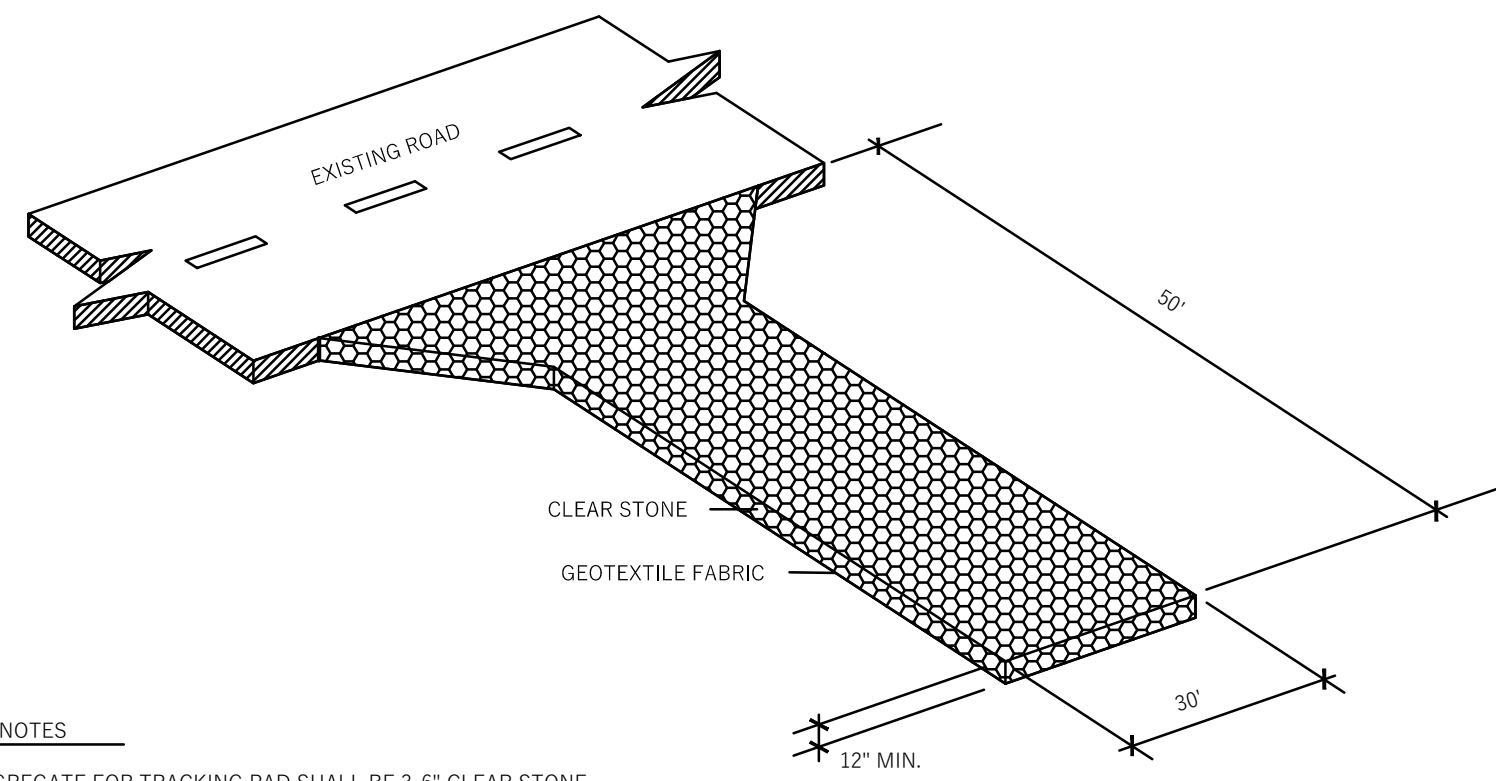
PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING UTILITY PLAN

DATE 11/29/2016

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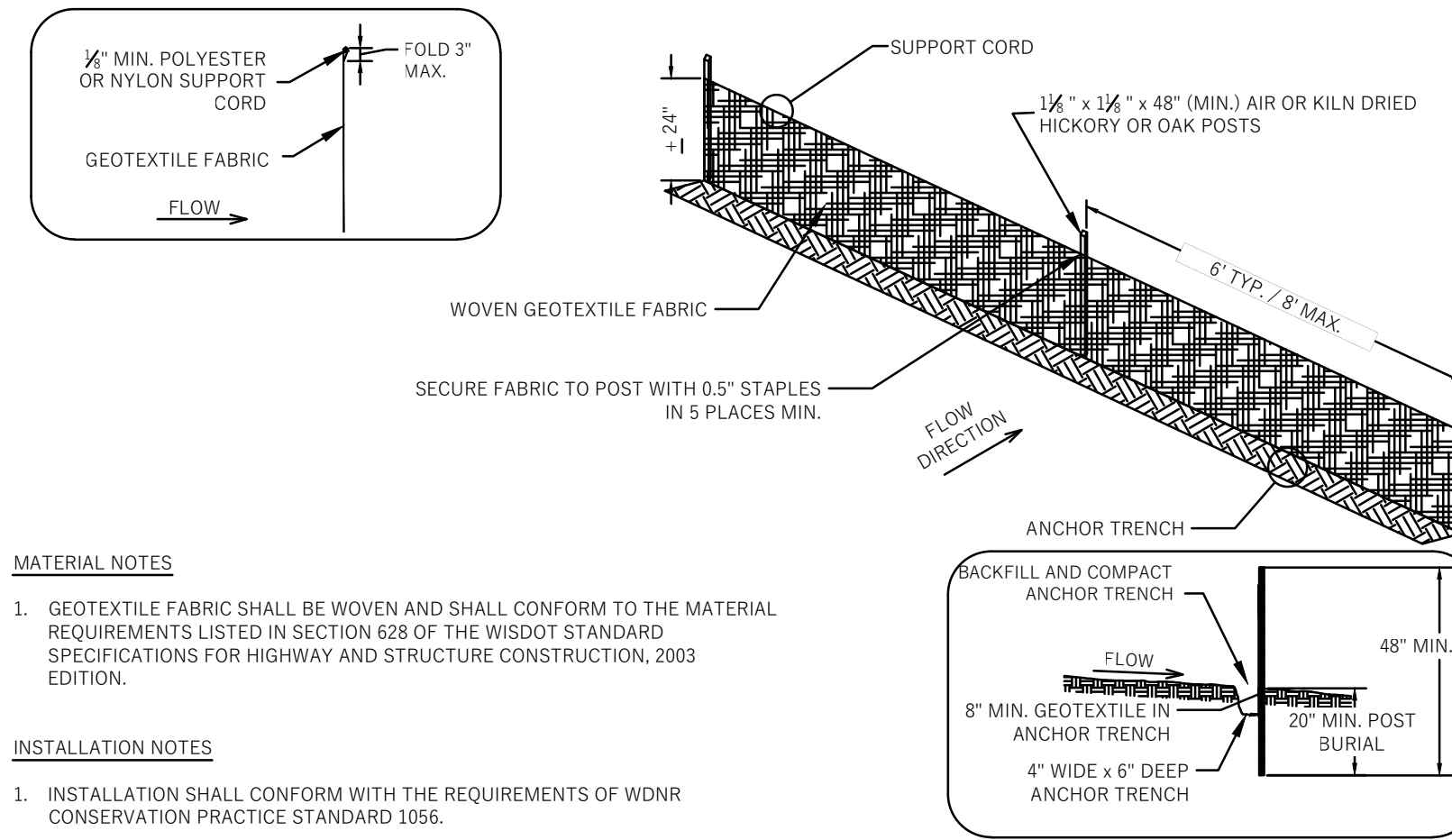


- MATERIAL NOTES**
1. THE AGGREGATE FOR TRACKING PAD SHALL BE 3-6" CLEAR STONE.
 2. THE TRACKING PAD SHALL BE UNDERLAIN WITH A WOOD TYPE R GEOTEXTILE FABRIC.

- INSTALLATION NOTES**
1. INSTALLATION SHALL CONFORM WITH THE REQUIREMENTS OF WDNR CONSERVATION PRACTICE STANDARD 1057.
 2. THE TRACKING PAD SHALL BE INSTALLED PRIOR TO ANY TRAFFIC LEAVING THE SITE. STONE TRACKING PAD SHALL BE USED AT ALL POINTS OF CONSTRUCTION EGRESS.
 3. DIMENSIONS OF THE TRACKING PAD SHALL BE MINIMUM AS NOTED ON THE FIGURE ABOVE.
 4. SURFACE WATER SHALL BE PREVENTED FROM PASSING THROUGH THE TRACKING PAD. FLOWS SHALL BE DIVERTED AWAY FROM TRACKING PADS OR CONVEYED UNDER AND AROUND THEM USING CULVERTS OR OTHER PRACTICES.
 5. TRACKING PAD SHALL BE REMOVED OR INCORPORATED INTO GRAVEL DRIVEWAY ONLY AFTER CONSTRUCTION IS COMPLETE AND THE SITE HAS BEEN STABILIZED.

- INSPECTION & MAINTENANCE NOTES**
1. STONE TRACKING PADS SHALL BE INSPECTED WEEKLY AND WITHIN 24 HOURS AFTER EVERY PRECIPITATION EVENT THAT PRODUCES 0.5 INCHES OF RAIN OR MORE DURING A 24 HOUR PERIOD.
 2. ADDITIONAL AGGREGATE SHALL BE PLACED IF THE TRACKING PAD BECOMES BURIED OR IF SEDIMENT IS NOT BEING REMOVED EFFECTIVELY FROM THE VEHICLE TIRES.
 3. A MINIMUM 30-FOOT WIDE BY 50-FOOT LONG BY 12-INCH THICK PAD SHALL BE MAINTAINED AT ALL TIMES.
 4. THE TRACKING PAD PERFORMANCE SHALL BE MAINTAINED BY SCRAPING OR TOP-DRESSING WITH ADDITIONAL AGGREGATE.
 5. ANY SEDIMENT TRACKED ONTO A PUBLIC OR PRIVATE ROAD SHOULD BE REMOVED BY STREET CLEANING AT THE END OF EACH WORKING DAY.
 6. MAINTENANCE SHALL BE COMPLETED AS SOON AS POSSIBLE WITH CONSIDERATION FOR SITE CONDITIONS.

CONSTRUCTION ENTRANCE (TRACKING PAD)

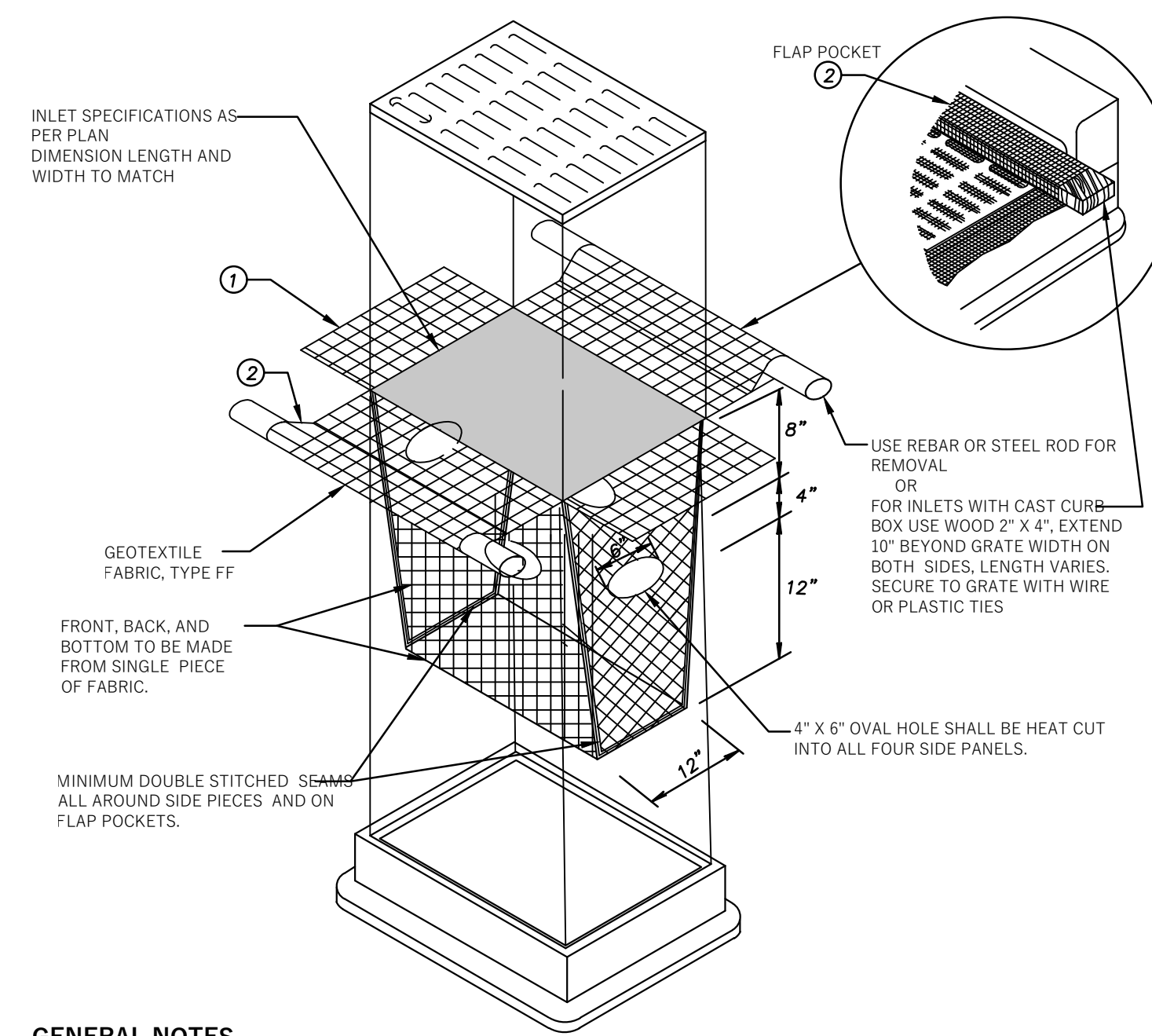


- MATERIAL NOTES**
1. GEOTEXTILE FABRIC SHALL BE WOVEN AND SHALL CONFORM TO THE MATERIAL REQUIREMENTS LISTED IN SECTION 628 OF THE WISDOT STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION, 2003 EDITION.

- INSTALLATION NOTES**
1. INSTALLATION SHALL CONFORM WITH THE REQUIREMENTS OF WDNR CONSERVATION PRACTICE STANDARD 1056.
 2. CONSTRUCT THE SILT FENCE IN AN ARC WITH THE ENDS POINTING UPSLOPE TO AVOID EROSION AROUND THE ENDS OF THE FENCE.
 3. FAILURE TO PROPERLY ANCHOR SILT FENCE COULD RESULT IN WATER AND SEDIMENT RELEASE BENEATH THE SILT FENCE. PROPERLY SECURE THE SILT FENCE INTO THE ANCHOR TRENCH.
 4. CONSTRUCT THE FENCE FROM A CONTINUOUS ROLL OF GEOTEXTILE TO AVOID JOINTS. WHERE JOINTS ARE NECESSARY, OVERLAP TO THE NEXT POST OR WRAP ADJOINING FABRICS TOGETHER AROUND THE JOINT POST AND TIGHTLY FASTEN.
 5. SILT FENCE SHALL NOT BE USED IN AREAS OF CONCENTRATED FLOW.

- INSPECTION & MAINTENANCE NOTES**
1. AT A MINIMUM, PERFORM INSPECTIONS WEEKLY AND WITHIN 24 HOURS OF PRECIPITATION EVENTS PRODUCING 0.5 INCHES OR MORE OF RAINFALL.
 2. INSPECT FENCES FOR DAMAGE TO STAKES AND FABRIC, UNDERCUTTING, EXCESSIVE SEDIMENT ACCUMULATION (GREATER THAN 1/2 OF THE FENCE HEIGHT), AND INDICATIONS OF SCOUR AROUND THE EDGES.
 3. REPAIR OR REPLACE SILT FENCE WITHIN 24 HOURS OF IDENTIFYING AND DEFICIENCIES.

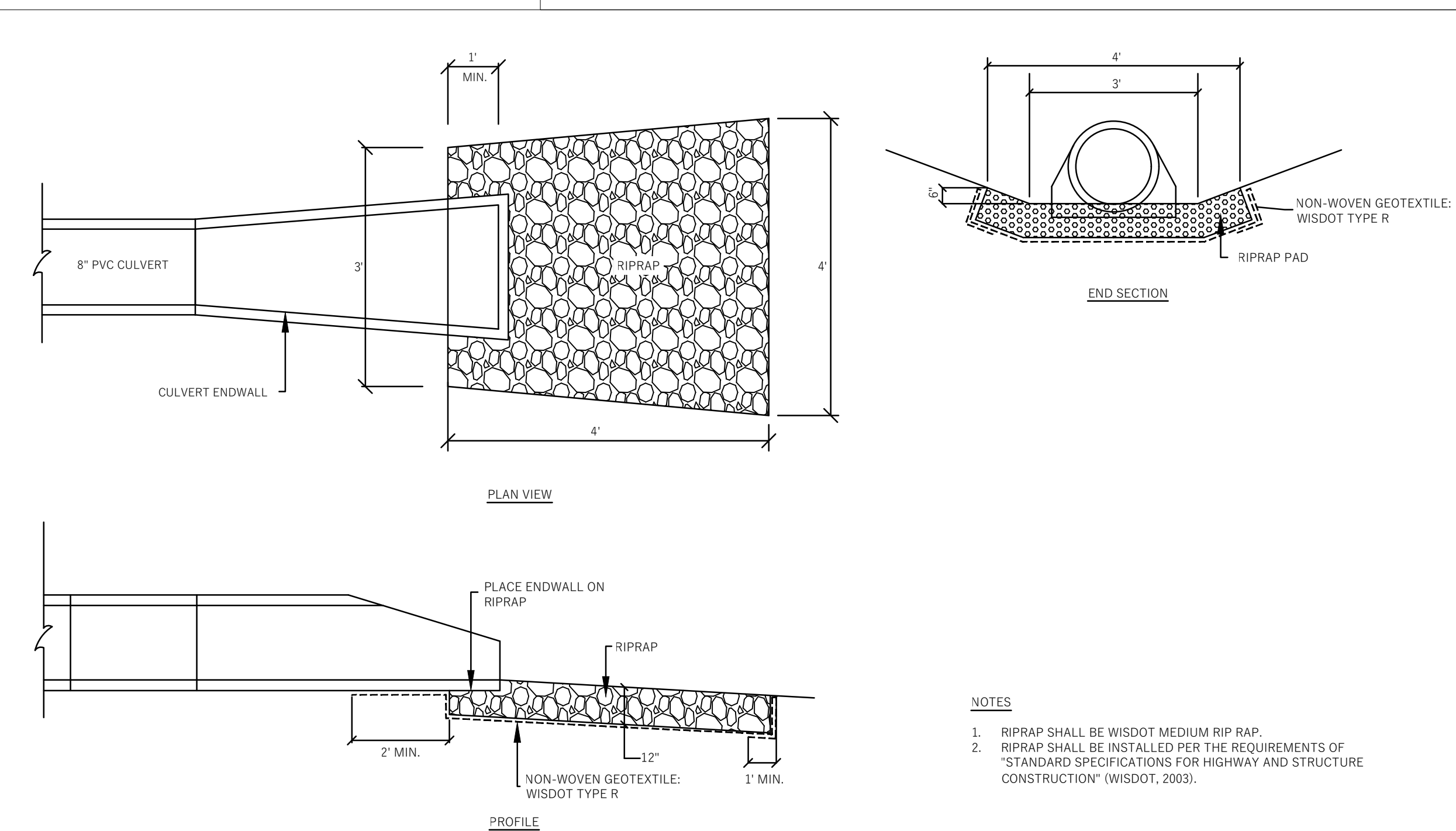
SILT FENCE



- GENERAL NOTES**
- THE WDNR TECHNICAL STANDARD 1050 FOR INLET PROTECTION SHALL BE FOLLOWED AT ALL TIMES. IF ANY VARIATION BETWEEN THIS DETAIL AND THE WDNR TECHNICAL STANDARD ARE FOUND, THE WDNR TECHNICAL STANDARD SHALL GOVERN.
- INLET PROTECTION DEVICES SHALL BE MAINTAINED OR REPLACED AT THE DIRECTION OF THE ENGINEER.
- MANUFACTURED ALTERNATIVES APPROVED AND LISTED ON THE DEPARTMENT'S EROSION CONTROL PRODUCT ACCEPTABILITY LIST MAY BE SUBSTITUTED.
- WHEN REMOVING OR MAINTAINING INLET PROTECTION, CARE SHALL BE TAKEN SO THAT THE SEDIMENT TRAPPED ON THE GEOTEXTILE FABRIC DOES NOT FALL INTO THE INLET. ANY MATERIAL FALLING INTO THE INLET SHALL BE REMOVED IMMEDIATELY.
1. FINISHED SIZE, INCLUDING FLAP POCKETS WHERE REQUIRED, SHALL EXTEND A MINIMUM OF 10" AROUND THE PERIMETER TO FACILITATE MAINTENANCE OR REMOVAL.
 2. FLAP POCKETS SHALL BE LARGE ENOUGH TO ACCEPT WOOD 2X4.

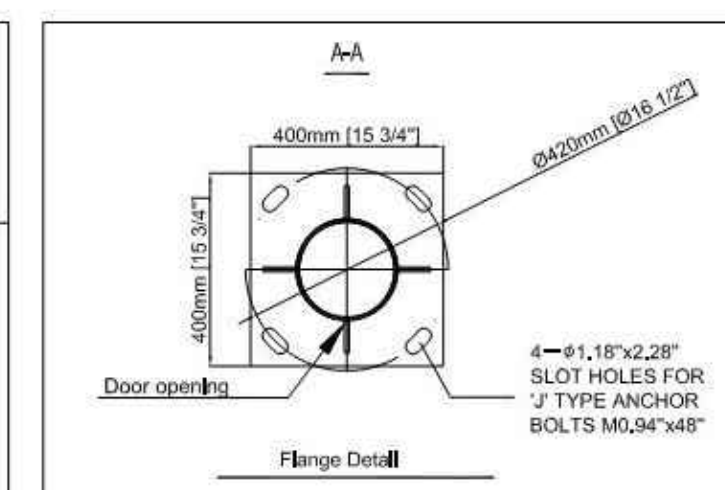
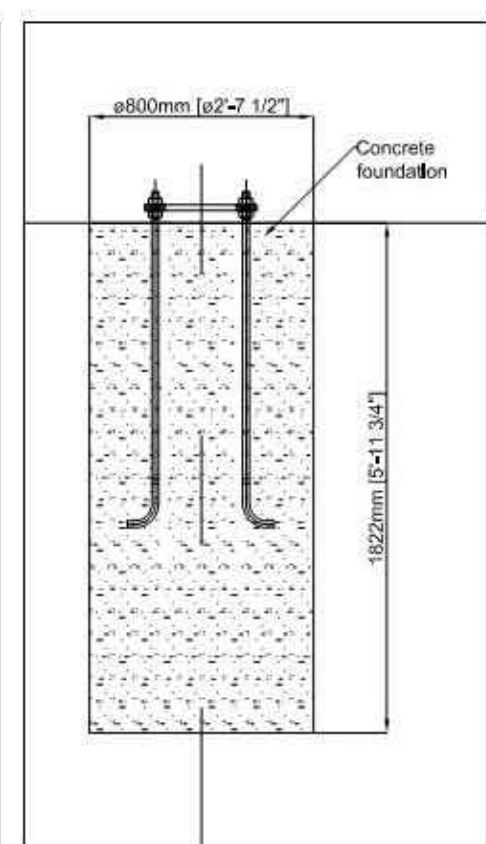
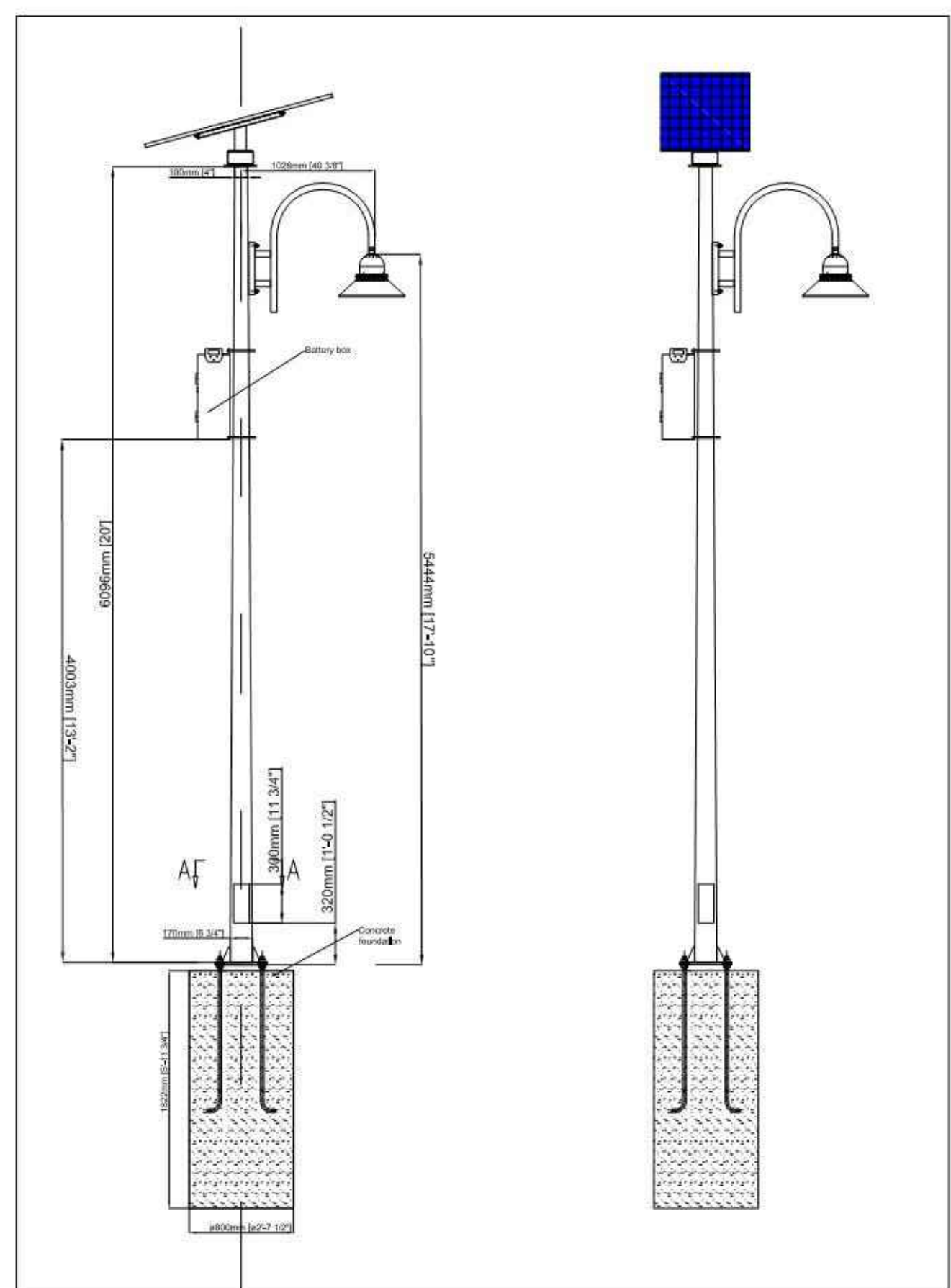
- INSTALLATION NOTES**
- DO NOT INSTALL INLET PROTECTION TYPE D IN INLETS SHALLOWER THAN 30", MEASURED FROM THE BOTTOM OF THE INLET TO THE TOP OF THE GRATE. USE TYPE C INLET PROTECTION WITHIN SHALLOW INLETS.
- TRIM EXCESS FABRIC IN THE FLOW LINE TO WITHIN 3" OF THE GRATE.
- THE INSTALLED BAG SHALL HAVE A MINIMUM SIDE CLEARANCE, BETWEEN THE INLET WALLS AND THE BAG, MEASURED AT THE BOTTOM OF THE OVERFLOW HOLES, OF 3". WHERE NECESSARY THE CONTRACTOR SHALL CINCH THE BAG, USING PLASTIC ZIP TIES, TO ACHIEVE THE 3" CLEARANCE. THE TIES SHALL BE PLACED AT A MAXIMUM OF 4" FROM THE BOTTOM OF THE BAG.

TYPE D INLET PROTECTION



OUTLET PROTECTION


- NOTES**
1. RIPRAP SHALL BE WISDOT MEDIUM RIPRAP.
 2. RIPRAP SHALL BE INSTALLED PER THE REQUIREMENTS OF "STANDARD SPECIFICATIONS FOR HIGHWAY AND STRUCTURE CONSTRUCTION" (WISDOT, 2003).



* Foundation dimensions shall be confirmed by a local engineering company.
 * GreenShine: Now energy will not be held liable for any defect of the concrete foundation due to improper siting.
 * Drawings are based using hot-dipped galvanized steel, powder coating with a thickness of 2\"/>

Tilt angle of the solar panels	15	30	45	60
EPA (ft ²)*	7.66	10.29	12.54	14.27
Wind resistance** (mph)	145	145	145	145

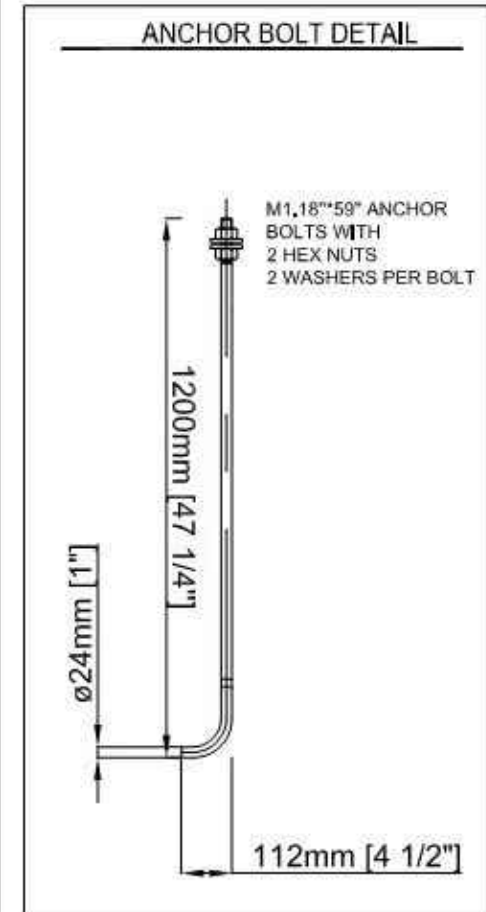
Proposal

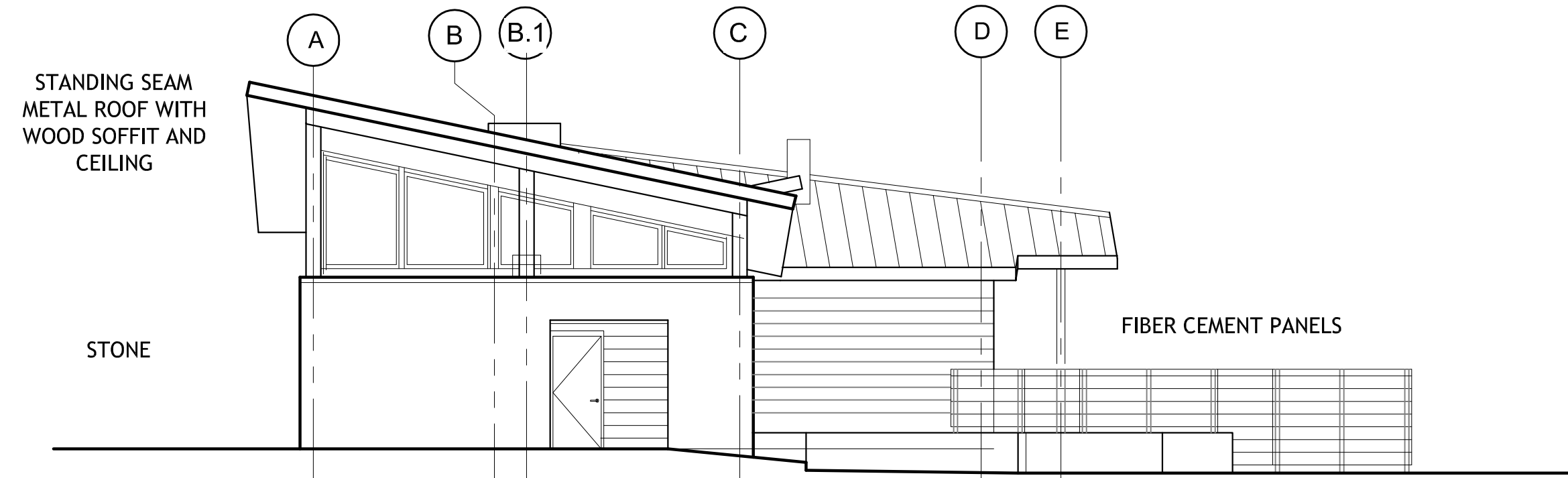


System Lumina series - 20' pole -1 panel

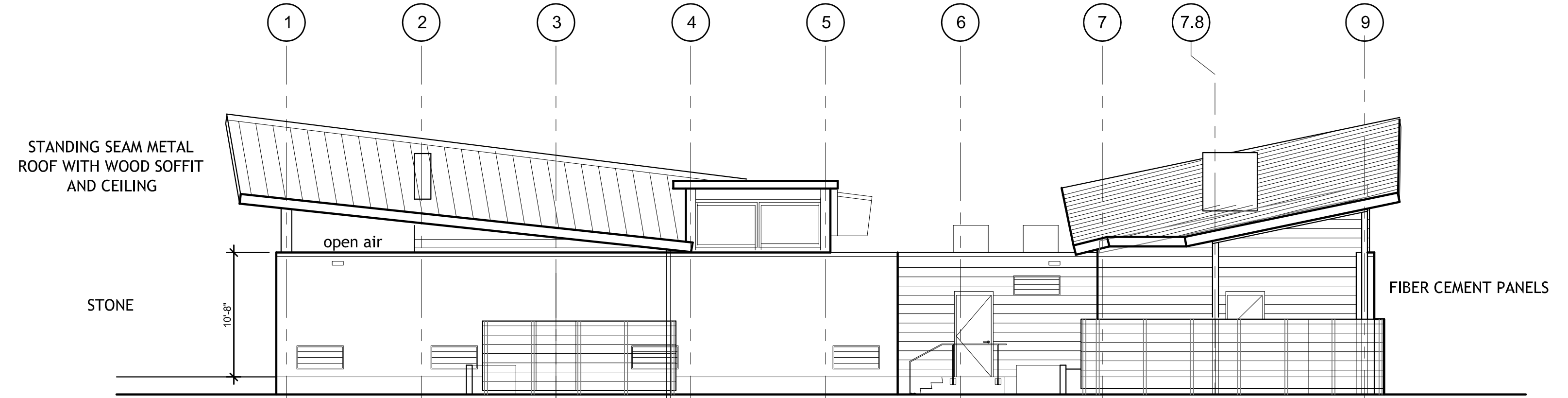
By _____ Date 6/24/2014

www.streetlights-solar.com

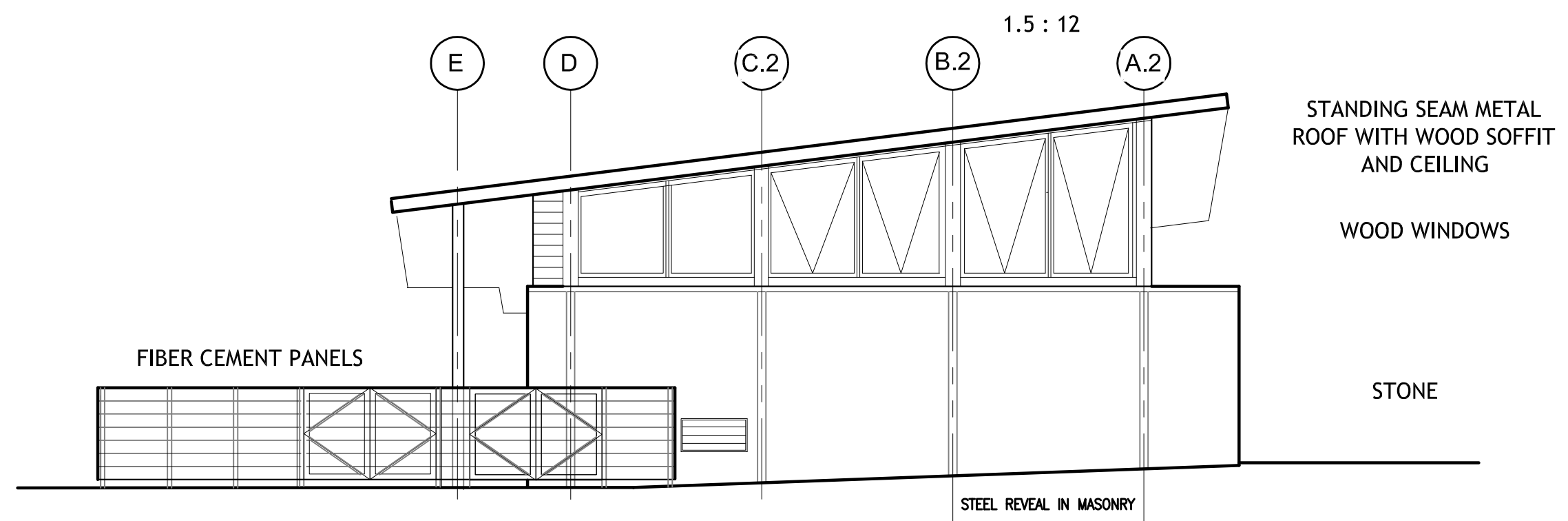




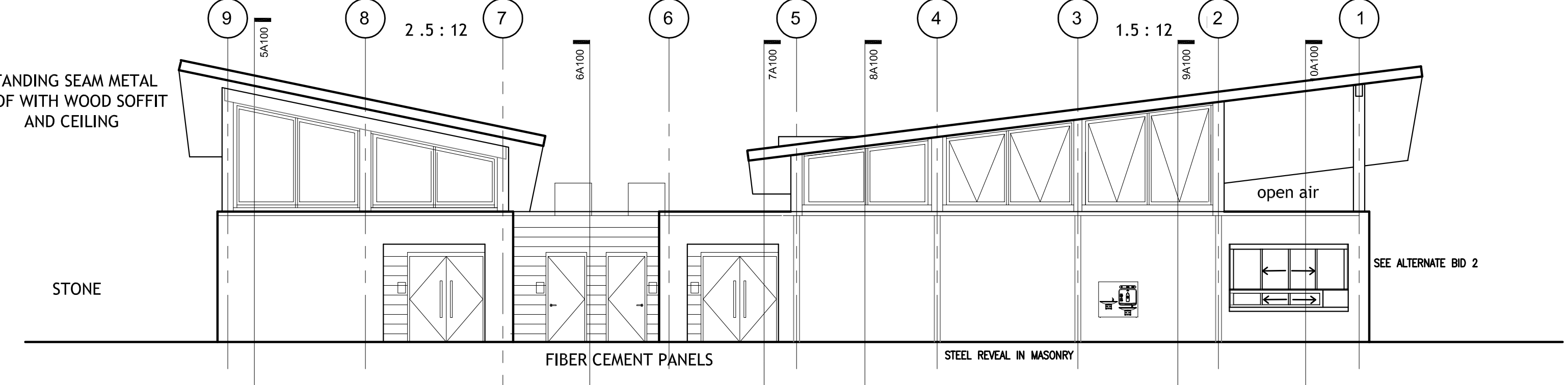
1 WEST ELEVATION
1/8"=1'-0"



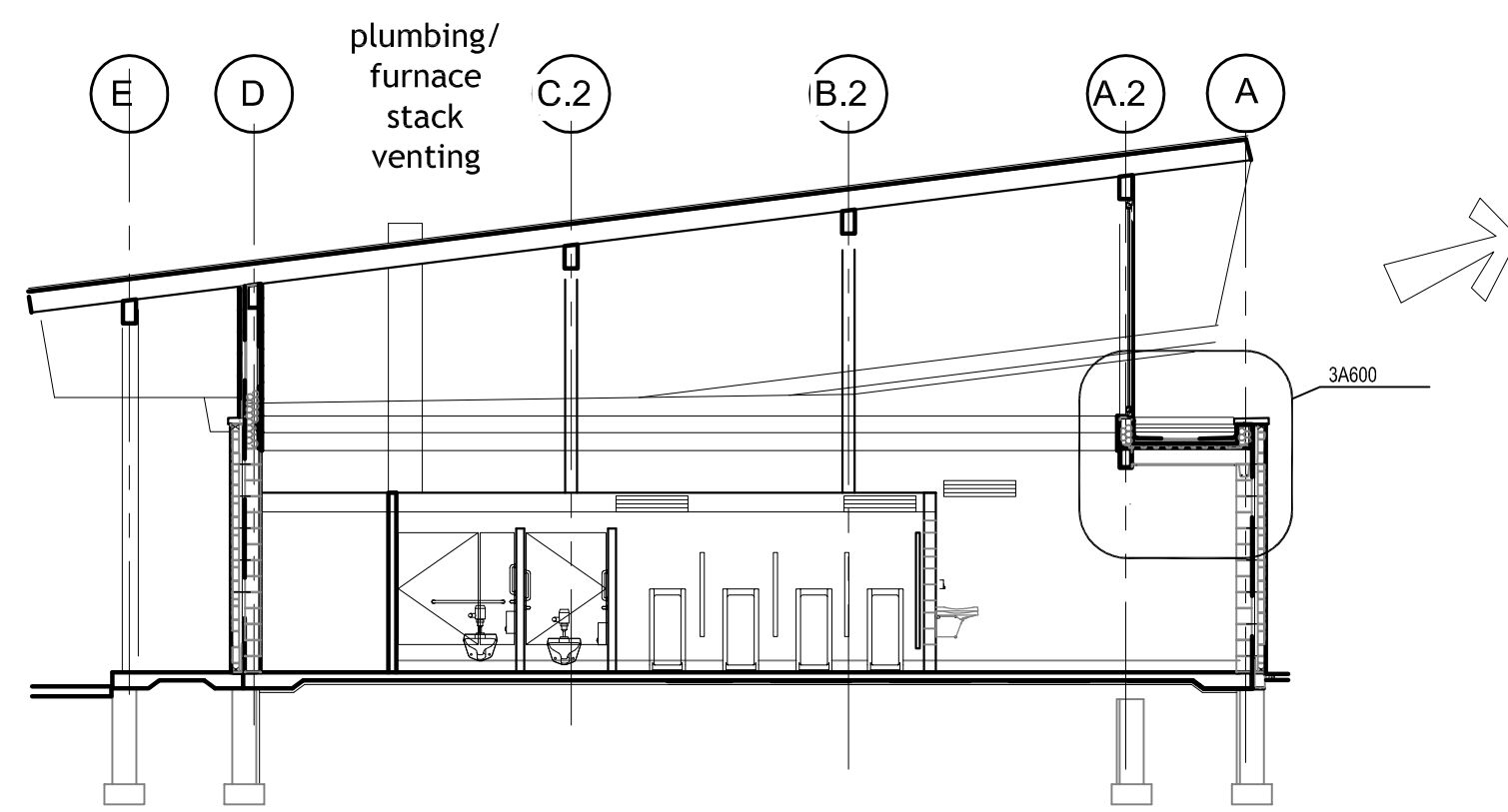
2 SOUTH PATIO ELEVATION
1/8"=1'-0"



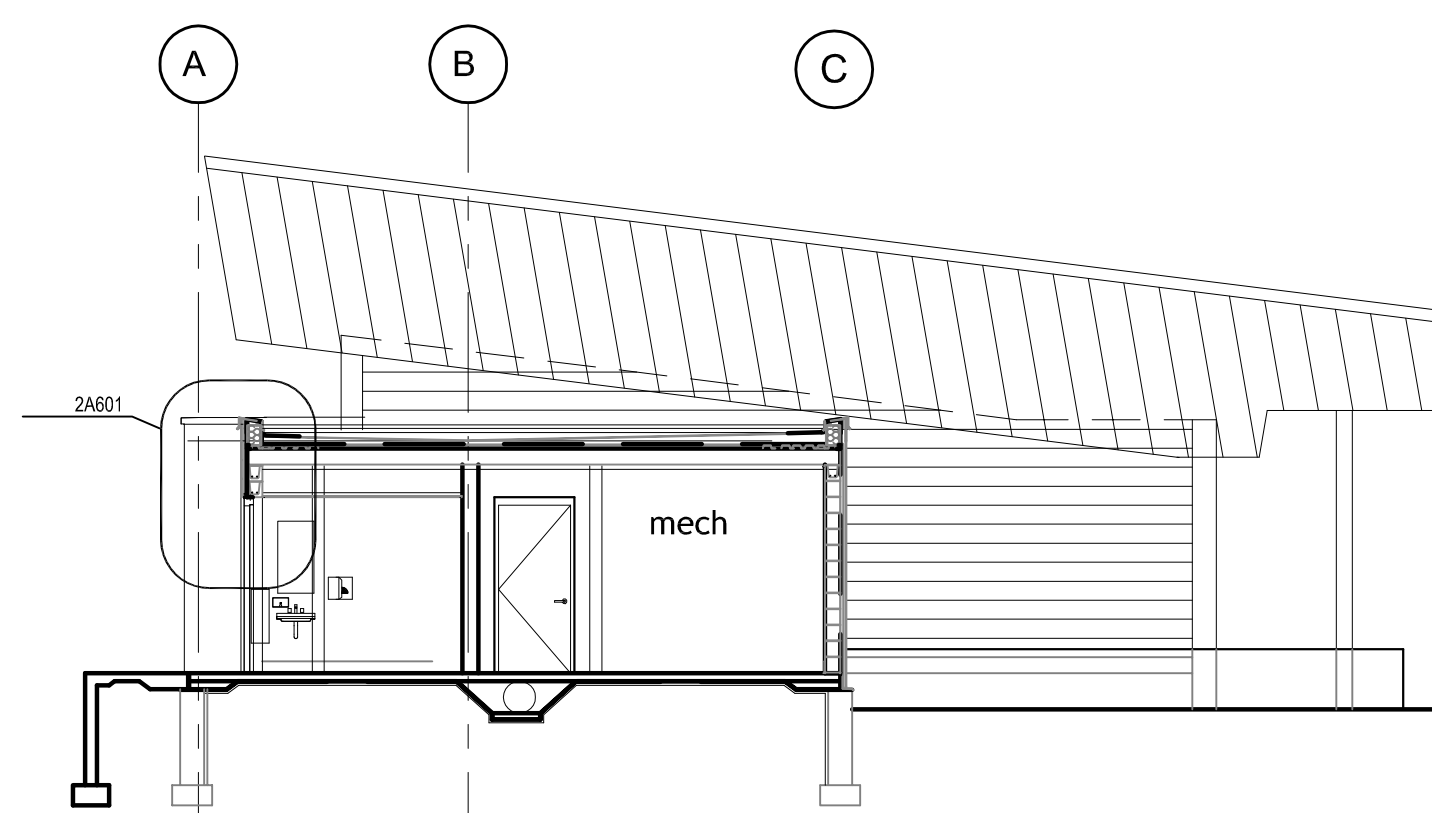
3 EAST ELEVATION
1/8"=1'-0"



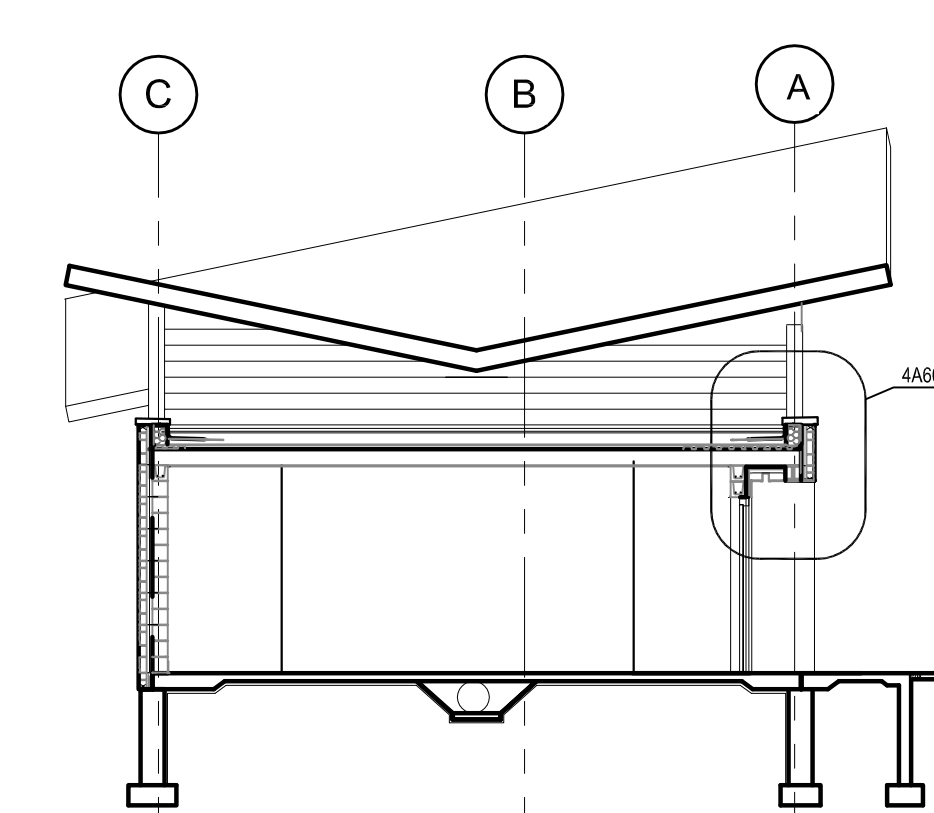
4 NORTH ELEVATION
1/8"=1'-0"



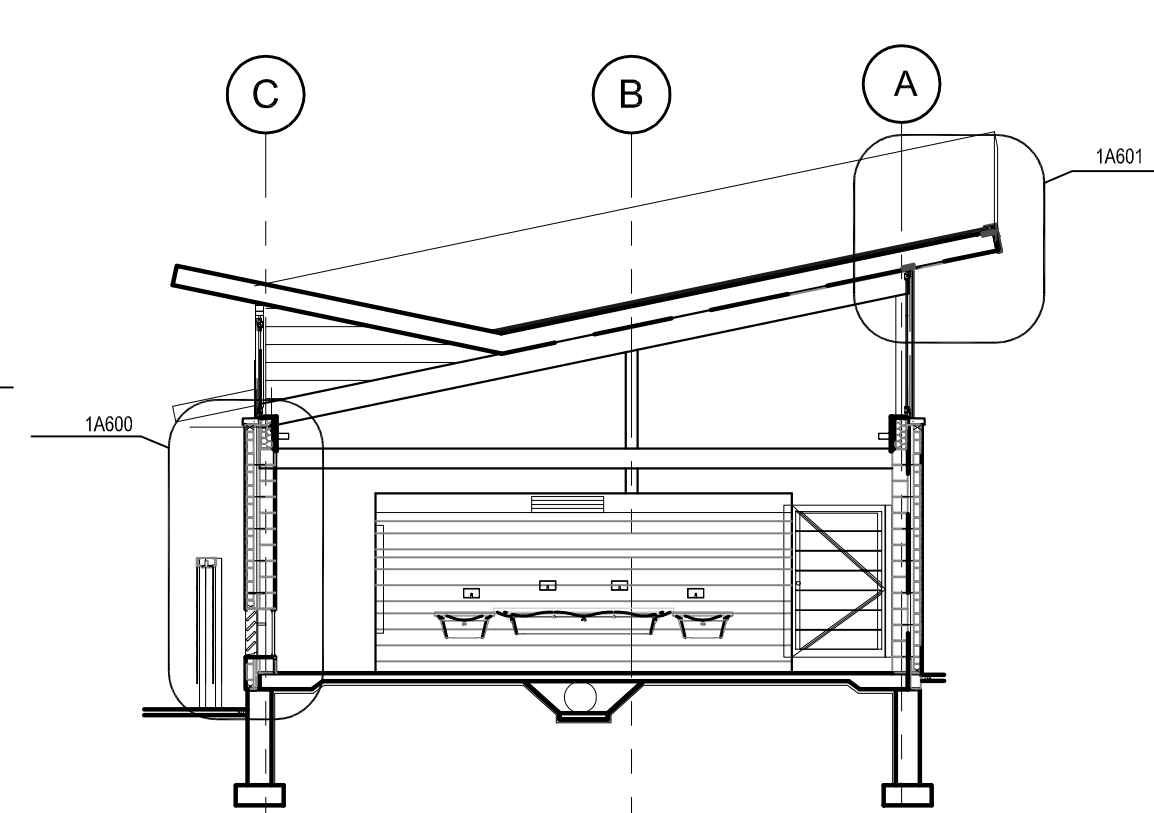
5 BUILDING SECTION
1/8"=1'-0"



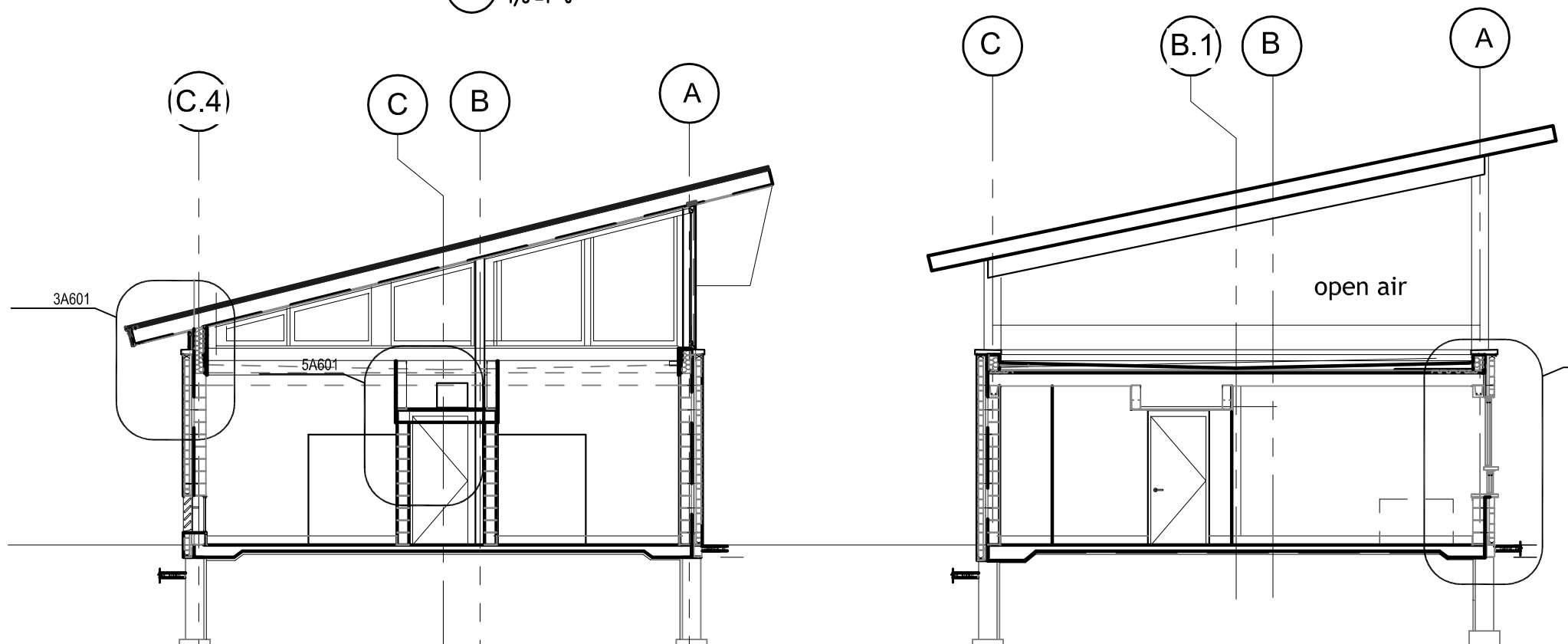
6 BUILDING SECTION
1/8"=1'-0"



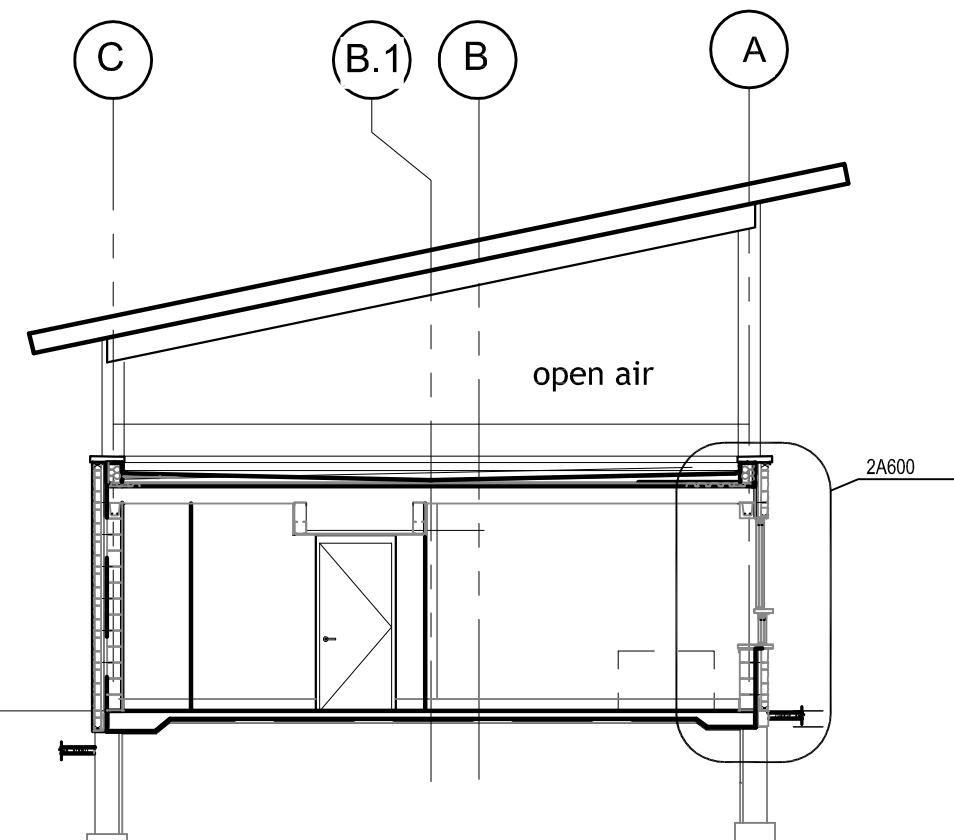
7 BUILDING SECTION
1/8"=1'-0"



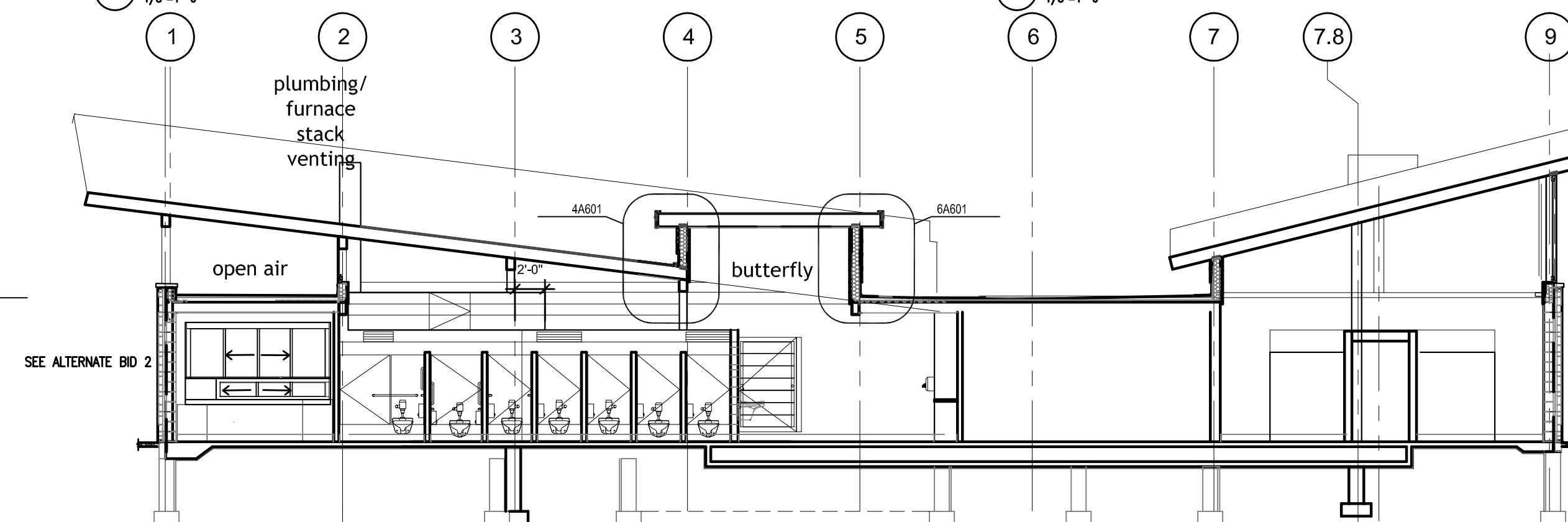
8 BUILDING SECTION
1/8"=1'-0"



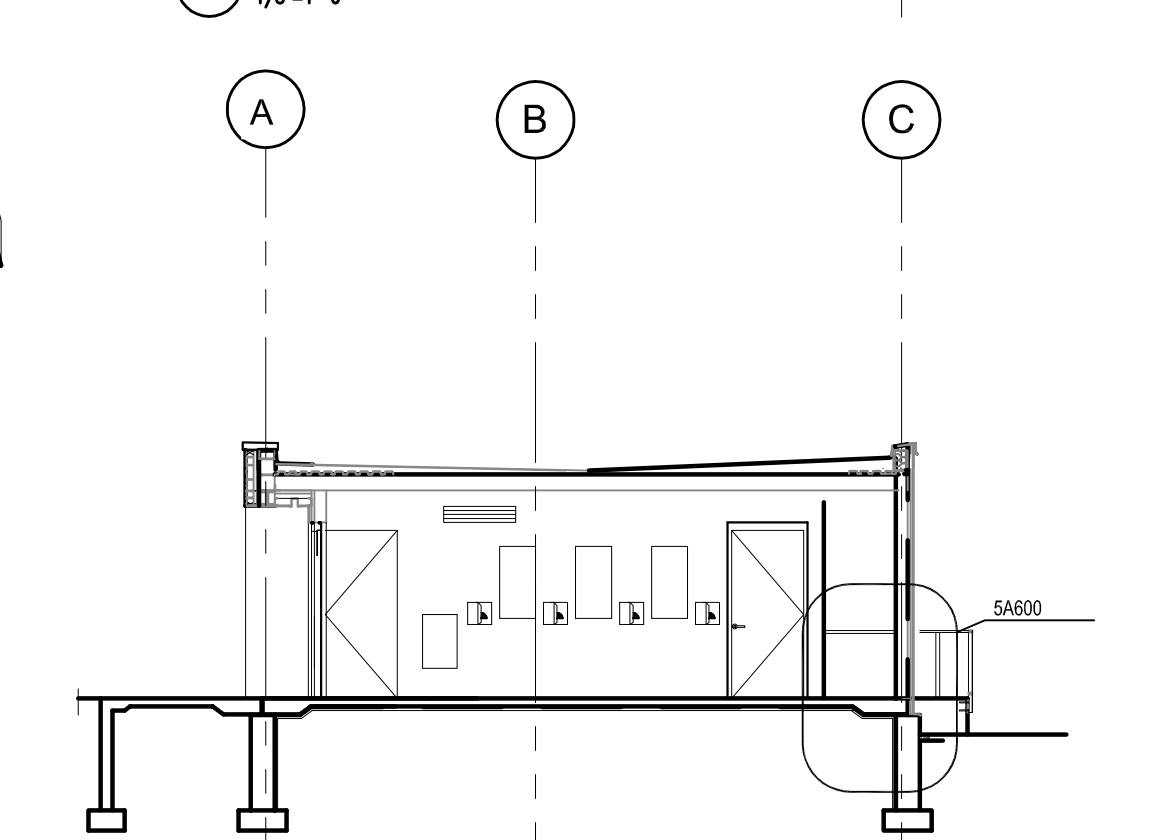
9 BUILDING SECTION
1/8"=1'-0"



10 BUILDING SECTION
1/8"=1'-0"



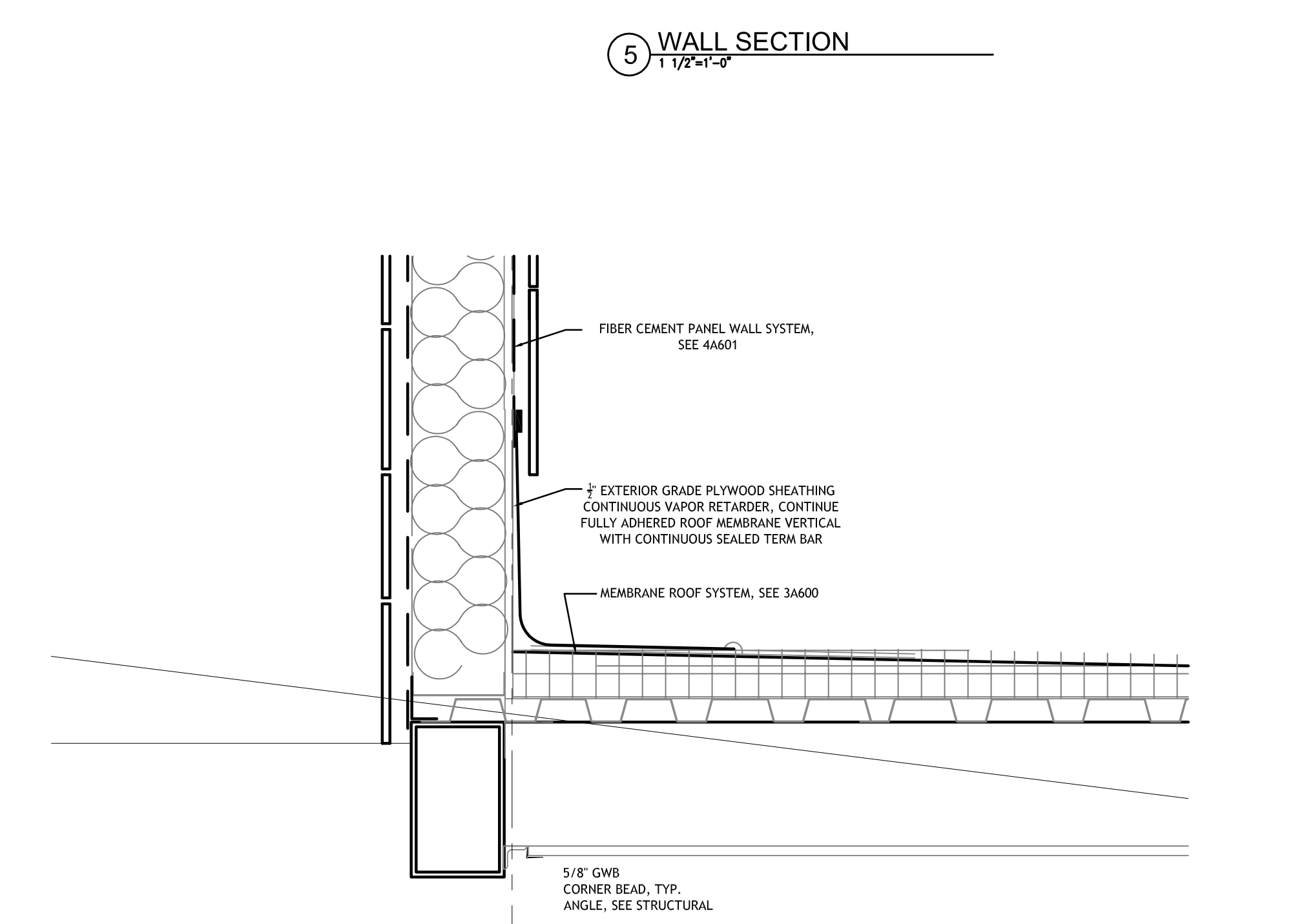
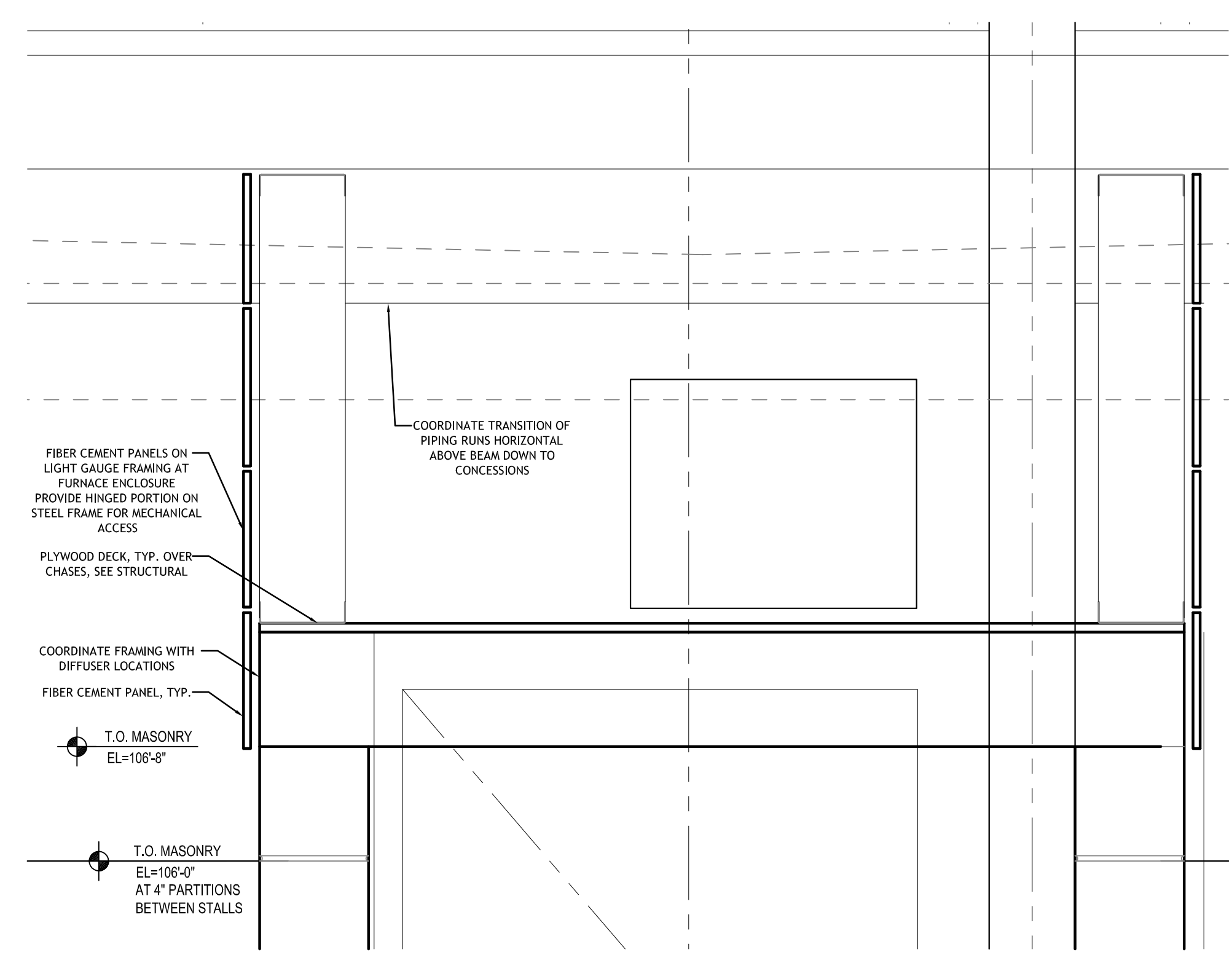
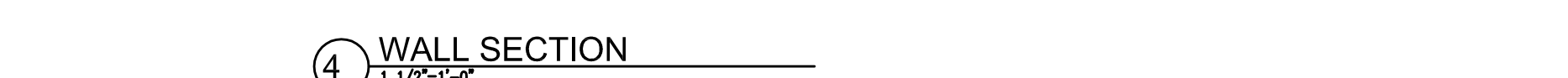
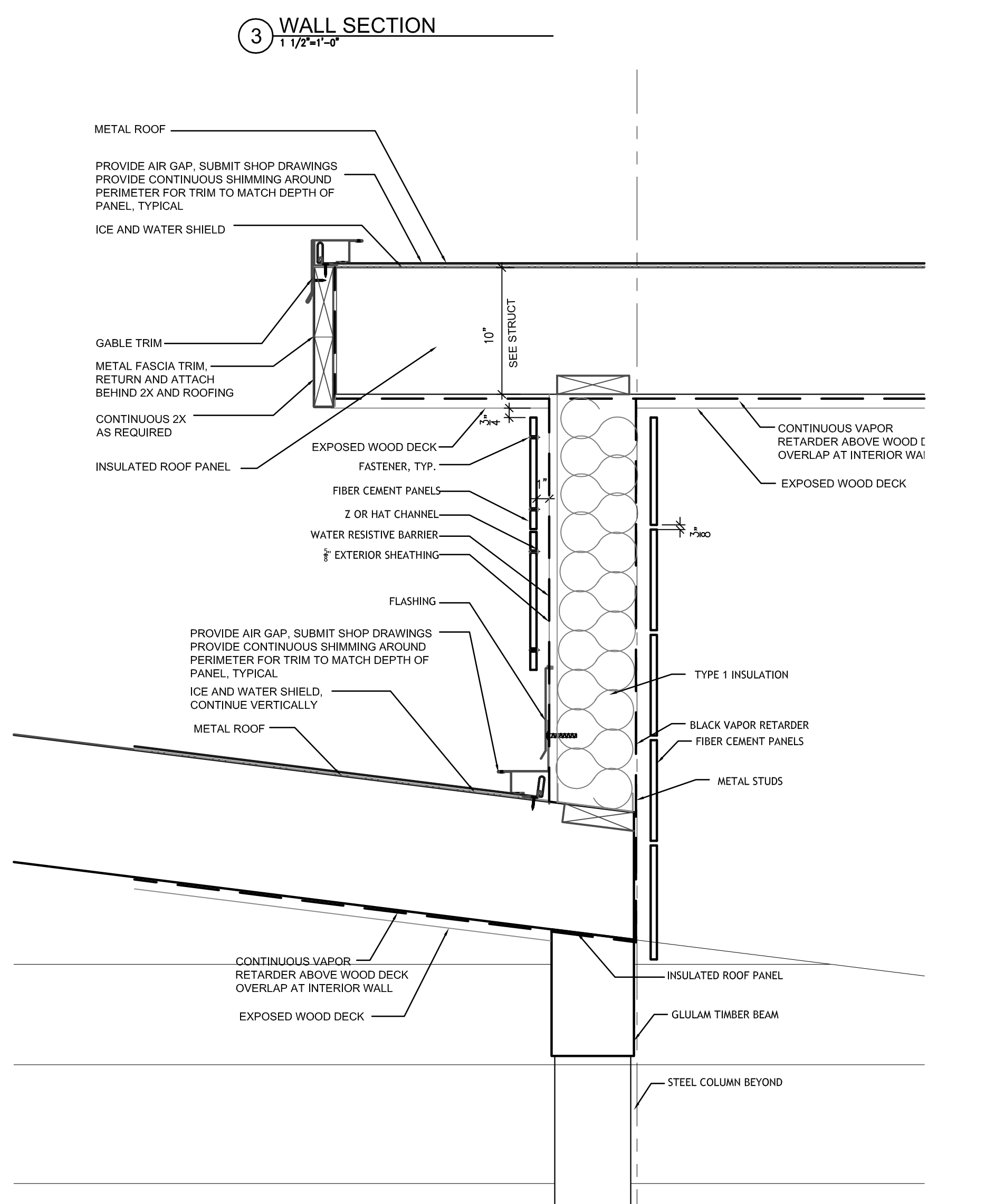
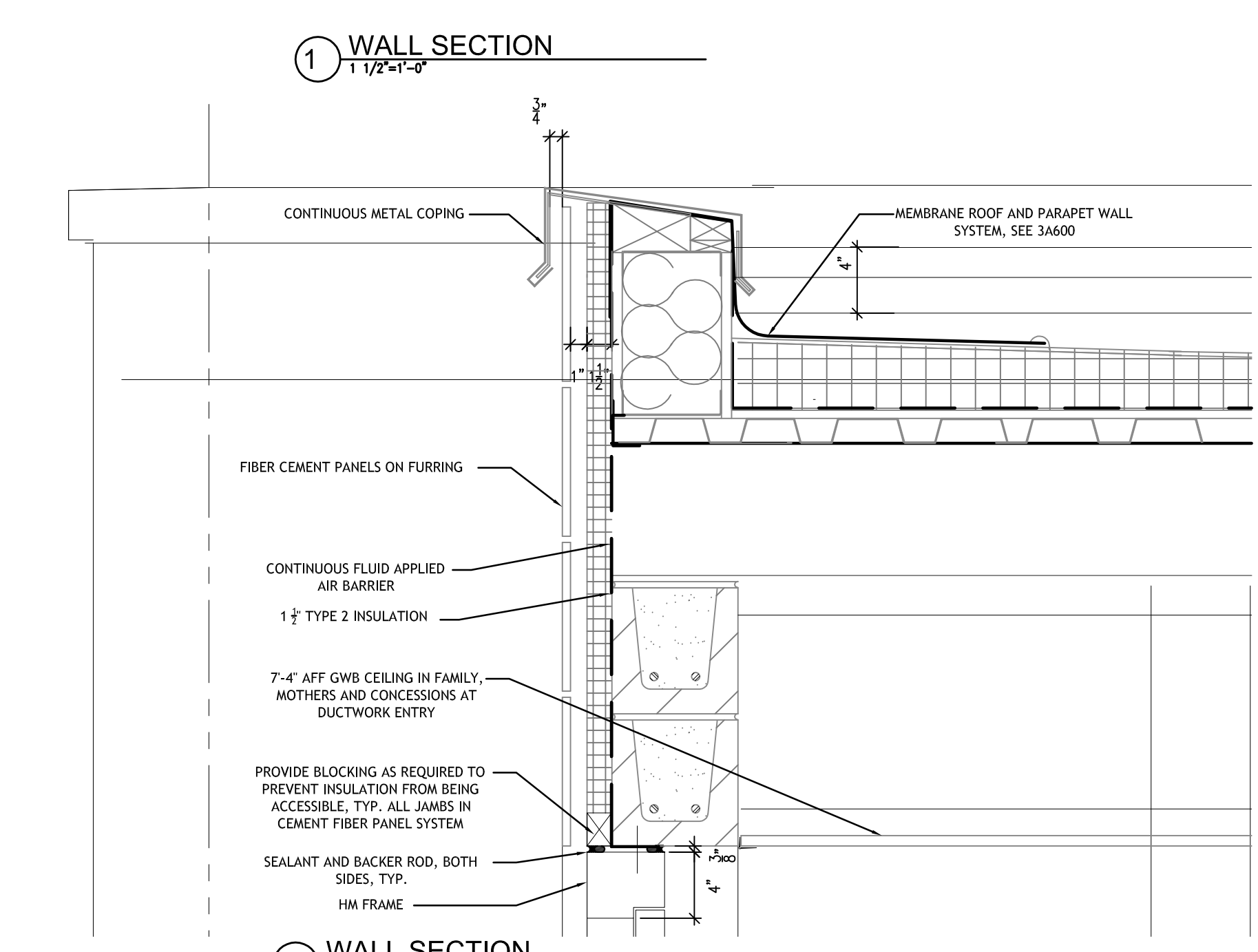
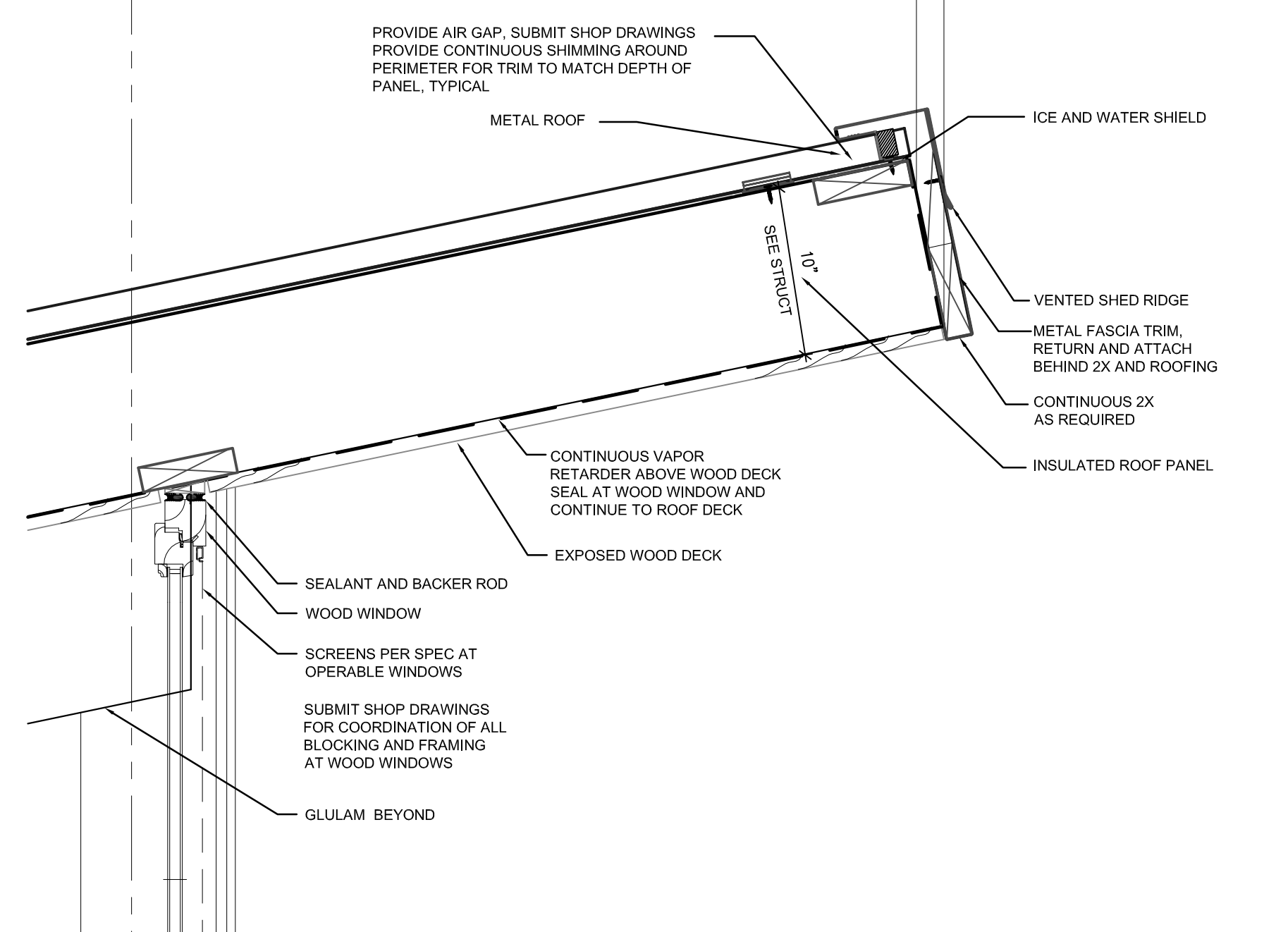
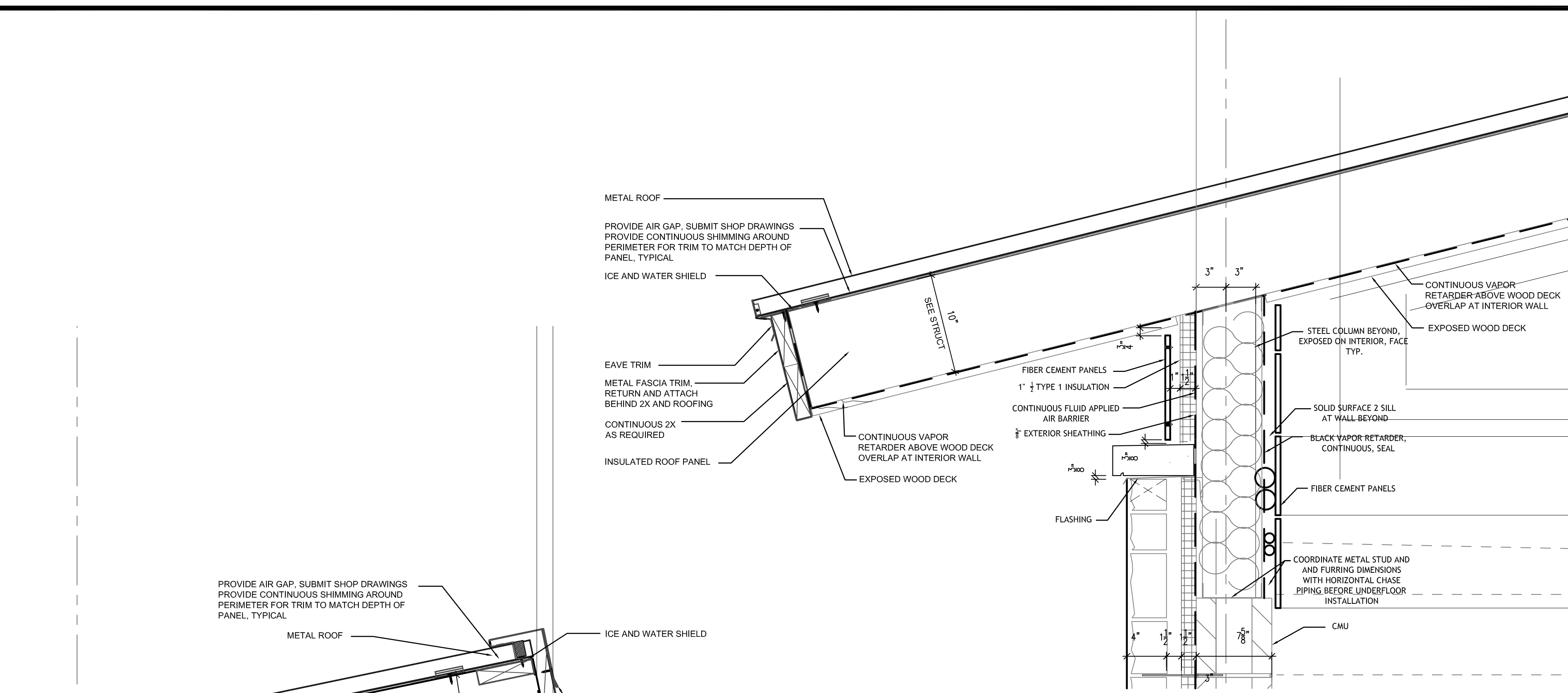
11 BUILDING SECTION
1/8"=1'-0"



12 BUILDING SECTION
1/8"=1'-0"

ISSUED

REBID 10.26.17

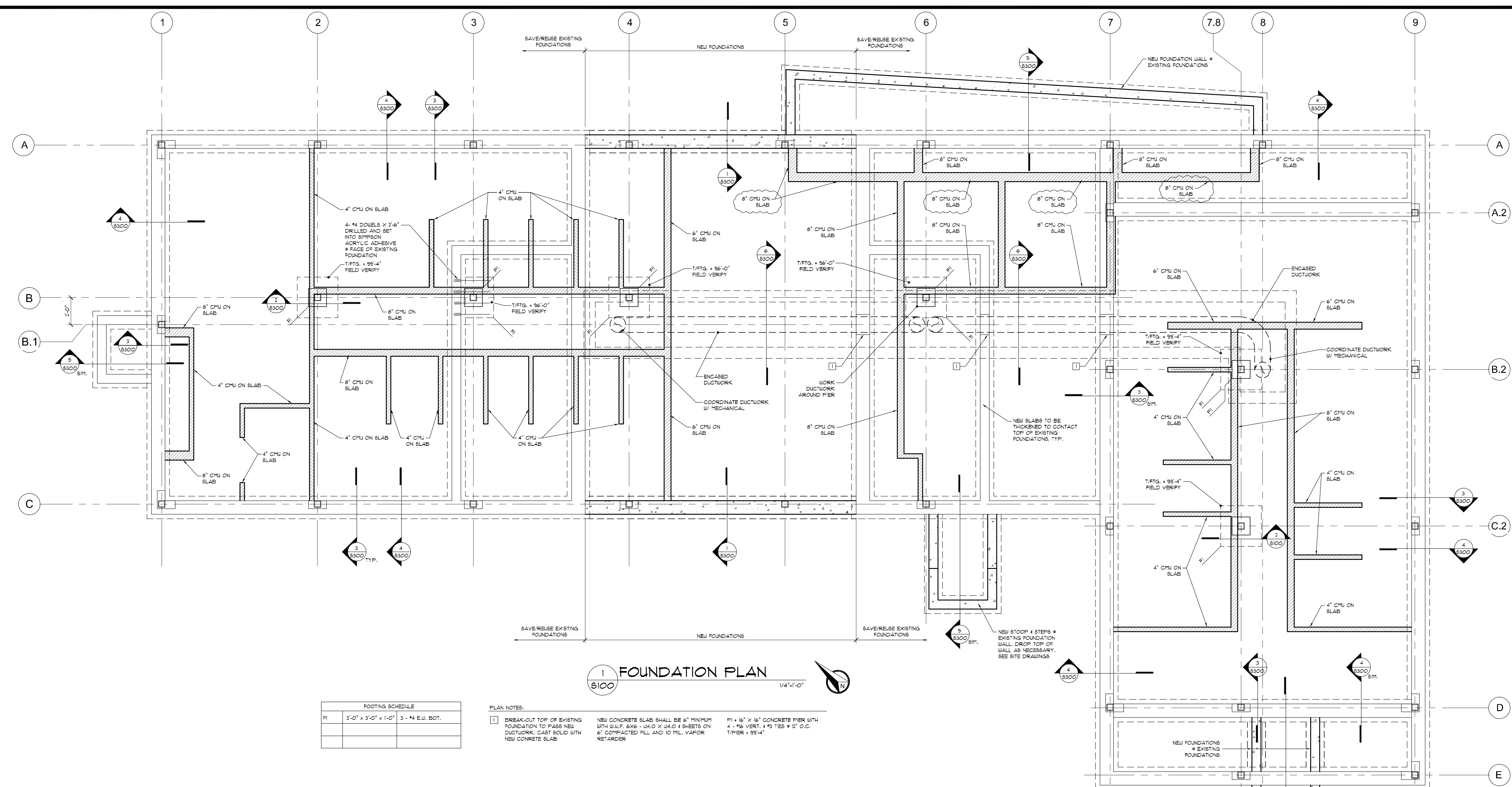


PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING
WALL SECTIONS

DATE
11.29.16

A601



1 FOUNDATION PLAN
1/4"=1'-0"

FOOTING SCHEDULE	
FI	3'-0" x 3'-0" x 1'-0" 3 - #4 E.W. BOT.

PLAN NOTES:

1 BREAK-OUT TOP OF EXISTING FOUNDATION TO PASS NEW DUCTWORK. CAST SOLID WITH NEW CONCRETE SLAB.

NEW CONCRETE SLAB SHALL BE 6" MINIMUM WITH 50% 6x6 x 14.0 x 14.0 #4 SHEETS ON 6" COMPACTED FILL AND 10 MIL VAPOR RETARDER.

PI x 16" x 16" CONCRETE PIER WITH 4 - #6 VERT. #3 TIES @ 12" O.C. TYPICAL @ 96" O.C.

Design Loads	
Snow	
Ground Snow	30 psf
Importance (I)	1.0
Exposure (Co)	1.0
Thermal Coefficient (Ct)	1.0
Wind Speed	90 mph
Importance Factor	1.0
Exposure Category	C
Seismic	
Site Class (to be verified by contractor)	D
Seismic Design Category	A
Floor Live Loads	
Restroom, Mechanical, Retail, Lobby Storage	100 psf
Material Strengths	
Concrete (F'c @ 28 days)	
Footings	3,000 psi
Foundation Walls	3,500 psi
Slabs (interior)	4,000 psi
Slabs (exterior)	4,500 psi
Grout Fill at Masonry Walls	3,000 psi
Reinforcing Steel (Fy)	
Rebar	60,000 psi
Welded Wire Fabric	65,000 psi
Structural Steel	
All Steel Shapes	50,000 psi
Hollow Structural Steel Shapes	46,000 psi
Threaded Anchor Rods	ASTM F1554 E70XX
Welding Electrodes	
Lightgage Steel Framing (Fy)	
Roof Deck	33,000 psi
Studs and Joists	40,000 psi
Tracks, Studs, or Joists < 18 gage	33,000 psi
Masonry (Minimum Compressive Strength)	
Concrete Masonry Units (F'm)	1,500 psi
Mortar Type "S"	1,800 psi
Masonry Grout/Fill	3,000 psi

Soil Bearing Pressure 2,500 psf
(To be verified in field by the contractor)

General Notes

Design and construction shall be in accordance with provisions of the latest edition of the International Building Code with Wisconsin Amendments.

See Specifications for additional information.

Consult architectural, mechanical, plumbing, and electrical drawings for verification of location and dimensions of cuts, depressions, door/closets, and other project requirements not shown on structural drawings.

All contractors shall verify and coordinate all dimensions and details as shown on the drawings. When discrepancies or questions arise, the architect shall be notified.

Verify size and location of all roof, floor, and wall openings with mechanical and electrical contractors. Openings less than 12 inches in dimension are generally not shown.

Foundations and Earthwork

Center column footings on column centerlines unless otherwise noted.

Wall footings are centered on foundation wall unless otherwise noted.

Wall footings are 12 inches thick and 8 inches wider than the wall above (footings project 4 inches beyond wall face) unless otherwise noted.

Elevations noted on plans are to the top of footing.

Bottom of footings shall be 4" minimum below exterior finish grade.

Column and wall footings shall bear on original, undisturbed soil or compacted fill as defined in soil report, but not higher than the minimum depth shown on drawings.

The client may conduct further soils investigation to provide additional confidence that foundations are suitable for reuse. Any areas found to be unsuitable shall be brought to the attention of the A.E.

All structural steel below slab on grade shall have a minimum of three inches concrete protection all around.

All footing top reinforcement shall be adequately supported by steel supports from grade below.

Slab on grade shall be underlain by a vapor barrier and six inches minimum of coarse granular (compacted) fill material.

Maintain gravel thickness, slab depth, reinforcement, and reinforcement position at dropped or thickened slab on grade.

Reinforce all slabs on grade with welded wire fabric as defined on the plans, positioned or supported to be in the top third of the slab unless noted otherwise.

Backfill around the exterior foundation walls with (a free draining granular material to the elevation of the rough grade).

Contractor to keep excavations dry and protected from frost at all times during the foundation construction.

Notify architect if nature of soil at depths shown is not suitable for foundations.

Concrete (Cast-In-Place, Non-Prestressed)

Concrete Reinforcing shall have the following minimum protective cover:

Concrete poured to earth or ground	3"
Concrete exposed to earth or weather	#5 bar and smaller 1 1/2"
Concrete with interior exposure	#11 bar and smaller 3/4"
Concrete piers	Primary reinforcement, ties, and splices 1 1/2"

No conduits, pipes, ducts, or fixtures shall be placed in concrete columns, piers or beams (unless specific review and approval is made by the engineer).

Bars shall be applied per details where provided. Otherwise bars shall be class "B" lap applied in longest cover minus lengths with adjacent laps staggered 3'-0" minimum. Bars shall be contact spliced or spaced a minimum distance apart of the lesser of 1.5h the lap length or six inches.

Embedment lengths, compression splice lengths and lap lengths for tension splices class "A" and "B" shall conform to those of CRSI "Reinforcement Anchorage and Splices" current edition.

No tack welding will be permitted on grade 40 or 60 reinforcing steel.

Interior concrete slabs shall be reinforced with 6c6 - W40xW4.0 WWF unless noted otherwise.

Limits of dropped and depressed slabs shall be located from architectural plans.

Contractor shall notify the architect at least 24 hours prior to placing concrete.

All construction joints shown shall be incorporated into structure unless their elimination is approved by the engineer, additional construction joints required to facilitate construction shall be located and detailed on shop drawings and are subject to engineer's approval.

Control and construction joints for slab on grade must be reviewed by the architect prior to the placing of concrete.

Provide 2 #5 bars around all openings and 2 #5 diagonally at all opening corners unless otherwise specified. Extend 2'-0" past opening, typical.

Anchor bolts shall be set and concrete bearing surface for columns shall be finished to the following tolerance:

- Elevation of concrete surface plus or minus 3/8".
- Elevation top of anchor bolts plus 1" or minus 3/8".
- Out of position of anchor bolts plus or minus 1/8".

Refer to architectural drawings for location and dimensions of concrete reveals, notches, registers, pads, curbs, chamfer blockouts at doorways, and all other project requirements not shown on the structural drawings.

Refer to specifications regarding dovetail anchors in concrete for masonry anchorage.

Masonry

Load bearing masonry units shall be of structural normal weight concrete conforming to ASTM C90.

Provide horizontal ladder-type wire reinforcing with adjustable wall tie eye sections at 16" on center maximum.

Special inspection is required for all masonry (inspection shall verify that materials used are as specified and the construction is in accordance with the plans and accepted masonry practice).

Where concrete filled bond beams intersect at corners at different elevations, run each bond beam around corner for two block lengths minimum before terminating.

Where concrete filled bond beams intersect parallel at different elevations, lap bond beam four block lengths minimum before terminating.

Provide corner and intersection bars in all bond beams.

Control joints shall be provided in masonry walls at 20'-0" maximum. See architectural drawings for location of control joints.

Lintel units shall be provided to span across openings in concrete masonry. Grout solid two courses high. Provide 2 #5 continuous 1" above bottom on lintel units. Provide steel lintels per schedule on contract documents.

All reinforced masonry work shall conform to current edition of Building Code Requirements for Masonry Structures (ACT 530.1).

Provide 1-#5 vertical reinforcement at all wall corners, ends, and intersections (place in second cell from end where steel lintel beams on wall end).

Splices in horizontal and vertical reinforcing shall be lapped 48 bar diameters or a minimum of 24", whichever is greater.

Provide a bond beam with 2-#5 continuous beneath all slab or beam bearings in masonry walls not grouted solid (all cells filled).

All head and bed joints shall be full.

Shrap of grout shall be in the range of 7 to 10 inches and shall be reconsolidated by mechanical vibration to eliminate voids created by bleed off of the water in the grout 1/2 hour following placement.

Structural Steel

Use connections as detailed on plans or the standard guide details provided with the contract documents. Whenever connections are not covered, the fabricator shall request the engineer to supply a connection detail.

Provide connections required for attachment of wood to steel members. Also, provide holes for lags.

Column cap plates are 1/2" thick unless noted. Slope to match beam slope.

Remove all slack from diagonal bracing before welding.

Where joints are supported on only one side of a beam, the joints shall extend a minimum of one inch beyond beam centerline.

Prior to grouting, columns shall be erected and aligned as to plumbness and elevation by means of steel slates or leveling nuts under the base plates. Setting plates shall only be used as templates to locate anchor bolts during concrete placement.

See architectural drawings for additional miscellaneous steel.

Lightgage Structural Steel Framing

Systems and members shall be designed by a structural engineer with at least 10 years of documented experience in the design of lightgage framing. The engineer shall be registered in the State of Wisconsin.

Calculations shall be submitted to the Engineer of Record for review and approval. Calculations shall be sealed by the lightgage component design engineer. The license shall be current for the State of Wisconsin.

Shop drawings shall be submitted to the Engineer of Record for review and approval. Shop drawings shall be sealed by the lightgage component design engineer. The drawings shall include sections and elevations necessary to adequately show intent and completeness. Drawings shall show a minimum framing sizes, end connections, slip connections, structural stud splices, brackets, box beams, side clips, stiffeners, bracing and bracing, and post applied zinc-rich protection at trimmed edges.

The minimum thickness permissible for the construction of structural lightgage framing members shall be 18 gage. Minimum stud depths shall be 6". Members noted are based on section properties and capacities as shown in the Clark/Dierich manufacturers catalogs. Other manufacturers will be considered if shown to be equal within 5 percent. Properties shall be computed in accordance with the latest AISI specifications.

The maximum load deformed framing of lightgage wall systems shall not exceed:

- L/360 for typical wall framing systems
- L/480 for brick/masonry veneer wall systems

Components may be attached together by welding or screwing. Minimum size of fasteners at screw attachments shall be #10 self tapping. Minimum weld size of welds shall be 1/8 x 1/2" long.

Minimum of two screw fasteners or welds are required at connections of components or other connection pieces or components.

Proper ventilation shall be provided during welding. Surfaces shall be properly prepared by grinding zinc coating away from welding surfaces. Welded surfaces shall be properly recoated with Zinc Rich Coating (ZRC).

Bearing studs shall be fully welded to bear on top and bottom track.

Spliced studs of wall sections shall align.

Bridging is required at 4 feet maximum on center for all studs.

Contractors shall provide erection bracing to ensure stability of the structural system prior to completion of construction.

Remove all slack from diagonal stop bracing before welding. Do not install diagonal stop bracing on load bearing walls until roofing is completed (roof dead load applied).

The minimum size load bearing and non-load bearing headers above openings shall consist of minimum two C16.18 gage on edge with track top and bottom of header.

Continuous studs shall be added to provide strength to wall systems at openings. Calculations shall take into account both strength and deflection limits at openings in the design of the continuous studs.

Shop drawings shall be submitted to the Engineer of Record for review and approval. Shop drawings shall be sealed by the lightgage component design engineer. The drawings shall include sections and elevations necessary to adequately show intent and completeness. Drawings shall show a minimum framing sizes, end connections, slip connections, structural stud splices, brackets, box beams, side clips, stiffeners, bracing and bracing, and post applied zinc-rich protection at trimmed edges.

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Architecture
Planning

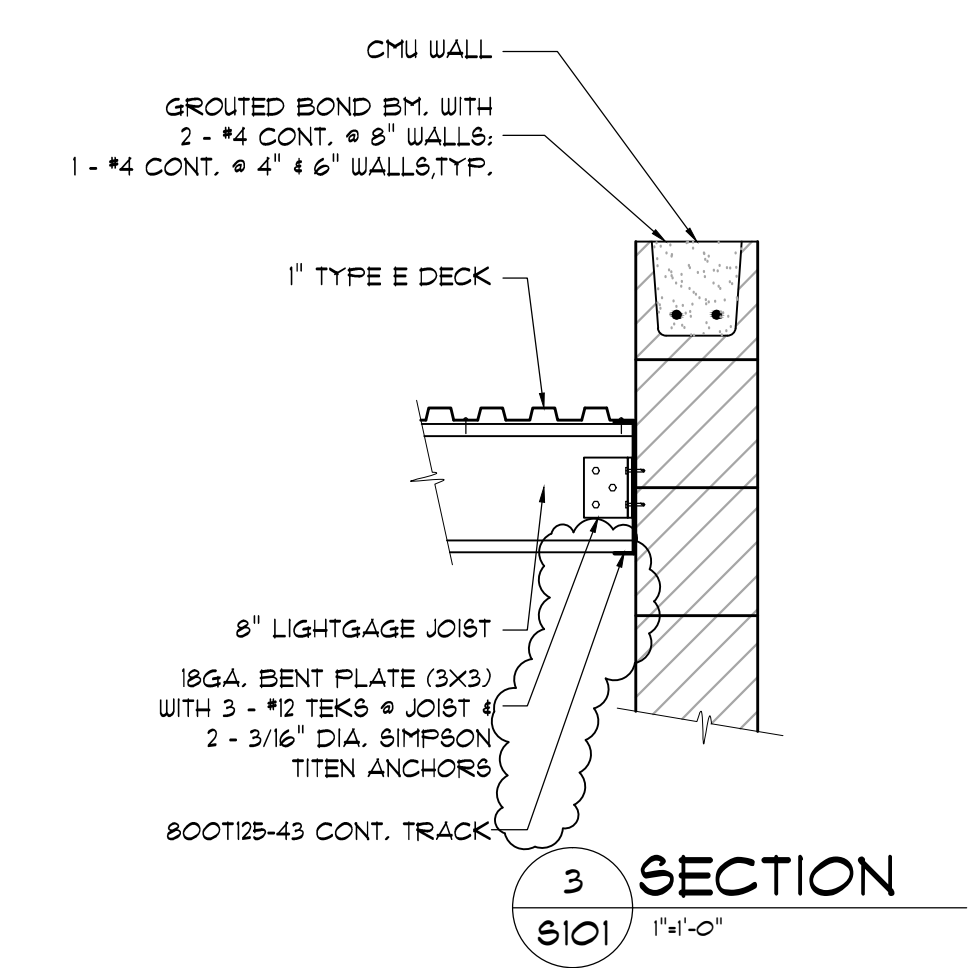
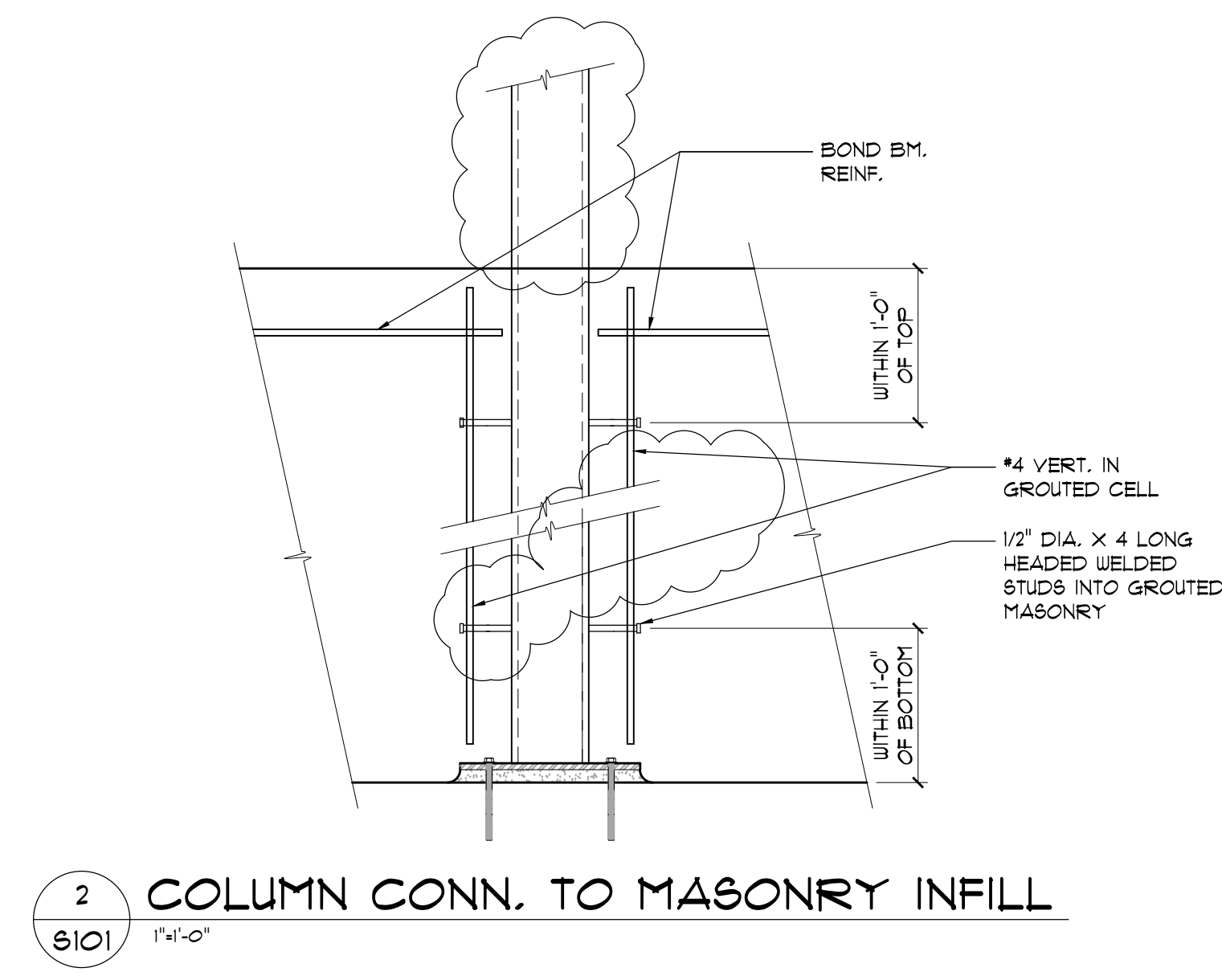
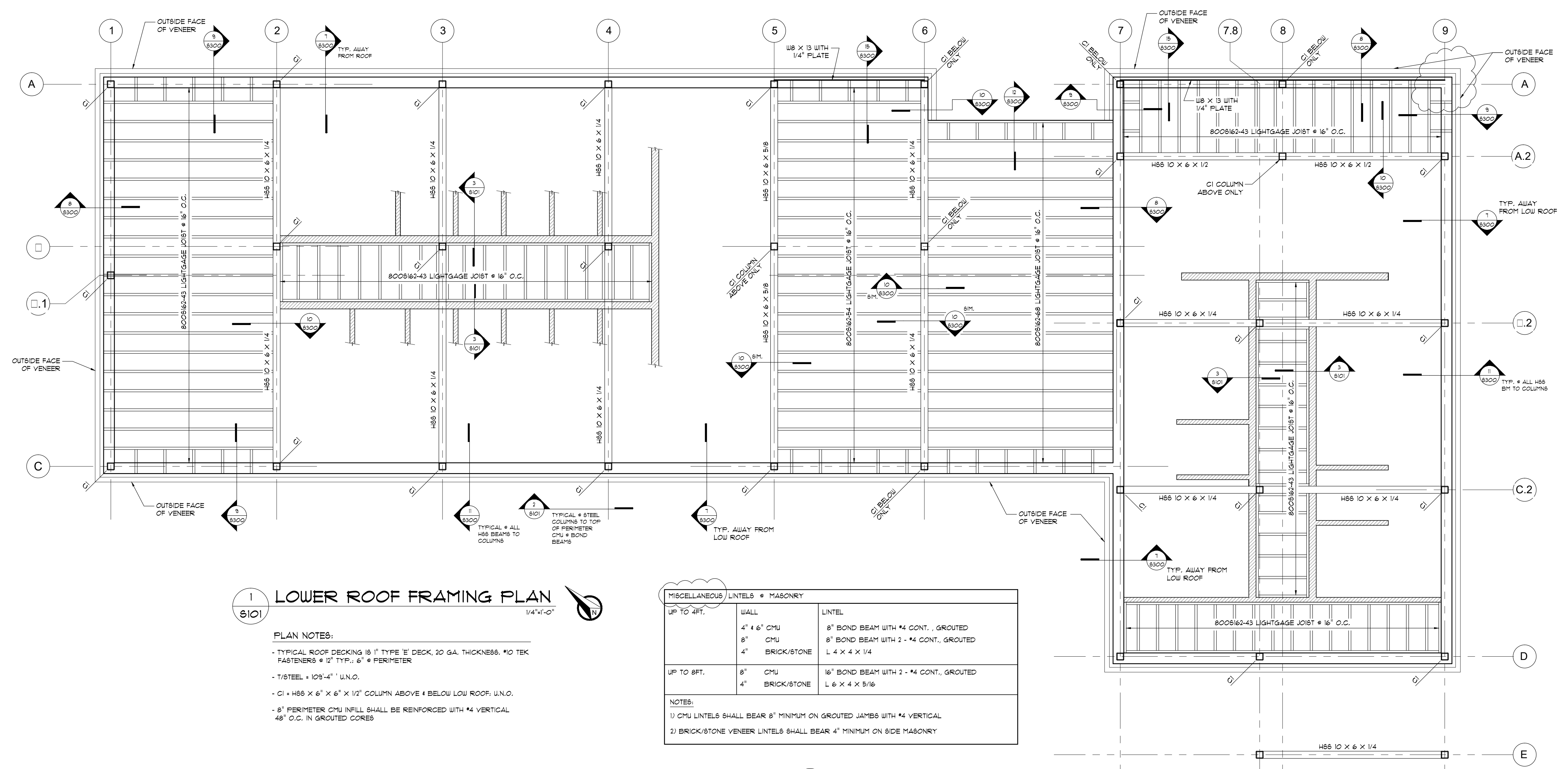
DorschnerAssociates, Inc.
849 E. Washington Ave., Ste 112
Madison, Wisconsin 53703



ISSUED
REBID 10.26.17

PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING
LOWER ROOF
FRAMING PLAN
AND DETAILS
DATE
11/29/2016



Architecture
Planning

DorschnerAssociates, Inc.
849 E. Washington Ave., Ste 112
Madison, Wisconsin 53703



ISSUED

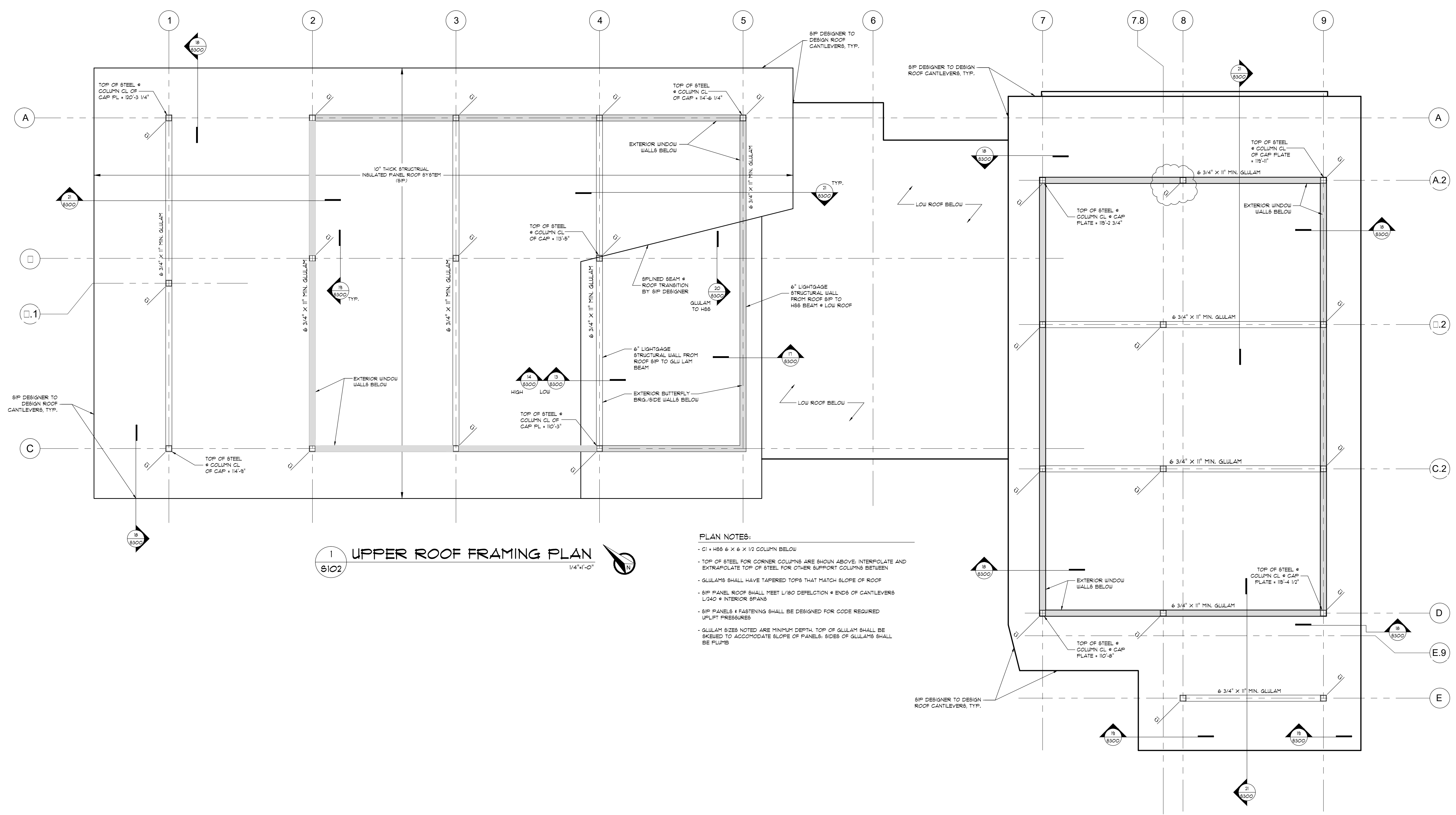
REBID 10.26.17

PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING
UPPER ROOF
FRAMING PLAN

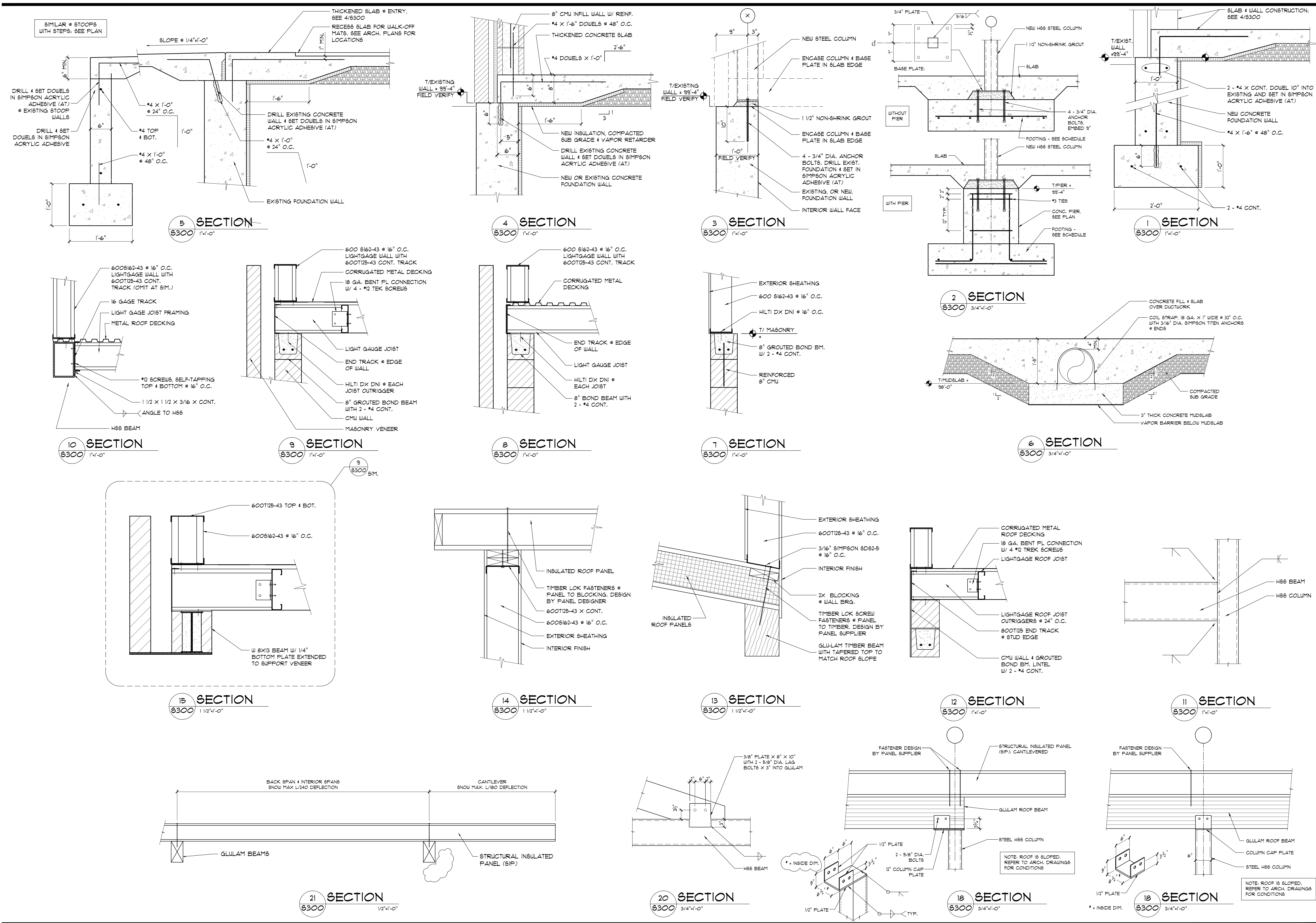
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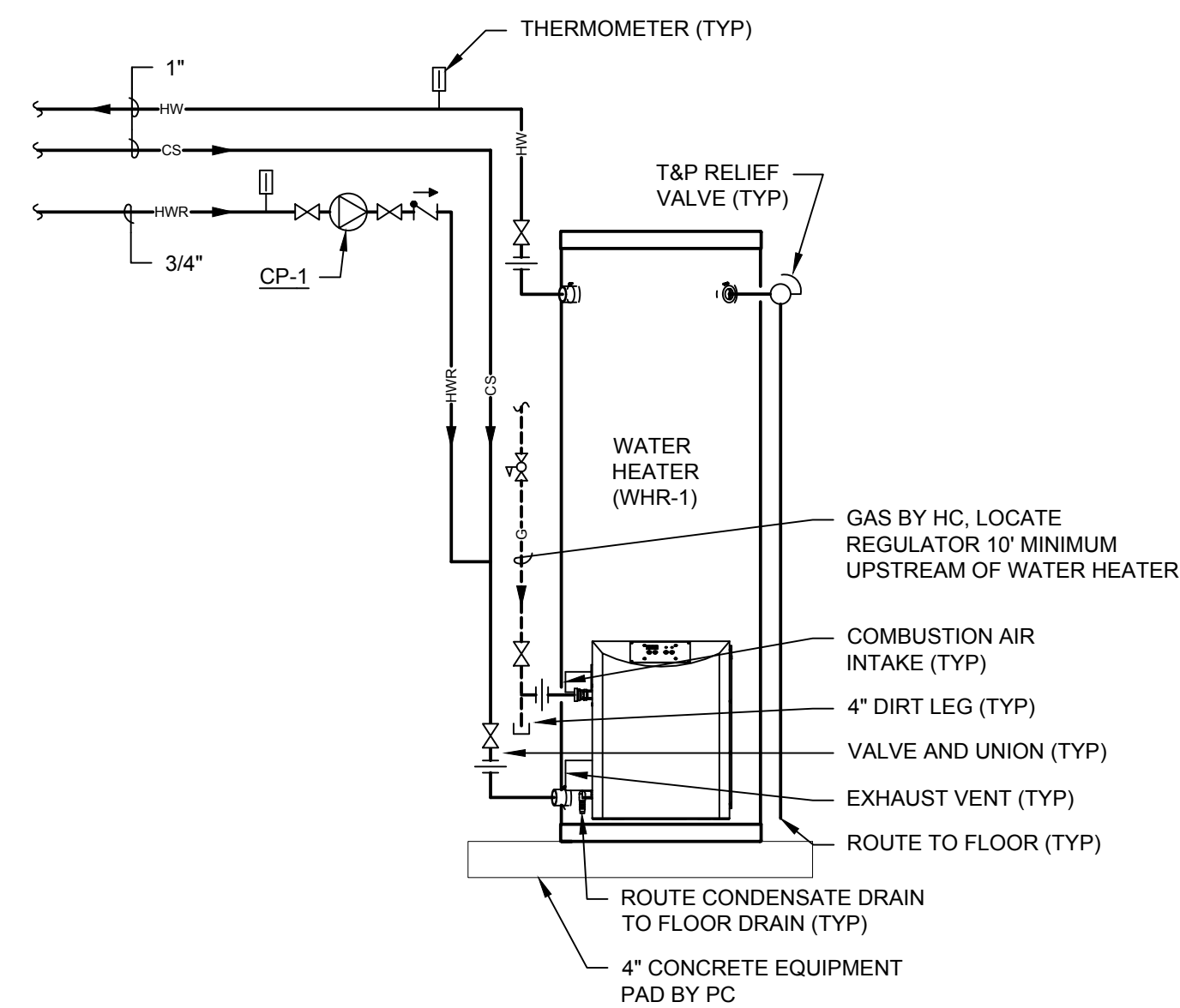
S102



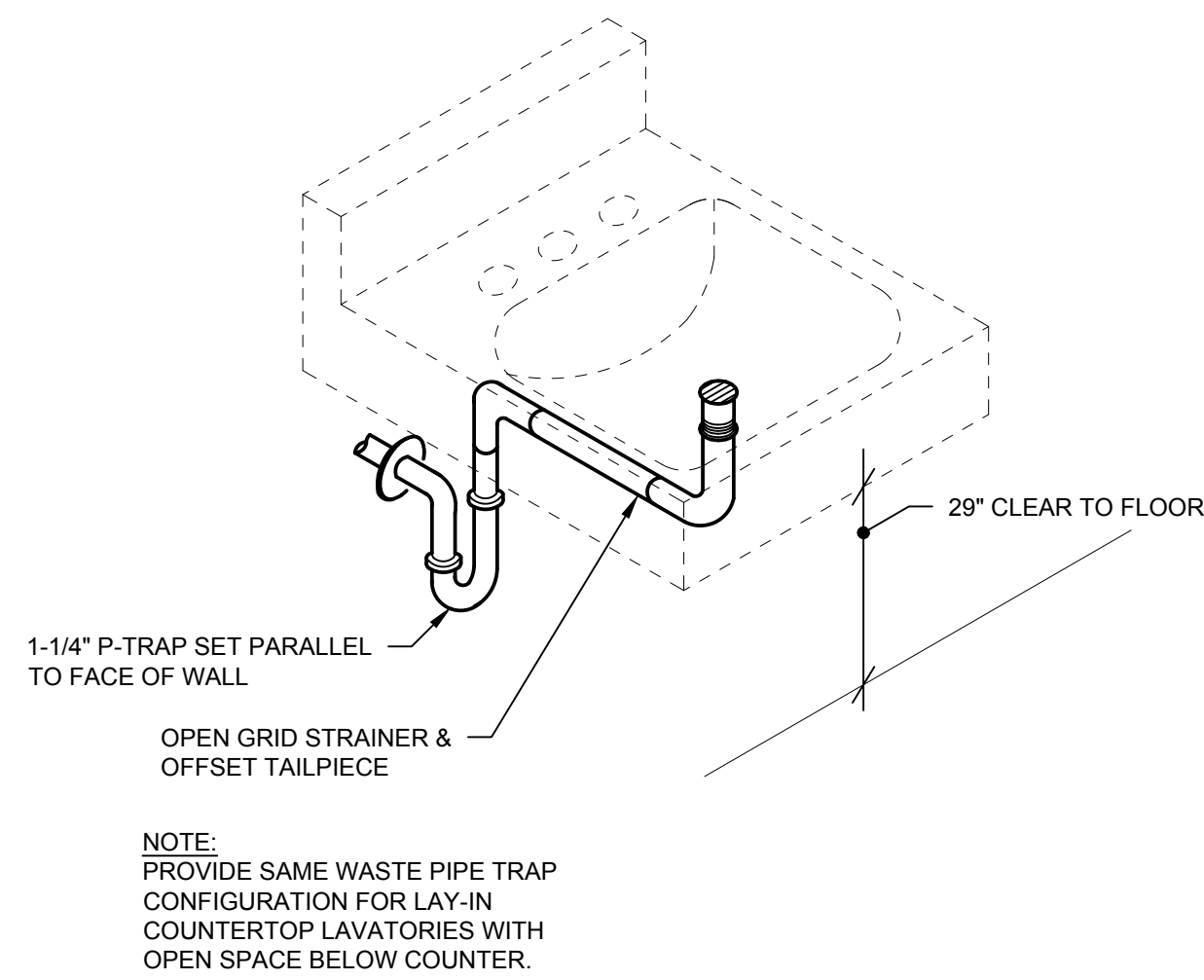
1 UPPER ROOF FRAMING PLAN
S102
1/4"=1'-0"

- PLAN NOTES:**
- C1 = H88 6" X 6" X 1/2" COLUMN BELOW
 - TOP OF STEEL FOR CORNER COLUMNS ARE SHOWN ABOVE, INTERPOLATE AND EXTRAPOLATE TOP OF STEEL FOR OTHER SUPPORT COLUMNS BETWEEN
 - GULLAMS SHALL HAVE TAPERED TOPS THAT MATCH SLOPE OF ROOF
 - SIP PANEL ROOF SHALL MEET L/80 DEFLECTION @ ENDS OF CANTILEVERS L/240 @ INTERIOR SPANS
 - SIP PANELS & FASTENING SHALL BE DESIGNED FOR CODE REQUIRED UPLIFT PRESSURES
 - GULLAM SIZES NOTED ARE MINIMUM DEPTH, TOP OF GULLAM SHALL BE SKEWERED TO ACCOMMODATE SLOPE OF PANELS, SIDES OF GULLAMS SHALL BE FLUMB



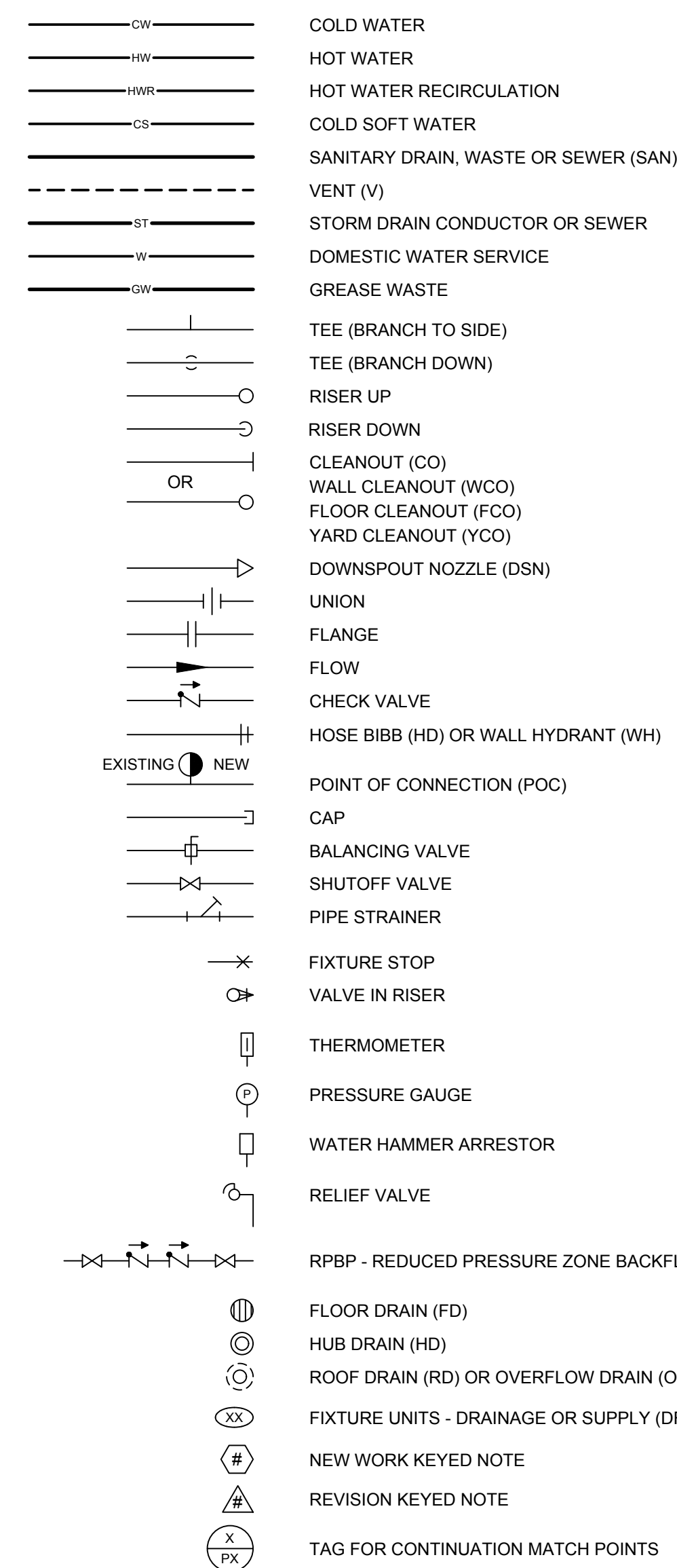


4 DOMESTIC WATER HEATING DETAIL
SCALE: NONE



1 WALL HUNG LAVATORY - BARRIER FREE
SCALE: NONE

PLUMBING LEGEND



ABBREVIATIONS

AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
BFF	BELOW FINISHED FLOOR
CB	CATCH BASIN
CO	CLEANOUT
CS	COLD SOFT WATER
CW	COLD WATER
DF	DRINKING FOUNTAIN
DSN	DOWNSPOUT NOZZLE
E	EXISTING
EC	ELECTRICAL CONTRACTOR
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
G	NATURAL GAS
GC	GENERAL CONTRACTOR
GI	GREASE TRAP/INTERCEPTOR
GW	GREASY WASTE
HB	HOSE BIBB
HC	HVAC CONTRACTOR
HD	HUB DRAIN
HW	HOT WATER
HWR	HOT WATER RECIRCULATION
IE	INVERT ELEVATION
L	LAVATORY
MB	MOP BASIN
MH	MANHOLE
PC	PLUMBING CONTRACTOR
RPBP	REDUCED PRESSURE ZONE BACKFLOW PREVENTER
S	SINK
SAN	SANITARY
ST	STORM
TD	TRENCH DRAIN
TMV	THERMOSTATIC MIXING VALVE
UR	URINAL
V	VENT
VTR	VENT THRU ROOF
W	DOMESTIC WATER SERVICE
WC	WATER CLOSET
WCO	WALL CLEAN OUT
WH	WALL HYDRANT
WHA	WATER HAMMER ARRESTOR
WHR	WATER HEATER
WS	WATER SOFTENER
YCO	YARD CLEANOUT

WATER CALCULATION WORKSHEET

WATER CALCULATION WORKSHEET FOR HENRY VILAS ZOO / 1246 VILAS PARK DRIVE MADISON, WI
NAME/ADDRESS OF PROJECT

INFORMATION REQUIRED TO CALCULATE WATER SERVICE SIZE

1. DEMAND OF BUILDING IN GALLONS PER MINUTE.	WSFU's = 192.75	=	(GPM)	90
2. DIFFERENCE IN ELEVATION FROM MAIN OR EXTERNAL PRESSURE TANK TO BUILDING CONTROL VALVE.			(feet)	0
3. SIZE OF THE WATER METER (WHEN APPLICABLE)			(inches)	N/A
4. DEVELOPED LENGTH FROM MAIN OR EXTERNAL PRESSURE TANK TO BUILDING CONTROL VALVE.			(feet)	50
5. LOW PRESSURE AT MAIN IN STREET OR EXTERNAL PRESSURE TANK.			(psig)	55

CALCULATE WATER SERVICE PRESSURE LOSS

6. LOW PRESSURE AT MAIN IN STREET OR EXTERNAL PRESSURE TANK. (VALUE OF # 5 ABOVE)				55.00
7. WATER SERVICE DIAMETER IS <u>2-1/2"</u> MATERIAL IS <u>COPPER</u> PRESSURE LOSS PER 100 FT = <u>2.3</u> PSI X <u>0.55</u> (DECIMAL EQUIVALENT OF SERVICE LENGTH, I.E.: 65FT = .65)				1.27
			(SUBTRACT LINE 7, FROM LINE 6.)	SUBTOTAL 53.74

8. DETERMINE PRESSURE GAIN OR LOSS DUE TO ELEVATION. (MULTIPLY THE VALUE OF # 2 ABOVE BY .434)

VALUE OF "8" 0.00

9. AVAILABLE PRESSURE AFTER THE BLDG. CONTROL VALVE. (SUBTRACT OR ADD LINE 8, ENTER IN "8".)

SUBTOTAL 53.74

CALCULATE THE PRESSURE AVAILABLE FOR UNIFORM LOSS (VALUE OF "A")

B. AVAILABLE PRESSURE AFTER THE BLDG. CONTROL VALVE. (FROM "9" ABOVE)

VALUE OF "B" 53.74

C. PRESSURE LOSS OF WATER METER (WHEN METER IS REQUIRED OR INSTALLED)

VALUE OF "C" 0

(SUBTRACT LINE C, FROM LINE B.)

SUBTOTAL 53.74

D. PRESSURE AT CONTROLLING FIXTURE. (CONTROLLING FIXTURE IS WATER CLOSET)

VALUE OF "D" 20.00

(SUBTRACT THE VALUE OF D.)

SUBTOTAL 33.74

E. DIFFERENCE IN ELEVATION BETWEEN THE BUILDING CONTROL VALVE AND THE CONTROLLING FIXTURE IN FEET 0 X .434 PSIF.T.

VALUE OF "E" 0.00

(SUBTRACT THE VALUE OF E.)

SUBTOTAL 33.74

F. PRESSURE LOSS DUE TO WATER TREATMENT DEVICES, INSTANTANEOUS WATER HEATERS AND BACKFLOW PREVENTERS WHICH SERVE THE CONTROLLING FIXTURE (PRESSURE LOSS DUE TO N/A)

VALUE OF "F" 0

(SUBTRACT THE VALUE OF F.)

SUBTOTAL 33.74

G. DEVELOPED LENGTH FROM BUILDING CONTROL VALVE TO CONTROLLING FIXTURE IN FEET 165 X 1.5

VALUE OF "G" 247.50

(DIVIDE BY THE VALUE OF G.)

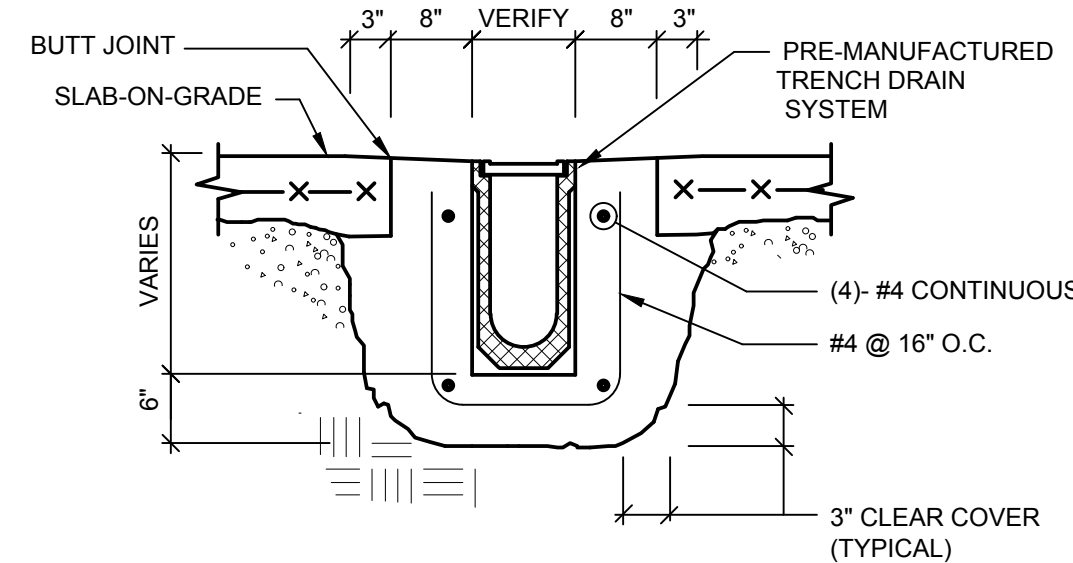
SUBTOTAL 0.1363

(WATER DISTRIBUTION PIPING MATERIAL IS TYPE 1' COPPER)

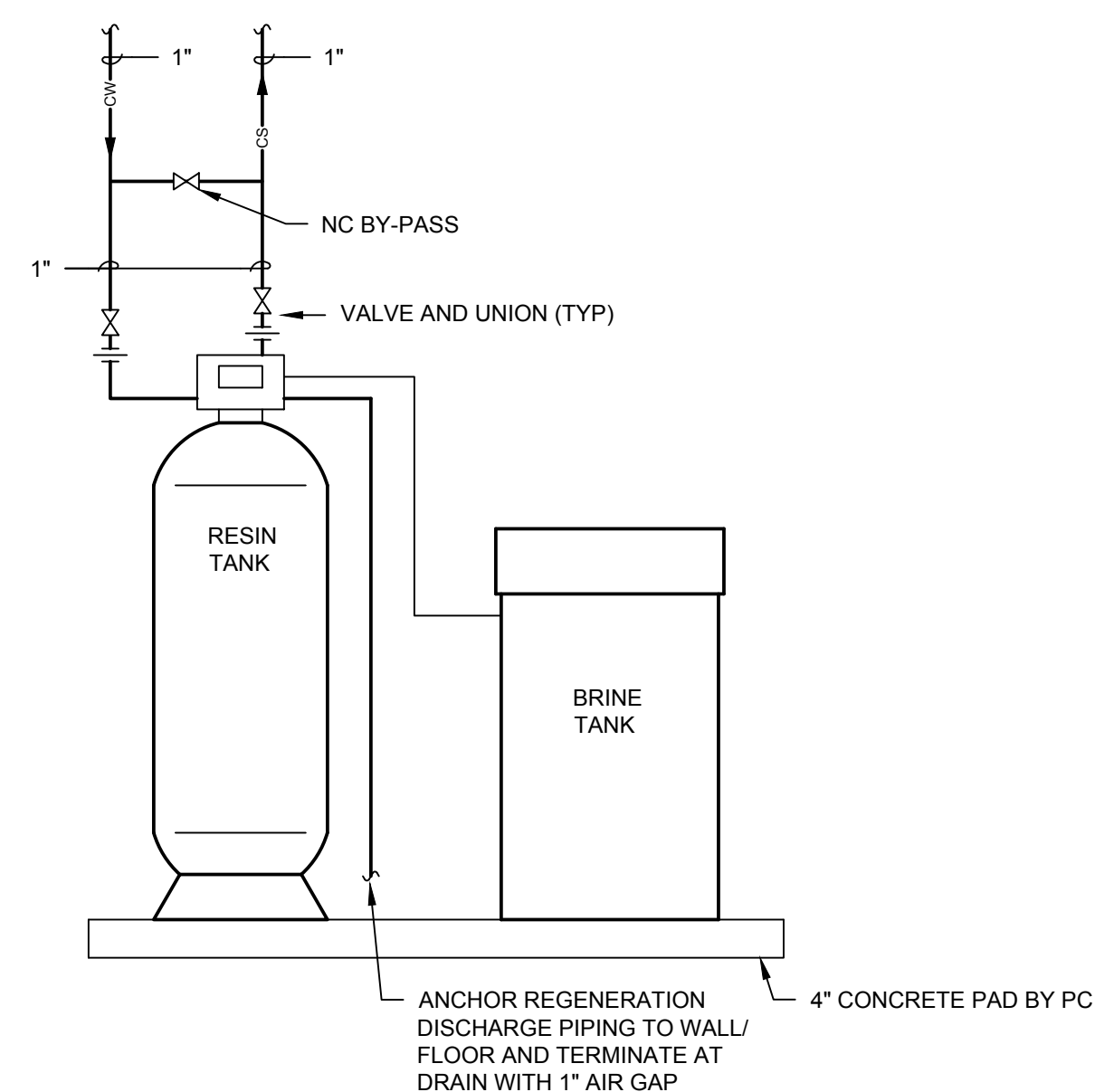
MULTIPLY BY 100

VALUE OF "A" 13.63

FORMULA: $A = \frac{B-(C+D+E+F)}{G} \times 100$



2 TRENCH DRAIN DETAIL
SCALE: NONE (PREMANUFACTURED SYSTEM)



3 WATER SOFTENER DETAIL
SCALE: NONE

PLUMBING SHEET INDEX

P000	SYMBOLS, ABBREVIATIONS, AND DETAILS - PLUMBING
P100	UNDERFLOOR PLAN - PLUMBING
P101	FLOOR PLAN - PLUMBING
P300	WASTE AND VENT RISER DIAGRAM - PLUMBING
P301	DOMESTIC WATER RISER DIAGRAM - PLUMBING
P800	SCHEDULES - PLUMBING

Architecture
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JDR PROJECT NO. 160205

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PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING
SYMBOLS, ABBREVIATIONS,
AND DETAILS - PLUMBING

DATE
11.29.16

P000

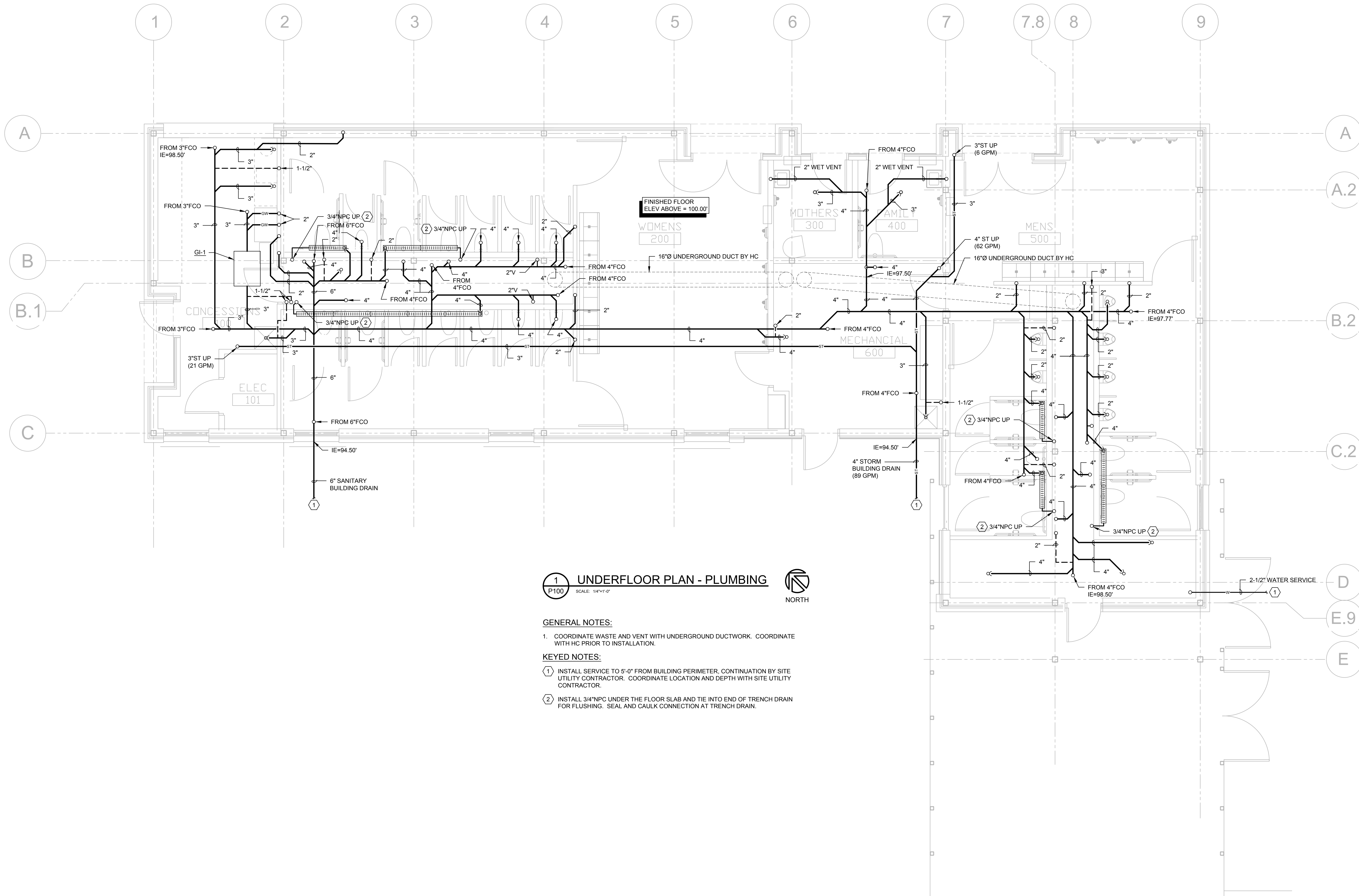
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1 UNDERFLOOR PLAN - PLUMBING
P100 SCALE: 1/8"=1'-0" NORTH

- GENERAL NOTES:**
- COORDINATE WASTE AND VENT WITH UNDERGROUND DUCTWORK. COORDINATE WITH HC PRIOR TO INSTALLATION.
- KEYED NOTES:**
- INSTALL SERVICE TO 5'-0" FROM BUILDING PERIMETER, CONTINUATION BY SITE UTILITY CONTRACTOR. COORDINATE LOCATION AND DEPTH WITH SITE UTILITY CONTRACTOR.
 - INSTALL 3/4" NPC UNDER THE FLOOR SLAB AND TIE INTO END OF TRENCH DRAIN FOR FLUSHING. SEAL AND CAULK CONNECTION AT TRENCH DRAIN.

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DRAWING
UNDERFLOOR PLAN -
PLUMBING

DATE
11.29.16

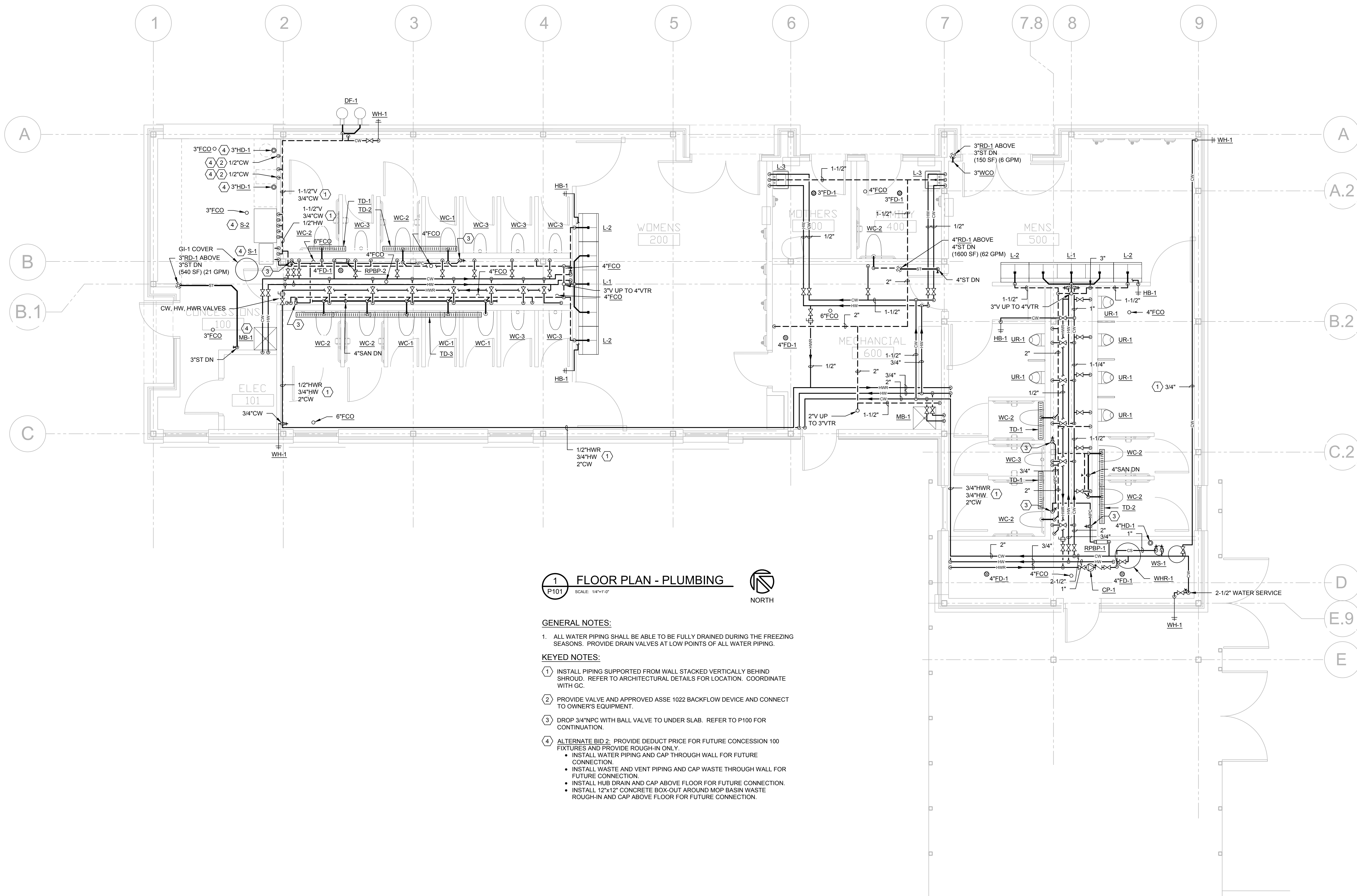
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1 FLOOR PLAN - PLUMBING
P101 SCALE: 1/8"=1'-0"



GENERAL NOTES:

1. ALL WATER PIPING SHALL BE ABLE TO BE FULLY DRAINED DURING THE FREEZING SEASONS. PROVIDE DRAIN VALVES AT LOW POINTS OF ALL WATER PIPING.

KEYED NOTES:

1. INSTALL PIPING SUPPORTED FROM WALL STACKED VERTICALLY BEHIND SHROUD. REFER TO ARCHITECTURAL DETAILS FOR LOCATION. COORDINATE WITH GC.
2. PROVIDE VALVE AND APPROVED ASSE 1022 BACKFLOW DEVICE AND CONNECT TO OWNER'S EQUIPMENT.
3. DROP 3/4"NPC WITH BALL VALVE TO UNDER SLAB. REFER TO P100 FOR CONTINUATION.
4. ALTERNATE BID 2: PROVIDE DEDUCT PRICE FOR FUTURE CONCESSION 100 FIXTURES AND PROVIDE ROUGH-IN ONLY.
 - INSTALL WATER PIPING AND CAP THROUGH WALL FOR FUTURE CONNECTION.
 - INSTALL WASTE AND VENT PIPING AND CAP WASTE THROUGH WALL FOR FUTURE CONNECTION.
 - INSTALL HUB DRAIN AND CAP ABOVE FLOOR FOR FUTURE CONNECTION.
 - INSTALL 12"x12" CONCRETE BOX-OUT AROUND MOP BASIN WASTE ROUGH-IN AND CAP ABOVE FLOOR FOR FUTURE CONNECTION.

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DRAWING
FLOOR PLAN - PLUMBING

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P101

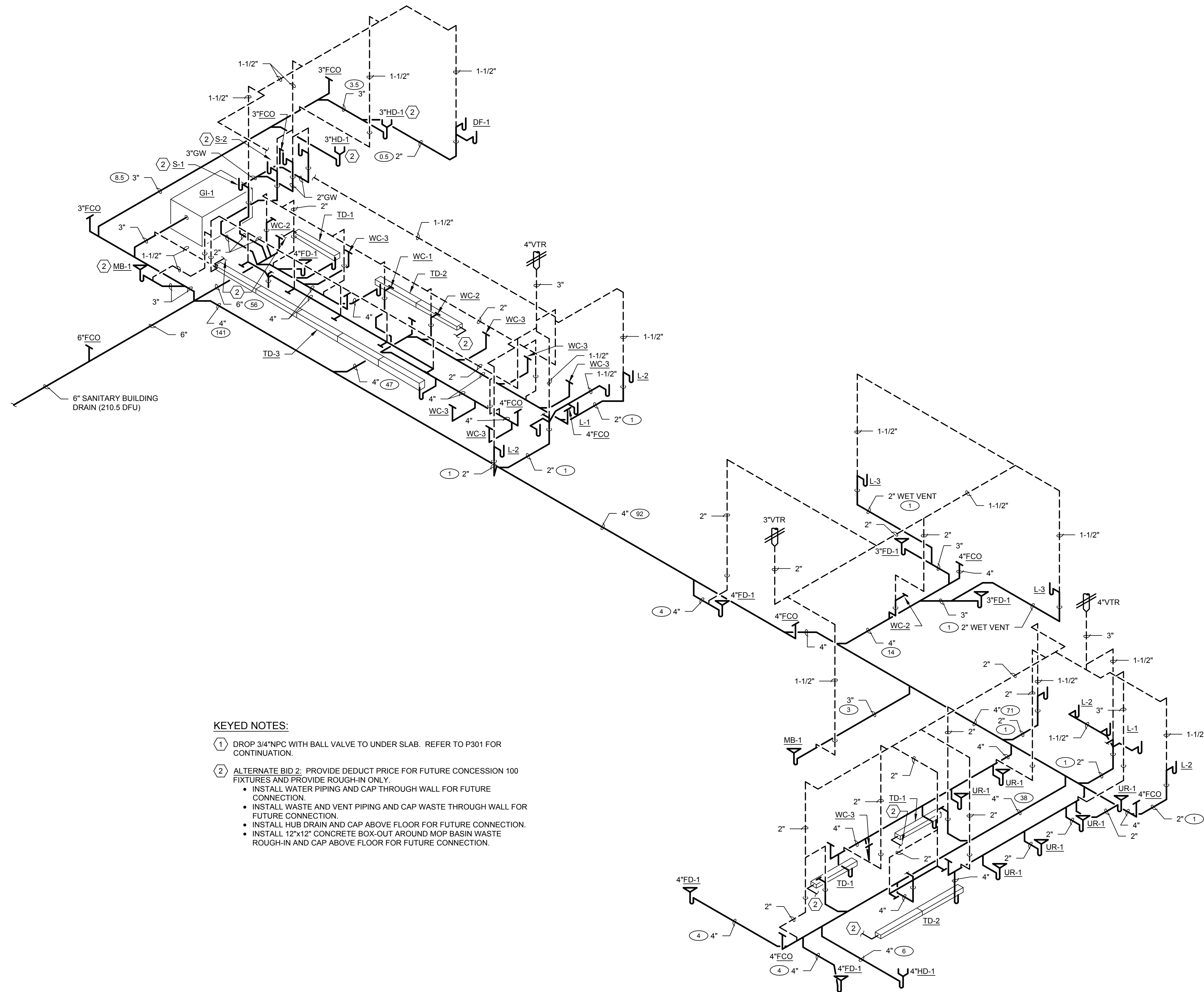
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KEYED NOTES:

- ① DROP 3/4" NPC WITH BALL VALVE TO UNDER SLAB. REFER TO P301 FOR CONTINUATION.
- ② ALTERNATE BID 2: PROVIDE DEDUCT PRICE FOR FUTURE CONCESSION 100 FIXTURES AND PROVIDE ROUGH-IN ONLY.
 - INSTALL WATER PIPING AND CAP THROUGH WALL FOR FUTURE CONNECTION.
 - INSTALL WASTE AND VENT PIPING AND CAP WASTE THROUGH WALL FOR FUTURE CONNECTION.
 - INSTALL HUB DRAIN AND CAP ABOVE FLOOR FOR FUTURE CONNECTION.
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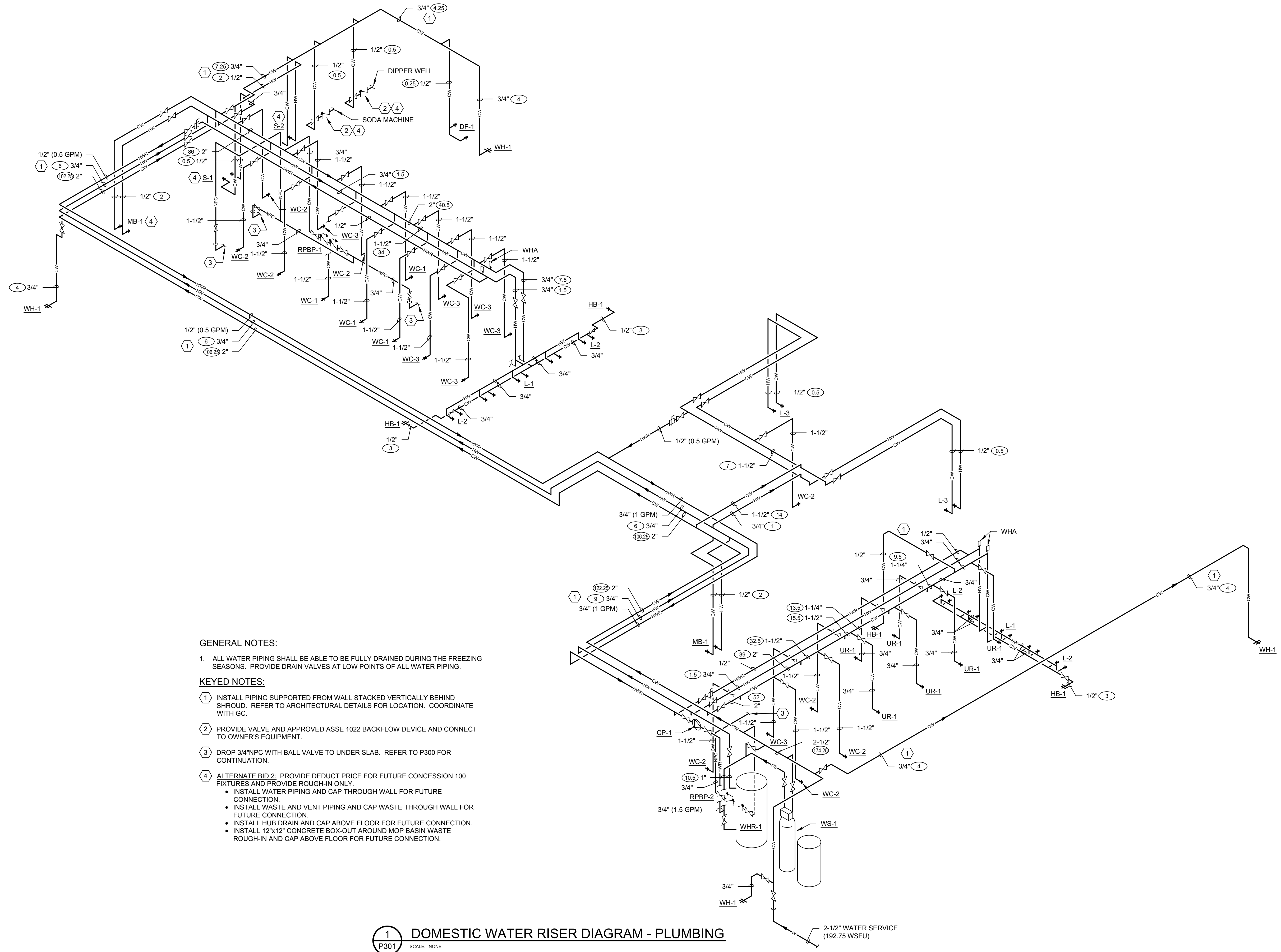
1 SANITARY WASTE AND VENT RISER DIAGRAM - PLUMBING
P300 SCALE: NONE

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MADISON, WISCONSIN

DRAWING
WASTE AND VENT RISER
DIAGRAM - PLUMBING

DATE
11.29.16

P300



PLUMBING DRAIN & CLEANOUT SCHEDULE

ID	FIXTURE	WASTE			DETAIL/SHEET	DESCRIPTION/REMARKS
		DFU	TRAP	VENT		
FD-1	FLOOR DRAIN	3 4	3" 4"	1-1/2" 2"	---	FIXTURE: ZURN ZN415-B, CAST IRON BODY, 6" DIAMETER NICKEL BRONZE "TYPE B" STRAINER, COMBINATION INVERTIBLE MEMBRANE CLAMP, AND ADJUSTABLE COLLAR.
HD-1	HUB DRAIN - AT GRADE	4 6	3" 4"	1-1/2" 2"	---	EXTEND HUB 2" AFF (MIN), INSTALL PIPE INCREASER ONE PIPE SIZE LARGER.
TD-1	TRENCH DRAIN	4	4"	2"	2/P000	FIXTURE: ACO KLASSIK DRAIN K100 TRENCH DRAIN SYSTEM, 4" INTERNAL WIDTH, ONE (1) ONE METER LENGTH SECTION K1-10, 4" ROUND BOTTOM OUTLET, LOWEST BOTTOM INVERT 5.91, INTEGRAL GALVANIZED FRAME, NO CROSS BARS, CONTINUOUS SLOPE SYSTEM AT 0.5%, INCLUDE END CAPS AT BEGINNING AND END OF TRENCH RUN, TYPE 494Q BLACK POLYPROPYLENE LOCKING GRATE, PROVIDE INSTALLATION DEVICES FOR CHANNELS AND SPARE GRATE REMOVAL TOOLS. REFER TO FLOOR PLANS FOR HIGH POINTS AND LENGTHS OF TRENCH RUN.
TD-2	TRENCH DRAIN	4	4"	2"	2/P000	FIXTURE: ACO KLASSIK DRAIN K100 TRENCH DRAIN SYSTEM, 4" INTERNAL WIDTH, TWO (2) ONE METER LENGTH SECTION K1-9 THRU K1-10, 4" ROUND BOTTOM OUTLET, LOWEST BOTTOM INVERT 5.91, INTEGRAL GALVANIZED FRAME, NO CROSS BARS, CONTINUOUS SLOPE SYSTEM AT 0.5%, INCLUDE END CAPS AT BEGINNING AND END OF TRENCH RUN, TYPE 494Q BLACK POLYPROPYLENE LOCKING GRATE, PROVIDE INSTALLATION DEVICES FOR CHANNELS AND SPARE GRATE REMOVAL TOOLS. REFER TO FLOOR PLANS FOR HIGH POINTS AND LENGTHS OF TRENCH RUN.
TD-3	TRENCH DRAIN	4	4"	2"	2/P000	FIXTURE: ACO KLASSIK DRAIN K100 TRENCH DRAIN SYSTEM, 4" INTERNAL WIDTH, FIVE (5) ONE METER LENGTH SECTION K1-6 THRU K1-10, 4" ROUND BOTTOM OUTLET, LOWEST BOTTOM INVERT 5.91, INTEGRAL GALVANIZED FRAME, NO CROSS BARS, CONTINUOUS SLOPE SYSTEM AT 0.5%, INCLUDE END CAPS AT BEGINNING AND END OF TRENCH RUN, TYPE 494Q BLACK POLYPROPYLENE LOCKING GRATE, PROVIDE INSTALLATION DEVICES FOR CHANNELS AND SPARE GRATE REMOVAL TOOLS. REFER TO FLOOR PLANS FOR HIGH POINTS AND LENGTHS OF TRENCH RUN.
RD-1	ROOF DRAIN	---	---	---	---	FIXTURE: ZURN ZC100-C-EA-R ROOF DRAIN, CAST IRON BODY, 15" DIA, COMBINATION MEMBRANE FLASHING CLAMP/GRAVEL GUARD, UNDERDECK CLAMP, ADJUSTABLE EXTENSION, ROOF SUMP RECEIVER, AND CAST IRON STRAINER.
FCO	FLOOR CLEANOUT	---	---	---	---	UNFINISHED AREAS: ZURN ZN1474-N, CAST IRON BODY, HEAVY DUTY CLEANOUT HOUSING, WITH NICKEL BRONZE TOP & INTERNAL CLEANOUT.
WCO	WALL CLEANOUT	---	---	---	---	FIXTURE: ZURN ZS1468, POLISHED STAINLESS STEEL, ROUND ACCESS COVER, SECURING SCREW & BRONZE RAISED HEX HEAD PLUG, VERIFY LENGTH OF SCREW REQUIRED WITH WALL CONSTRUCTION.

GAS WATER HEATER SCHEDULE

ID	MANUFACTURER MODEL #	GAS CFH	GAS PRESS IN WC	RECOVERY		TANK CAP GAL	DETAIL/SHEET	DESCRIPTION/REMARKS
				GPH	RISE °F			
WHR-1	HTP PHOENIX PH100-80	35-100	12	152	80	80	4/P000	TANK TYPE NATURAL GAS FIRED WATER HEATER, 96% EFFICIENT, SEALED COMBUSTION, 3" VENT/INTAKE, STAINLESS STEEL TANK, MODULATING BURNER WITH 5:1 TURNDOWN, LCD DISPLAY, INCLUDE CONCENTRIC VENTING KIT KGAVT0801CVT AND VENT THRU ROOF.

PUMP SCHEDULE

ID	MANUFACTURER MODEL #	ELECTRICAL				RPM	VFD	DISCHARGE		DETAIL/SHEET	DESCRIPTION/REMARKS
		HP	AMPS	VOLTS	PHASE			GPM	HD FT		
CP-1	B&G NBF-12U	FRACT	0.48	120	1	2800	NO	1.5	2.4	4/P000	BRONZE IN-LINE PUMP, HORIZONTAL LUBRICATED TYPE, CARBON BEARINGS, NORYL IMPELLER, CERAMIC SHAFT, STAINLESS STEEL ACCESSORIES. INCLUDE TIMER KIT TC-1.

GREASE INTERCEPTOR SCHEDULE

ID	MANUFACTURER MODEL #	LIQUID CAP (GAL)	GREASE CAP (LBS)	RATED GPM	SIZE (LxWxH)	DETAIL/SHEET	DESCRIPTION/REMARKS
GI-1	SCHIER PRODUCTS GB-50	52	249	50	37"x28"x28.5"	---	MOLDED SEAMLESS HDPE CONSTRUCTION, EXTENSION TO FINISHED FLOOR, BOLTED DOWN COMPOSITE LID RATED FOR FOOT TRAFFIC, 3" INLET/OUTLET, DIFFUSERS ON INLET AND OUTLET, INSTALL PER MANUFACTURER'S INSTRUCTIONS. CALCULATIONS: FLOW RATE: EACH BASIN SIZE = 21"x12"x14" = 3528 CU IN / 1728 = 2.04 CU FT x 4805 = 15.27 GALLONS x 0.75 (3/4 CAPACITY) = 11.45 GPM LIQUID CAPACITY: 11.45 x 2 BASINS = 22.90 GALLONS GREASE CAPACITY: 22.90 x 2 = 45.82 LBS

REDUCED PRESSURE BACKFLOW PREVENTERS

ID	MANUFACTURER MODEL #	SIZE	GPM	PRESS DROP	SYSTEM	DETAIL/SHEET	DESCRIPTION/REMARKS
RPBP-1	WATTS 919QT-S	3/4"	10	13	TRENCH WASH	---	BRONZE BODY, SILICONE RUBBER DISC IN BOTH CHECK SEATS, STAINLESS STEEL RELIEF VALVE SEATS, INCLUDE AIR GAP FITTING.
RPBP-2	WATTS 919QT-S	3/4"	10	13	TRENCH WASH	---	BRONZE BODY, SILICONE RUBBER DISC IN BOTH CHECK SEATS, STAINLESS STEEL RELIEF VALVE SEATS, INCLUDE AIR GAP FITTING.

PLUMBING FIXTURE SCHEDULE

REFER TO SPECIFICATION SECTION 22 40 00 FOR ACCEPTABLE EQUAL MANUFACTURERS

ID	FIXTURE	WASTE			WATER				DETAIL/SHEET	DESCRIPTION/REMARKS
		DFU	TRAP	VENT (MIN)	COLD		HOT			
					CWFU	SIZE	HWFU	SIZE		
DF-1	DRINKING FOUNTAIN	0.5	1-1/4"	1-1/2"	0.25	1/2"	---	---	---	FIXTURE: ELKAY EZWS-EDFPB117K WALL HUNG, RECESSED, HI-LO ELECTRIC WATER COOLER WITH BOTTLE FILLER, STAINLESS STEEL BASINS, SELF-CLOSING PUSH BUTTON VALVE CONTROLS, 115V/60HZ HARD-WIRED CONNECTION, ADA COMPLIANT. TRAP: CHROME PLATED CAST BRASS P-TRAP. FIXTURE SUPPORT: SEE MANUFACTURER'S WRITTEN INSTRUCTIONS FOR SUPPORT BACKING. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
HB-1	HOSE BIBB	---	---	---	3	1/2"	---	---	---	FIXTURE: WOODFORD MODEL B24 ANTI-SIPHON HOSE BIBB, RECESSED LOCKABLE BOX, INTEGRAL VACUUM BREAKER, 3/4" HOSE CONNECTION.
L-1	LAVATORY (ADA HEIGHT)	1	1-1/4"	1-1/2"	0.5	1/2"	0.5	1/2"	---	FIXTURE: BRADLEY VERGE LVSD3-SHANK-NSD-TMA-MYKONOS-STAIN-IW-CHROME LAVATORY SYSTEM, THREE (3) STATIONS, SINGLE HOLE DRILLING FOR THREE (3) FAUCET HOLES, NO SOAP DISPENSER, THERMOSTATIC MIXING VALVE PER FAUCET, MYKONOS COLOR BOWL, STAINLESS STEEL ACCESS PANEL, THREE (3) CHROME PLATED P-TRAPS, ADA COMPLIANT. FAUCETS: MOEN COMMERCIAL 8894 METERED FAUCET (THREE FAUCETS), 0.5 GPM AERATOR, SINGLE MOUNTING HOLE, CHROME FINISH, BRASS CONSTRUCTION, CHROME PLATED, ADA COMPLIANT. TRAP & DRAIN: INCLUDED WITH FIXTURE. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
L-2	LAVATORY (JUVENILE HEIGHT)	1	1-1/4"	1-1/2"	0.5	1/2"	0.5	1/2"	---	FIXTURE: BRADLEY VERGE LVSD1-SHANK-NSD-TMA-MYKONOS-STAIN-IW-CHROME LAVATORY SYSTEM, ONE (1) STATION, SINGLE HOLE DRILLING FOR ONE (1) FAUCET HOLE, NO SOAP DISPENSER, THERMOSTATIC MIXING VALVE PER FAUCET, MYKONOS COLOR BOWL, STAINLESS STEEL ACCESS PANEL, ONE (1) CHROME PLATED P-TRAP, ADA COMPLIANT. FAUCET: MOEN COMMERCIAL 8894 METERED FAUCET, 0.5 GPM AERATOR, SINGLE MOUNTING HOLE, CHROME FINISH, BRASS CONSTRUCTION, CHROME PLATED, ADA COMPLIANT. TRAP & DRAIN: INCLUDED WITH FIXTURE. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
L-3	LAVATORY (ADA HEIGHT)	1	1-1/4"	1-1/2"	0.5	1/2"	0.5	1/2"	1/P000	FIXTURE: KOHLER KINGSTON K-2007 WALL HUNG LAVATORY SINK, WHITE VITREOUS CHINA, DRILLED FOR CONCEALED ARM CARRIER, ONE (1) FAUCET HOLE, WITH OVERFLOW, ADA COMPLIANT. FAUCET: MOEN COMMERCIAL 8894 METERED FAUCET, 0.5 GPM AERATOR, SINGLE MOUNTING HOLE, CHROME FINISH, BRASS CONSTRUCTION, CHROME PLATED, ADA COMPLIANT. TRAP & DRAIN: PRE-WRAPPED OFFSET DRAIN & P-TRAP, WITH GRID STRAINER DRAIN. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
MB-1	MOP BASIN (REFER TO ALTERNATE BID 2)	3	3"	1-1/2"	2	1/2"	2	1/2"	---	FIXTURE: MUSTEE 63M 24"x24"x10" HIGH BASIN, ONE PIECE MOLDED DURASTONE, INTEGRAL MOLDED-IN DRAIN, 3" DRAIN CONNECTION. FAUCET: CHICAGO FAUCETS SERVICE SINK FAUCET 305-RCF WITH ROUGH CHROME FINISH, 3/4" MALE HOSE THREADED OUTLET, PAIL HOOK, ADJUSTABLE SUPPLY ARMS WITH INTEGRAL SERVICE STOPS AND LEVER HANDLES. PROVIDE WATTS MODEL 8AC NON-REMOVABLE CHROME VACUUM BREAKER. TRAP & DRAIN: CAST IRON OR PVC P-TRAP. ACCESSORIES: HOSE & HOSE HOLDER 65.700, & MOP HANGER 65.600.
S-1	SINK (HAND SINK) (REFER TO ALTERNATE BID 2)	1	1-1/4"	1-1/2"	0.5	1/2"	0.5	1/2"	1/P000	FIXTURE: KOHLER KINGSTON K-2005 WALL HUNG LAVATORY SINK, WHITE VITREOUS CHINA, DRILLED FOR CONCEALED ARM CARRIER, THREE (3) FAUCET HOLES ON 2" CENTERS, WITH OVERFLOW, ADA COMPLIANT. FAUCET: CHICAGO FAUCETS 895-317GN2AE3XKOP, MANUAL FAUCET, BRASS CONSTRUCTION, 2.2 GPM AERATOR, POLISHED CHROME FINISH, 5-1/4" RIGID GOOSENECK SPOUT, TWO 4" WRISTBLADE HANDLES, TWO HOLE MOUNTING ON 4" CENTERS, DECK MOUNTED, ADA COMPLIANT. TRAP & DRAIN: PRE-WRAPPED OFFSET DRAIN & P-TRAP, WITH GRID STRAINER DRAIN. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
S-2	SINK (3-COMPARTMENT) (REFER TO ALTERNATE BID 2)	2	1-1/2"	1-1/2"	2	1/2"	2	1/2"	---	FIXTURE: ADVANCED TABCO 400 SERIES 4-3-36, 16 GAUGE TYPE 430 STAINLESS STEEL SINK, FLOOR STANDING, THREE COMPARTMENTS 21"x12"x14" DEEP, TWO FAUCET HOLES ON 8" CENTERS ON BACK SPLASH. FAUCET: CHICAGO FAUCETS 510-GC613AL15ABCP, MANUAL FAUCET WITH PRE-RINSE FAUCET, BRASS CONSTRUCTION, POLISHED CHROME FINISH, TWO HOLE MOUNTING ON 8" CENTERS, 14" SWING SPOUT, 23" RISER WITH SPRING GUIDE, 44" FLEXIBLE STAINLESS STEEL HOSE WITH INSULATED HANDLE ON PRE-RINSE FAUCET. TRAP & DRAIN: CHROME PLATED CAST BRASS P-TRAP, WITH GRID STRAINER DRAIN. STOPS & SUPPLIES: MCGUIRE H2167LK, LOOSE KEY QUARTER TURN ANGLE STOPS WITH CHROME PLATED ESCUTCHEONS & CHROME PLATED COPPER RISER SUPPLIES.
UR-1	URINAL (ADA COMPLIANT)	2	2	1-1/2"	2	3/4"	---	---	---	FIXTURE: KOHLER BRANHAM K-4920-T FLOOR MOUNTED URINAL, WHITE VITREOUS CHINA, WASHOUT, 3/4" TOP SPUD, 0.5 GPF, ADA COMPLIANT. FLUSH VALVE: SLOAN ROYAL 186-0.5 URINAL FLUSH VALVE, MANUAL OPERATION, DIAPHRAGM TYPE, CHROME FINISH, 3/4" TOP SPUD, 3/4" SCREWDRIVER ANGLE STOP, ADA COMPLIANT.
WC-1	WATER CLOSET (STANDARD HEIGHT)	6	4"	2"	6.5	1-1/2"	---	---	---	FIXTURE: KOHLER KINGSTON K-4325, WALL HUNG, FLUSH VALVE TOILET, WHITE VITREOUS CHINA, ELONGATED BOWL, 1.6 GPF MAX, 2.25" TRAPWAY, 1-1/2" TOP SPUD, 15" RIM HEIGHT. FLUSH VALVE: SLOAN ROYAL 111-1.6 WATER CLOSET FLUSH VALVE, MANUAL OPERATION, DIAPHRAGM TYPE, CHROME FINISH, 1-1/2" TOP SPUD, 1" SCREWDRIVER ANGLE STOP, ADA COMPLIANT. SEAT: BEMIS 1655-SSC TOILET SEAT, INJECTION MOLDED WHITE PLASTIC, OPEN FRONT, ELONGATED BOWL, STAINLESS STEEL HINGES. SUPPORT: COMMERCIAL GRADE, WALL HUNG WATER CLOSET SUPPORT, STEEL STANCHIONS, IRON WELDED FEET, STEEL SLEEVES, FASTEN TO FLOOR.
WC-2	WATER CLOSET (ADA HEIGHT)	6	4"	2"	6.5	1-1/2"	---	---	---	FIXTURE: SAME AS WC-1, ADA HEIGHT. FLUSH VALVE: SAME AS WC-1, ADA HEIGHT. SEAT: BEMIS 1655-SSC TOILET SEAT, INJECTION MOLDED WHITE PLASTIC, OPEN FRONT, ELONGATED BOWL, STAINLESS STEEL HINGES. SUPPORT: COMMERCIAL GRADE, WALL HUNG WATER CLOSET SUPPORT, STEEL STANCHIONS, IRON WELDED FEET, STEEL SLEEVES, FASTEN TO FLOOR.
WC-3	WATER CLOSET (CHILD HEIGHT)	6	4"	2"	6.5	1-1/2"	---	---	---	FIXTURE: KOHLER PRIMARY K-4321, FLOOR MOUNTED, FLUSH VALVE TOILET, WHITE VITREOUS CHINA, 1-1/2" TOP SPUD, 2.125" PASSAGEWAY, 1.6 GPF, 10" ROUGH-IN, CHILD HEIGHT. FLUSH VALVE: SLOAN ROYAL 111-1.6 WATER CLOSET FLUSH VALVE, MANUAL OPERATION, DIAPHRAGM TYPE, CHROME FINISH, 1-1/2" TOP SPUD, 1" SCREWDRIVER ANGLE STOP, CHILD HEIGHT. SEAT: KOHLER K-4886, OPEN FRONT TOILET SEAT, INJECTION MOLDED, SCALLOPED HANDHOLD LOCATIONS FOR CHILDREN.
WH-1	WALL HYDRANT	---	---	---	4	3/4"	---	---	---	FIXTURE: WOODFORD MODEL 67, EXTERNAL FREEZELESS WALL HYDRANT, AUTOMATIC DRAINING, INTEGRAL VACUUM BREAKER, 3/4" HOSE CONNECTION, LOOSE TEE KEY.

WATER SOFTENER SCHEDULE

ID	MANUFACTURER MODEL #	ELECTRICAL			GPM		MAX PRESS DROP	GRAINS CAPACITY/ LBS SALT	RESIN TANK SIZE		SALT STORAGE			DETAIL/SHEET	DESCRIPTION/REMARKS
		AMPS	VOLTS	PHASE	CONT	PEAK			DIA	HEIGHT	DIA	HEIGHT	LBS		
WS-1	HELLENBRAND H125-48	FRACT	120	1	19	28	15	48,460/22.5	10"	54"	18"	40"	330	3/P000	SIMPLEX SYSTEM, 1.25" METER AND VALVE, FULLY PROGRAMMABLE, LCD DISPLAY, BRINE TANK INCLUDED.

Architecture
Planning

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SCHEDULES - PLUMBING

DATE
11.29.16

P800

ABBREVIATIONS

A	COMPRESSED AIR	EJ	EXPANSION JOINT	LAT	LEAVING AIR TEMPERATURE	T	THERMOSTAT/TEMPERATURE SENSOR
ACC	AIR COOLED CONDENSER	EL	ELEVATION	LBS	POUNDS	TA	THROWAWAY
ACCU	AIR COOLED CONDENSING UNIT	ELEC	ELECTRICAL	LD	LINEAR DIFFUSER	TCAC	TEMPERATURE CONTROL AIR COMPRESSOR
ACU	AIR CONDITIONING UNIT	EQUIP	EQUIPMENT	LPC	LOW PRESSURE CONDENSATE	TCC	TEMPERATURE CONTROL CONTRACTOR
AD	ACCESS DOOR	ER	EXHAUST REGISTER	LPS	LOW PRESSURE STEAM	TCP	TEMPERATURE CONTROL PANEL
ADJ	ADJUSTABLE	ERU	ENERGY RECOVERY UNIT	LR	LINEAR RETURN	TCV	TEMPERATURE CONTROL VALVE
A/E	ARCHITECT/ENGINEER	ERV	ENERGY RECOVERY VENTILATOR	LT	LIGHT TROFFER	TEMP	TEMPORARY
AF	AIR FOIL	ET	EXPANSION TANK	LWT	LEAVING WATER TEMPERATURE	TF	TRANSFER FAN
AFB	ABOVE FINISHED FLOOR	ETR	EXISTING TO REMAIN	M	MOTOR OPERATED DAMPER	TFA	TO FLOOR ABOVE
AFMS	AIR FLOW MEASURING STATION	EWH	ELECTRIC WALL HEATER	MAT	MIXED AIR TEMPERATURE	TFB	TO FLOOR BELOW
AHU	AIR HANDLING UNIT	EWT	ENTERING WATER TEMPERATURE	MA	MIXED AIR	TG	TRANSFER GRILLE
AL	ALUMINUM	EXH	EXHAUST	MAU	MAKE-UP AIR UNIT	TO	TEST OPENINGS
AMP	AMPERE	EXT	EXTERIOR OR EXTERNAL	MAX	MAXIMUM	TS	TIP SPEED
AP	ACCESS PANEL	F	FURNACE	MBS	MAXIMUM BRITISH THERMAL UNITS/HOUR	TYP	TYPICAL
APD	AIR PRESSURE DROP	°F	DEGREES FAHRENHEIT	MCA	MINIMUM CIRCUIT AMPS	UH	UNIT HEATER
ASC	ABOVE SUSPENDED CEILING	F&B	FACE & BYPASS	MCC	MOTOR CONTROL CENTER	UST	UNDERGROUND STORAGE TANK
ATR	AIR TROFFER - RETURN	F&T	FLOAT & THERMOSTAT TRAP	MECH	MECHANICAL	UV	UNIT VENTILATOR
ATS	AIR TROFFER - SUPPLY	FA	FREE AREA	MEZZ	MEZZANINE	UNEX	UNEXCAVATED
AUTO	AUTOMATIC	FC	FORWARD CURVED	MFS	MAXIMUM FUSE SIZE	V	VENT
B	BOILER	FCU	FAN COIL UNIT	MH	MANHOLE	VAC	VACUUM
BB	BASEBOARD	FD	FLOOR DRAIN OR FIRE DAMPER	MIN	MINIMUM	VAV	VARIABLE AIR VOLUME
BC	BOOSTER COIL	FFA	FROM FLOOR ABOVE	MOCOP	MAXIMUM OVERCURRENT PROTECTION	VB	VACUUM BREAKER
BCU	BLOWER COIL UNIT	FFB	FROM FLOOR BELOW	MTD	MOUNTED	VD	VOLUME DAMPER
BDD	BACK DRAFT DAMPER	FILL	FILL LINE	MUA	MAKE-UP AIR UNIT	VDT	VERTICAL DRAW THRU
BFP	BACKFLOW PREVENTER	FLA	FULL LOAD AMPS	NC	NOISE CRITERIA	VEL	VELOCITY
BHP	BRAKE HORSEPOWER	FLEX	FLEXIBLE	NO	NORMALLY CLOSED	VERT	VERTICAL
BI	BACKWARD INCLINED	FM	FLOW METER	NIC	NOT IN CONTRACT	VFD	VARIABLE FREQUENCY DRIVE
BLOG	BUILDING	FOR	FUEL OIL RETURN	NO	NORMALLY OPEN	VSC	VARIABLE SPEED CONTROL
BOD	BOTTOM OF DUCT	FOS	FUEL OIL SUPPLY	NPLV	NOMINAL PART LOAD VALUE	W TO W	WALL TO WALL
BOP	BOTTOM OF PIPE	FOV	FUEL OIL VENT	NTS	NOT TO SCALE	WB	WET BULB
BOS	BOTTOM OF STRUCTURE	FPC	FIRE PROTECTION CONTRACTOR	O	OXYGEN	WC	WATER COLUMN
BR	BRINE RETURN	FPM	FEET PER MINUTE	OA	OUTDOOR AIR	WF	WALL FIN
BRG	BEARING	FS	FLOW SWITCH	OAT	OUTDOOR AIR TEMPERATURE	WP	WEATHER PROOF
BS	BRINE SUPPLY	FT	FOOT OR FEET	OC	ON CENTER	WPD	WATER PRESSURE DROP
BSMT	BASEMENT	G	GAS	OPD	OPPOSED BLADE DAMPER	YH	YARD HYDRANT
BTU	BRITISH THERMAL UNIT	GA	GALLON	P	PUMP		
C	CONVECTOR	GAL	GALLON	PC	PLUMBING CONTRACTOR		
CA	COMBUSTION AIR	GALV	GALVANIZED	PD	PUMP DISCHARGE		
CAB	CABINET	GC	GENERAL CONTRACTOR	PLBG	PLUMBING		
CCC	COOLING COIL CONDENSATE	GLYR	GLYCOL RETURN	POC	POINT OF CONNECTION		
CD	CEILING DIFFUSER	GLYS	GLYCOL SUPPLY	PRE	POWER ROOF EXHAUST FAN		
CF	CEILING (DESTRATIFICATION) FAN	GRH	GAS FIRED RADIANT HEAT	PRELIM	PRELIMINARY		
CFM	CUBIC FEET PER MINUTE	GPM	GALLONS PER MINUTE	PRESS	PRESSURE		
CH	CHILLER	GUH	GAS FIRED UNIT HEATER	PRV	PRESSURE REDUCING VALVE		
CWR	CHILLED WATER RETURN	GV	GAS VENT	PS	PRESSURE SWITCH		
CWS	CHILLED WATER SUPPLY	H	HUMIDIFIER	PSD	PUMP SUCTION DIFFUSER		
CI	CAST IRON OR CUBIC INCH	HB	HOSE BIBB	PSI	POUNDS PER SQUARE INCH		
CL	CENTERLINE	HC	HEATING CONTRACTOR	PTAC	PACKAGED TERMINAL AIR CONDITIONER		
CLG	CEILING	HCR	HOT/CHILLED WATER RETURN	PVC	POLYVINYL CHLORIDE		
CMU	CONCRETE MASONARY UNIT	HCS	HOT/CHILLED WATER SUPPLY	R	REFRIGERANT		
COMB	COMBINATION OR COMBUSTION	HD	HUB DRAIN	RA	RETURN AIR		
CONC	CONCRETE	HDT	HORIZONTAL DRAW THRU	RCP	RADIANT CEILING PANEL		
COND	CONDENSATE	HG	HEIGHT	RD	ROOF DRAIN		
CONTR	CONTRACTOR	HGT	HEIGHT	REQD	REQUIRED		
COP	COEFFICIENT OF PERFORMANCE	HP	HORSEPOWER	RF	RETURN FAN		
CP	CONDENSATE PUMP	HPC	HIGH PRESSURE CONDENSATE	RG	RETURN GRILLE		
CRU	COMPUTER ROOM UNIT	HPS	HIGH PRESSURE STEAM	RH	RELIEF HOOD		
CR	CONDENSER WATER RETURN	HPU	HEAT PUMP UNIT	RHG	REFRIGERANT HOT GAS		
CS	CONDENSER WATER SUPPLY	HPWR	HEAT PUMP WATER RETURN	RL	REFRIGERANT LIQUID		
CT	COOLING TOWER	HPWS	HEAT PUMP WATER SUPPLY	RPM	REVOLUTIONS PER MINUTE		
CU	COPPER	HR	HOUR	RR	RETURN REGISTER		
CUH	CABINET UNIT HEATER	HRU	HEAT RECOVERY UNIT	RTU	ROOF TOP UNIT		
CW	COLD WATER	HSR	HEAT SINK RETURN	S	SUPPLY		
D	DRAIN	HSS	HEAT SINK SUPPLY	SA	SUPPLY AIR		
DB	DRY BULB	HTWR	HIGH TEMPERATURE HOT WATER RETURN	SCR	SILICONE CONTROLLED RECTIFIERS		
DC	DRY COOLER	HTWS	HIGH TEMPERATURE HOT WATER SUPPLY	SD	SLOT DIFFUSER		
DCO	DOOR CUTOFF BY GC	HVAC	HEATING VENTILATING AND AIR CONDITIONING	SEER	SEASONAL ENERGY EFFICIENCY RATIO		
DDC	DIRECT DIGITAL CONTROL	HW	HOT WATER	SEG	SECURITY EXHAUST GRILLE		
DEPT	DEPARTMENT	HWR	HOT WATER RETURN	SF	SUPPLY FAN		
DG	DOOR GRILLE BY GC	HWS	HOT WATER SUPPLY	SG	SUPPLY GRILLE		
DIA	DIAMETER	HWY	HIGHWAY	SM	SHEET METAL		
DN	DOWN	HX	HEAT EXCHANGER	SQ FT	SQUARE FEET		
DSA	DUCT SOUND ATTENUATOR	HYD	HYDRANT	SR	SUPPLY REGISTER		
DSF	DESTRATIFICATION FAN	HZ	HERTZ	SRG	SECURITY RETURN GRILLE		
DWD	DUAL WALL DUCTWORK	IH	INTAKE HOOD	SRV	SAFETY RELIEF VALVE		
DWDI	DOUBLE WIDTH DOUBLE INLET	IFBP	INTERNAL FACE & BYPASS	SS	STAINLESS STEEL		
DWG	DRAWING	IN	INCH	SSG	SECURITY SUPPLY GRILLE		
E	EXISTING	INV	INVERT	STG	SECURITY TRANSFER GRILLE		
EAT	ENTERING AIR TEMPERATURE	IPLV	INTEGRATED PART LOAD VALUE	SWD	SINGLE WALL DUCTWORK		
EC	ELECTRICAL CONTRACTOR	JWR	JACKET WATER RETURN	SWI	SINGLE WIDTH SINGLE INLET		
EF	EXHAUST FAN	JWS	JACKET WATER SUPPLY				
EER	ENERGY EFFICIENCY RATIO	KW	KILOWATT				
EFBP	EXTERNAL FACE & BYPASS						
EG	EXHAUST GRILLE						

PIPING SYSTEMS

	GENERAL SHUTOFF VALVE SEE SPECIFICATIONS FOR TYPE
	BALL VALVE
	GAUGE VALVE
	BUTTERFLY VALVE
	GATE VALVE
	PLUG VALVE (GAS)
	BLIND FLANGE
	CAP
	CONNECTION, BOTTOM
	CONNECTION, TOP
	ELBOW, TURNED UP
	ELBOW, TURNED DOWN
	REDUCER, CONCENTRIC
	REDUCER, ECCENTRIC - STRAIGHT INVERT
	REDUCER, ECCENTRIC - STRAIGHT CROWN
	FLEXIBLE CONNECTOR
	PITCH OF PIPE
	PIPE FLANGE
	ATMOSPHERIC VENT
	GAS
	REFRIGERANT HOT GAS
	REFRIGERANT SUCTION
	REFRIGERANT LIQUID
	DRAIN

GENERAL SYMBOLS

	THERMOSTAT OR TEMPERATURE SENSOR
	THERMOSTAT OR TEMPERATURE SENSOR WITH SECURITY COVER
	MOTOR STARTER
	SPEED CONTROLLER
	START/STOP SWITCH
	CARBON DIOXIDE SENSOR
	EXISTING TO REMAIN (DUCTWORK, PIPING, & EQUIPMENT)
	EXISTING TO BE REMOVED (DUCTWORK, PIPING, & EQUIPMENT)
	NEW DUCTWORK/PIPING
	NEW EQUIPMENT

DUCTWORK SYSTEMS

	DUCT SIZE, (FIRST FIGURE IS SIDE SHOWN)
	ROUND DUCT
	CHANGE OF ELEVATION IN DIRECTION OF AIR FLOW
	ACCESS DOOR, VERTICAL OR HORIZONTAL
	ACOUSTICAL DUCT LINER
	FLEXIBLE CONNECTION
	DUCT SOUND ATTENUATOR
	DUCT TRANSITION (DOUBLE LINE)
	DUCT TRANSITION (RECT. TO ROUND)
	DUCT TRANSITION (SINGLE LINE)
	HIDDEN DUCTWORK
	BACK DRAFT DAMPER
	MOTOR OPERATED DAMPER
	MANUAL VOLUME DAMPER
	FIRE DAMPER
	STANDARD BRANCH, SUPPLY, RETURN, OR EXHAUST, NO SPLITTER
	ROOF VENTILATOR OR HOOD ON ROOF ABOVE
	ROOF VENTILATOR OR HOOD ON ROOF
	DUCT CAP
	END OF DUCT
	POSITIVE PRESSURE DUCT SECTION
	POSITIVE PRESSURE DUCT (DOWN OR AWAY)
	NEGATIVE PRESSURE DUCT SECTION
	NEGATIVE PRESSURE DUCT (DOWN OR AWAY)
	FLEXIBLE DUCT DIFFUSER CONNECTION
	SIDEWALL AIR DEVICE
	EXHAUST, RETURN, OR TRANSFER AIR DEVICE
	SUPPLY AIR DEVICE

	LOUVER AND BIRD SCREEN
	DOOR GRILLE
	3/4\"/>
	ELBOW WITH TURNING VANES
	UNIT HEATER
	AIR FLOW
	SQUARE FEET
	ELEVATION SYMBOL

HVAC SHEET INDEX

M000	ABBREVIATIONS AND SYMBOLS - HVAC
M101	FLOOR PLAN - HVAC
M102	ROOF PLAN - HVAC
M400	SYSTEM SCHEMATIC - HVAC
M400	SECTIONS - HVAC
M800	SCHEDULES - HVAC
M801	SCHEDULES - HVAC
M900	DETAILS - HVAC

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JDR PROJECT NO. 160205

ISSUED

REBID 10.26.17

PROJECT
HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

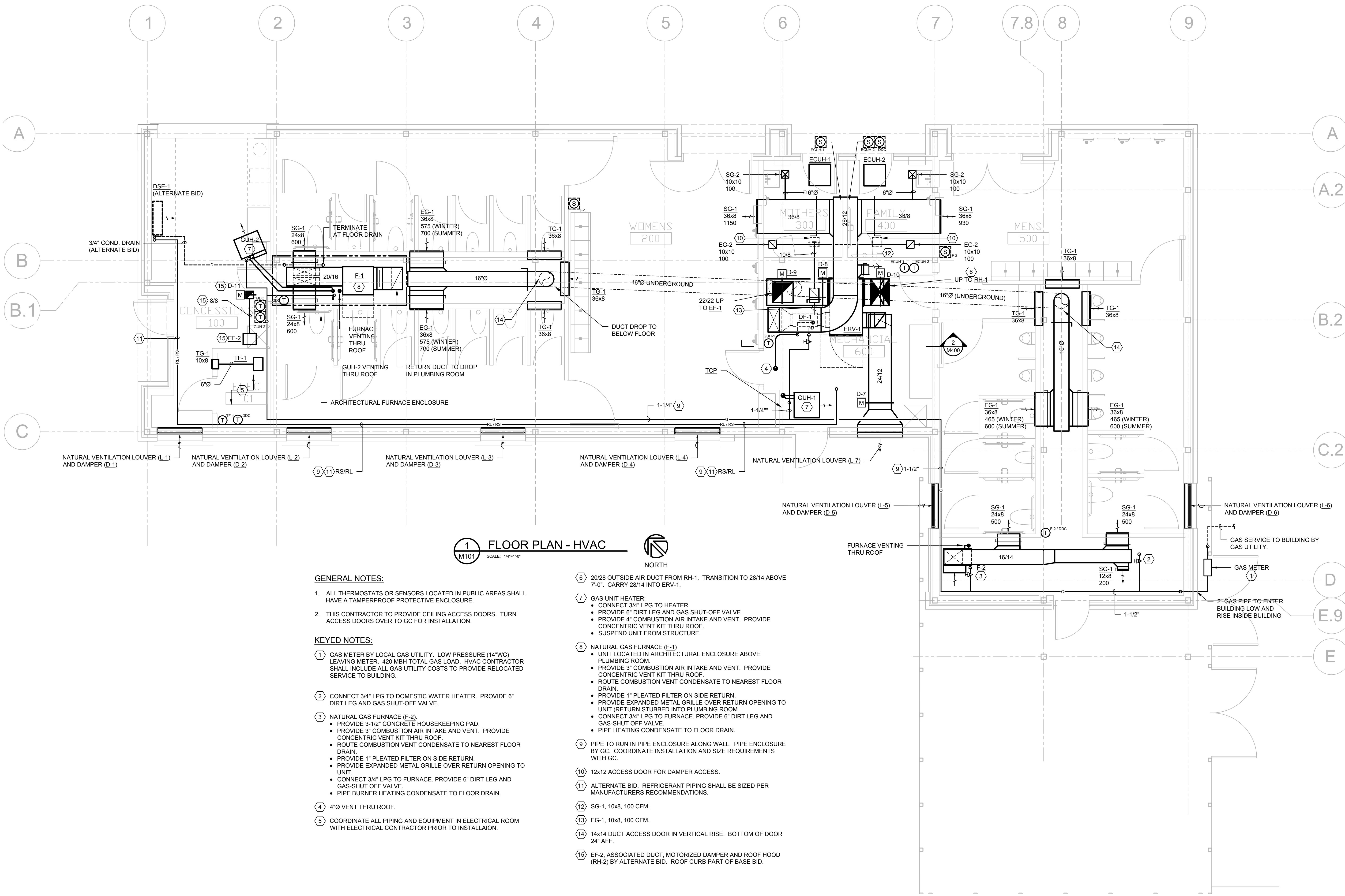
DRAWING
ABBREVIATIONS AND
SYMBOLS - HVAC

DATE
11.29.16

M000

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1 FLOOR PLAN - HVAC
SCALE: 1/4"=1'-0"
NORTH

GENERAL NOTES:

1. ALL THERMOSTATS OR SENSORS LOCATED IN PUBLIC AREAS SHALL HAVE A TAMPERPROOF PROTECTIVE ENCLOSURE.
2. THIS CONTRACTOR TO PROVIDE CEILING ACCESS DOORS. TURN ACCESS DOORS OVER TO GC FOR INSTALLATION.

KEYED NOTES:

- 1 GAS METER BY LOCAL GAS UTILITY. LOW PRESSURE (14"WC) LEAVING METER. 420 MBH TOTAL GAS LOAD. HVAC CONTRACTOR SHALL INCLUDE ALL GAS UTILITY COSTS TO PROVIDE RELOCATED SERVICE TO BUILDING.
- 2 CONNECT 3/4" LPG TO DOMESTIC WATER HEATER. PROVIDE 6" DIRT LEG AND GAS SHUT-OFF VALVE.
- 3 NATURAL GAS FURNACE (F-2).
 - PROVIDE 3-1/2" CONCRETE HOUSEKEEPING PAD.
 - PROVIDE 3" COMBUSTION AIR INTAKE AND VENT. PROVIDE CONCENTRIC VENT KIT THRU ROOF.
 - ROUTE COMBUSTION VENT CONDENSATE TO NEAREST FLOOR DRAIN.
 - PROVIDE 1" PLEATED FILTER ON SIDE RETURN.
 - PROVIDE EXPANDED METAL GRILLE OVER RETURN OPENING TO UNIT.
 - CONNECT 3/4" LPG TO FURNACE. PROVIDE 6" DIRT LEG AND GAS-SHUT OFF VALVE.
 - PIPE BURNER HEATING CONDENSATE TO FLOOR DRAIN.
- 4 4" VENT THRU ROOF.
- 5 COORDINATE ALL PIPING AND EQUIPMENT IN ELECTRICAL ROOM WITH ELECTRICAL CONTRACTOR PRIOR TO INSTALLATION.

- 6 20/28 OUTSIDE AIR DUCT FROM RH-1. TRANSITION TO 28/14 ABOVE 7'-0". CARRY 28/14 INTO ERV-1.
- 7 GAS UNIT HEATER:
 - CONNECT 3/4" LPG TO HEATER.
 - PROVIDE 6" DIRT LEG AND GAS SHUT-OFF VALVE.
 - PROVIDE 4" COMBUSTION AIR INTAKE AND VENT. PROVIDE CONCENTRIC VENT KIT THRU ROOF.
 - SUSPEND UNIT FROM STRUCTURE.
- 8 NATURAL GAS FURNACE (F-1)
 - UNIT LOCATED IN ARCHITECTURAL ENCLOSURE ABOVE PLUMBING ROOM.
 - PROVIDE 3" COMBUSTION AIR INTAKE AND VENT. PROVIDE CONCENTRIC VENT KIT THRU ROOF.
 - ROUTE COMBUSTION VENT CONDENSATE TO NEAREST FLOOR DRAIN.
 - PROVIDE 1" PLEATED FILTER ON SIDE RETURN.
 - PROVIDE EXPANDED METAL GRILLE OVER RETURN OPENING TO UNIT (RETURN STUBBED INTO PLUMBING ROOM).
 - CONNECT 3/4" LPG TO FURNACE. PROVIDE 6" DIRT LEG AND GAS-SHUT OFF VALVE.
 - PIPE HEATING CONDENSATE TO FLOOR DRAIN.
- 9 PIPE TO RUN IN PIPE ENCLOSURE ALONG WALL. PIPE ENCLOSURE BY GC. COORDINATE INSTALLATION AND SIZE REQUIREMENTS WITH GC.
- 10 12x12 ACCESS DOOR FOR DAMPER ACCESS.
- 11 ALTERNATE BID. REFRIGERANT PIPING SHALL BE SIZED PER MANUFACTURERS RECOMMENDATIONS.
- 12 SG-1, 10x8, 100 CFM.
- 13 EG-1, 10x8, 100 CFM.
- 14 14x14 DUCT ACCESS DOOR IN VERTICAL RISE. BOTTOM OF DOOR 24" AFF.
- 15 EF-2 ASSOCIATED DUCT, MOTORIZED DAMPER AND ROOF HOOD (RH-2) BY ALTERNATE BID. ROOF CURB PART OF BASE BID.

PROJECT
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DRAWING
FLOOR PLAN - HVAC

DATE
11.29.16

M101

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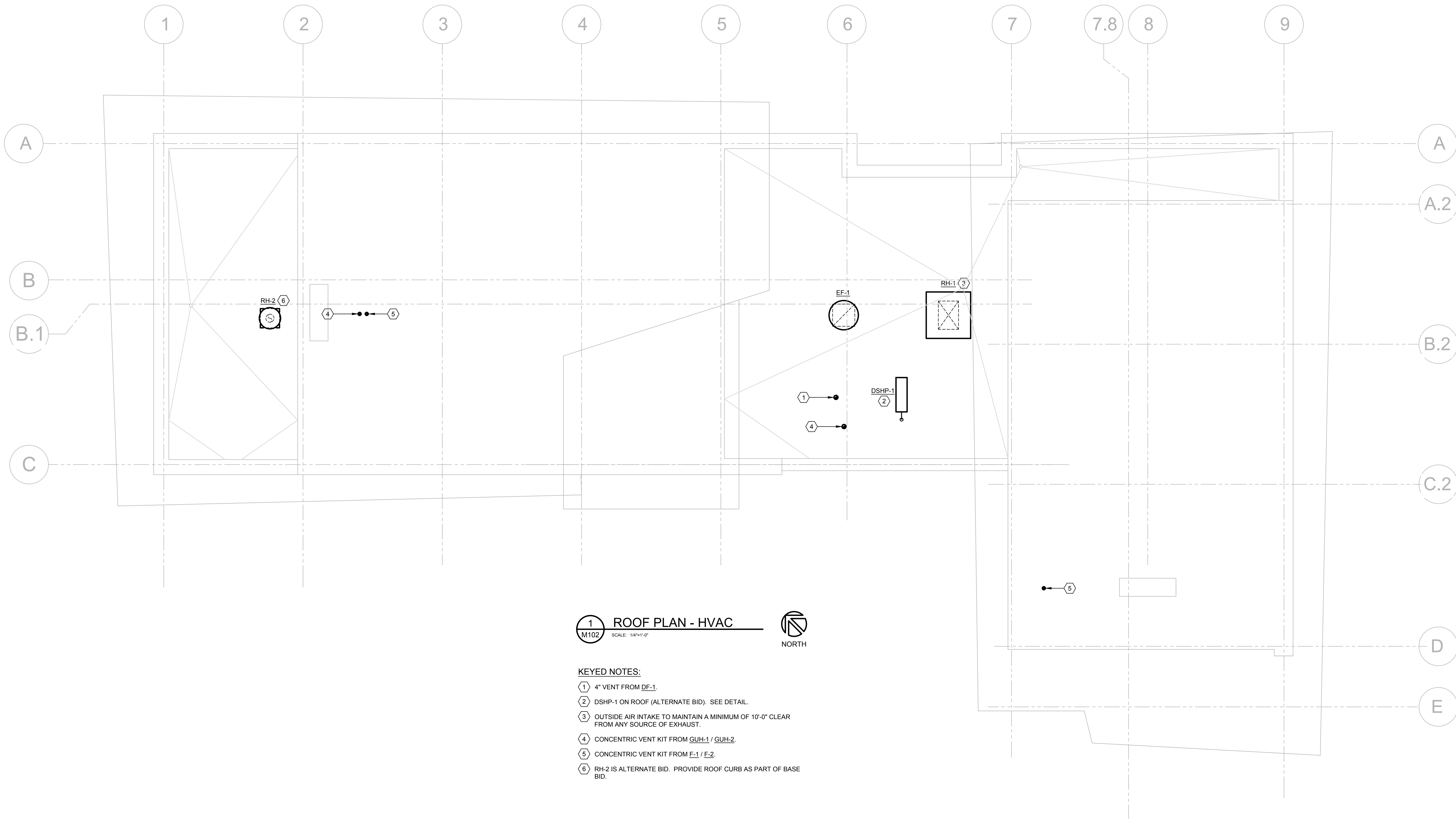
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NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING
ROOF PLAN - HVAC

DATE
11.29.16

M102



1 ROOF PLAN - HVAC
M102 SCALE: 1/4"=1'-0" NORTH

- KEYED NOTES:**
- ① 4" VENT FROM EF-1.
 - ② DSH-1 ON ROOF (ALTERNATE BID). SEE DETAIL.
 - ③ OUTSIDE AIR INTAKE TO MAINTAIN A MINIMUM OF 10'-0" CLEAR FROM ANY SOURCE OF EXHAUST.
 - ④ CONCENTRIC VENT KIT FROM GUH-1 / GUH-2.
 - ⑤ CONCENTRIC VENT KIT FROM E-1 / E-2.
 - ⑥ RH-2 IS ALTERNATE BID. PROVIDE ROOF CURB AS PART OF BASE BID.

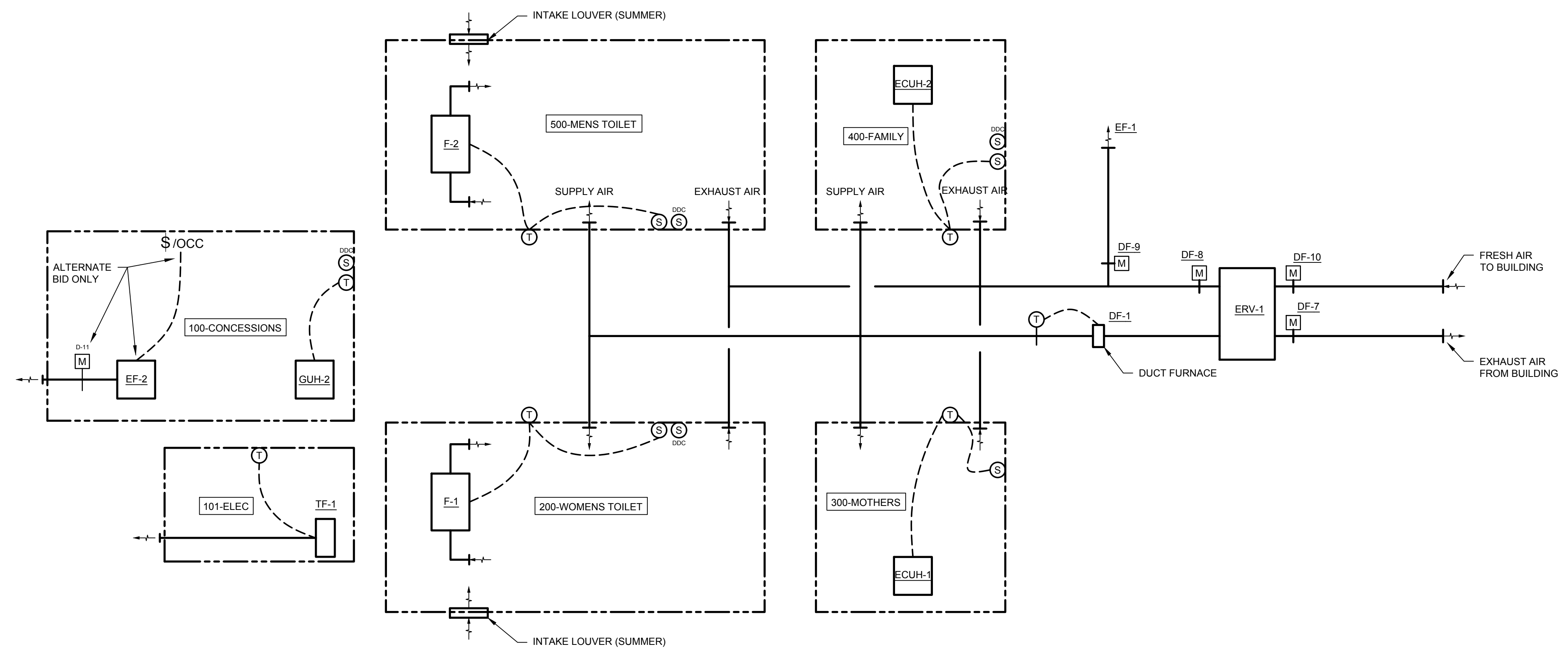
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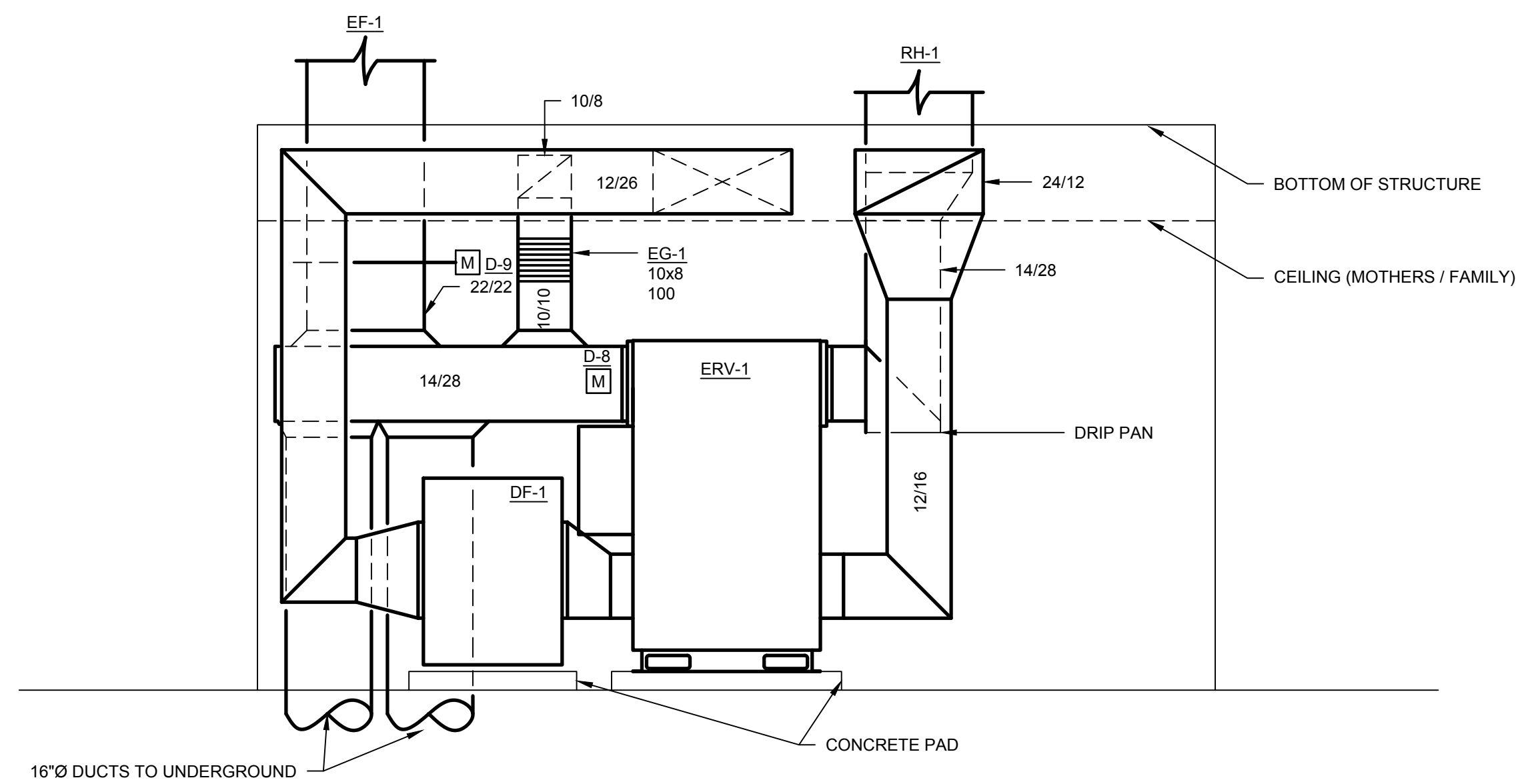
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1 SYSTEM SCHEMATIC - HVAC
M400 SCALE: 1/4"=1'-0"



2 SECTION - HVAC
M400 SCALE: 1/4"=1'-0"

PROJECT
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DRAWING
SYSTEM SCHEMATIC -
HVAC

DATE
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M400

GAS-FIRED UNIT HEATER SCHEDULE

UNIT NO.	GUH-1	GUH-2
SERVICE	600 - MECH	100 - CONCESS.
MANUFACTURER	REZNOR	REZNOR
MODEL NO.	UDAS	UDAS
TYPE	SEP COMBUS.	SEP COMBUS.
THROW (FT)	-	-
AIR FLOW (CFM)	450	450
EAT (°F)	50	50
GAS INPUT (MBH)	30.0	30.0
HEATING OUTPUT (MBH)	24.6	24.6
CONTROL	SINGLE STAGE	SINGLE STAGE
GAS PRESSURE (IN WC)	14.0	14.0
MOTOR HP	0.02	0.02
VOLTAGE / PHASE	120 / 1	120 / 1
FLA	1.9	1.9
MOCP	15.0	15.0
REMARKS	①	①

KEYED NOTES:
 ① STAINLESS STEEL HEAT EXCHANGER.

GAS-FIRED DUCT FURNACE SCHEDULE

UNIT NO.	DF-1
SERVICE	600 - MECH
MANUFACTURER	REZNOR
MODEL NO.	SC
TYPE	SEP COMBUS.
GAS INPUT (MBH)	100.0
MIN HEATING OUTPUT (MBH)	80.0
AIRFLOW (CFM)	2,275
EAT (°F)	30.0
CONTROL	ELEC. MODUL.
GAS PRESSURE (IN WC)	14.0
MOTOR HP	0.02
VOLTAGE / PHASE	120 / 1
FLA	1.9
MOCP	15.0
REMARKS	①

KEYED NOTES:
 ① STAINLESS STEEL HEAT EXCHANGER, BOTTOM DRIP PAN AND BURNER.

ENERGY RECOVERY VENTILATOR SCHEDULE

UNIT NO.	ERV-1	-	-
SERVICE	TOILETS	-	-
MANUFACTURER	RENEWAIRE	-	-
MODEL NO.	HE3XINH	-	-
INDOOR TEMP (DB) SUMMER	-	-	-
INDOOR RH (%) SUMMER	-	-	-
INDOOR TEMP (DB) WINTER	50.0	-	-
INDOOR RH (%) WINTER	35.0	-	-

OUTSIDE AIR DATA

CFM STD AIR	2,380	-	-
EXT. SP (IN WG)	1.0	-	-
TOTAL SP (IN WG)	-	-	-
EAT/EWB (F) SUMMER	-	-	-
LAT/LWB (F) SUMMER	-	-	-
EAT (F) WINTER	-15.0	-	-
LAT (F) WINTER	30.0	-	-

EXHAUST AIR DATA

CFM STD AIR	2,380	-	-
EXT. SP (IN WG)	1.0	-	-
TOTAL SP (IN WG)	-	-	-
LAT (F) SUMMER	-	-	-
LAT (F) WINTER	-	-	-
FILTER	MERV 8	-	-
FRPM	-	-	-
BHP	-	-	-
HP	3.0	-	-
VFD	YES	-	-

ELECTRICAL DATA

VOLTAGE/PHASE	240 / 1	-	-
MCA	40.2	-	-
MOCP	45.0	-	-
UNIT WEIGHT	150	-	-

KEYED NOTES:
 ① PROVIDE UNIT WITH FACTORY VARIABLE FREQUENCY DRIVES.

FAN SCHEDULE

SF = SUPPLY FAN EF = EXHAUST FAN
 RF = RETURN FAN TF = TRANSFER FAN

UNIT NO.	EF-1	EF-2	TF-1
LOCATION	ROOF	100 - CONCESS	101 - ELEC
MANUFACTURER	GREENHECK	GREENHECK	GREENHECK
MODEL NO.	G-163	SP-A390	SP-A190
SERVICE	BUILDING	100 - CONCESS	ELEC
FAN TYPE	PRV	CEILING	CEILING
ARRANGEMENT	DOWNBLAST	CEILING	CEILING
DESIGN CFM	2,800	210	130
EXT. SP (IN WC)	0.75	0.50	0.375
FAN WHEEL TYPE	-	-	-
FAN DIAMETER	16	-	-
APPROXIMATE FAN RPM	1,249	1,350	1,400
BHP	0.76	-	-
MOTOR HP	1.0	135 WATT	55 WATT
VOLTS/PHASE	120 / 1	120 / 1	120 / 1
DRIVE	DIRECT	DIRECT	DIRECT
TWO SPEED	NO	NO	NO
VFD	NO	NO	NO
DAMPER	YES-MOTORIZED	YES-MOTORIZED	NO
WEIGHT (LBS)	125.0	25.0	20.0
MAX. SONES	16	5.0	2.5
MAX. FAN INLET AIR SOUND POWER BY OCTAVE BAND (dB)	1		
	2		
	3		
	4		
	5		
	6		
	7		
	8		
REMARKS	①	②	②

KEYED NOTES:
 ① MOTORIZED DAMPER SHALL BE LOW LEAKAGE INSULATED DAMPER, UNIT CONTROLLED BY DDC SYSTEM.
 ② FAN TO BE CONTROLLED BY HEATING / COOLING THERMOSTAT, STAND-ALONE CONTROL.
 ③ MOTORIZED DAMPER SHALL BE LOCK LEAKAGE INSULATED DAMPER, FAN TO BE INTERLOCKED WITH ROOM LIGHTS.

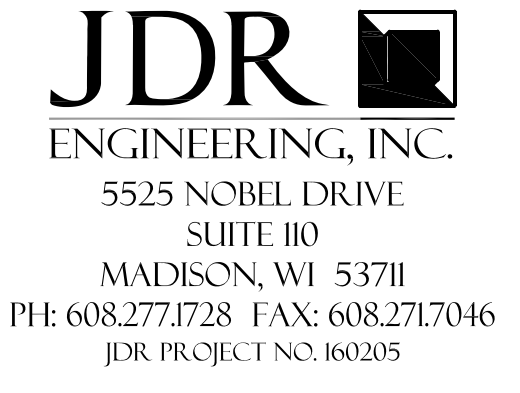
FURNACE SCHEDULE

UNIT NO.	F-1	F-2
SERVICE	200 - WOMENS	500 - MENS
MANUFACTURER	DAIKIN	DAIKIN
MODEL NO.	DM97MC	DM97MC
SUPPLY FAN		
SUPPLY CFM	1,200	1,200
MIN. OA CFM	0	0
EXT. SP (IN WC)	0.625	0.625
SUPPLY FAN HP		
SUPPLY FAN TYPE		
FUEL	NATURAL GAS	NATURAL GAS
EAT / LAT (°F)		
STAGES	MODULATING	MODULATING
MIN INPUT (MBH)	60.0	30.0
MIN OUTPUT (MBH)	56.0	28.0
MIN. EFFICIENCY (%)	95.0	95.0
MIN/MAX GAS INPUT PRESSURE	6.0 / 14.0	6.0 / 14.0
HEATING DATA		
DB		
WB		
DB		
WB		
COOLING COIL		
LAT (°F) / EAT (°F)		
TOTAL CAP. (MBH)		
SENSIBLE CAP. (MBH)		
FACE VELOCITY FPM MAX.		
MAX. AIR PD (IN WG)		
REFRIGERANT TYPE		
FILTER TYPE	2" PLEATED	2" PLEATED
FILTER EFFICIENCY	MERV 8	MERV 8
MIN. CIRCUIT AMPS	11.6	11.6
MOCP	15.0	15.0
VOLTS/PHASE	120.0	120.0
WEIGHT (LBS)		
REMARKS	①	①

KEYED NOTES:
 ① HEATING ONLY WITH STAINLESS STEEL HEAT EXCHANGER, NO COOLING.

Architecture
 Planning

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 849 E. Washington Ave., Ste 112
 Madison, Wisconsin 53703



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 REBID 10.26.17

PROJECT
 HENRY VILAS ZOO
 NEW RESTROOM FACILITY
 1246 VILAS PARK DRIVE
 MADISON, WISCONSIN

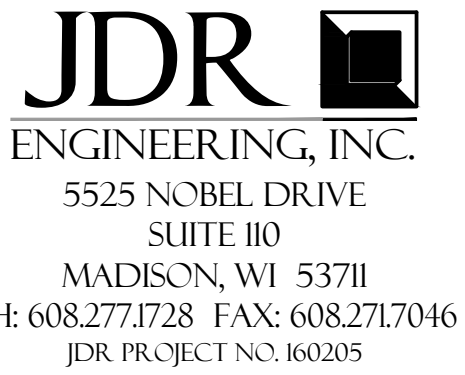
DRAWING
 SCHEDULES-- HVAC

DATE
 11.29.16

M800

Architecture
Planning

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849 E. Washington Ave., Ste 112
Madison, Wisconsin 53703



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M801

DAMPER SCHEDULE						
UNIT NO.	D-1 THRU D-6	D-7	D-8	D-9	D-10	D-11
SERVICE	L-1 THRU L-6	ERV-1 EA	ERV-1 EA	EF-1	ERV-1 OA	EF-2 / RH-2
MANUFACTURER	RUSKIN	RUSKIN	RUSKIN	RUSKIN	RUSKIN	RUSKIN
MODEL NO.	TED50XT	CDTI-50	CDTI-50	CDTI-50	CDTI-50	CDTI-50
DEPTH (IN)	5	5	5	5	5	5
BLADE TYPE	OPPOSED	X	X	X	X	X
	PARALLEL					
FAIL POSITION	FC	-	X	X	X	X
	FO	-				
SIZE (IN) WxH	48x24	48x18	28x14	22x22	28x20	8x8
ACTUATION TYPE	MANUAL	MOTORIZED	MOTORIZED	MOTORIZED	MOTORIZED	MOTORIZED
REMARKS	(1)	(1)	(1)	(1)	(1)	(1)(2)

KEYED NOTES:

- (1) LOW LEAK AND COMPLETELY THERMALLY BROKEN DAMPER WITH INSULATED BLADES. COORDINATE EXACT SIZE OF DAMPER WITH ASSOCIATED LOUVER. DAMPER SHALL BE ACCESSIBLE FOR MANUAL ACTUATION FROM INSIDE THE BUILDING.
- (2) ALTERNATE BID ONLY.

ROOF HOOD SCHEDULE		
UNIT NO.	RH-1	RH-2
SERVICE	ERV-1 INTAKE	EF-2
LOCATION	ROOF	ROOF
MANUFACTURER	GREENHECK	GREENHECK
MODEL NO.	FGI	GRSR
CFM	2,275	210
NECK SIZE (IN)	28x20	8"Ø
CURB HEIGHT (IN)	24	18
FREE AREA VELOCITY (FPM)	586	545
FREE AREA (FT²)	3.88	0.37
MOTORIZED AUTO DAMPERS	YES	YES
INTAKE	●	
EXHAUST		●
RELIEF		
REMARKS		(1)

KEYED NOTES:

- (1) BY BASE BID PROVIDE ROOF CURB ONLY. BY ALTERNATE BID PROVIDE CURB AND HOOD.

AIR DEVICE SCHEDULE					
UNIT NO.	EG-1	EG-2	SG-1	SG-2	TG-1
SERVICE	EXHAUST	EXHAUST	SUPPLY	SUPPLY	TRANSFER
MANUFACTURER	TITUS	TITUS	TITUS	TITUS	TITUS
MODEL NO.	301RL-FS	301RL-FS	300RL-FS	300RL-FS	301RL-FS
FACE STYLE	LOUVERED	LOUVERED	LOUVERED	LOUVERED	LOUVERED
PATTERN	SINGLE DEFLECT	SINGLE DEFLECT	DBL DEFLECT	DBL DEFLECT	SINGLE DEFLECT
FINISH	MILL	MILL	MILL	MILL	MILL
MATERIAL	ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM
CFM RANGE	-	-	-	-	-
MOUNTING	SURFACE	SURFACE	SURFACE	SURFACE	SURFACE
DAMPER	NO	YES	NO	YES	NO
REMARKS		(1)		(1)	

GENERAL NOTES:

- 1. CONTRACTOR SHALL VERIFY MOUNTING SURFACE / FRAME REQUIREMENTS.
- 2. BRANCH DUCT SIZE TO DIFFUSER SHALL BE THE NECK SIZE OF THE DIFFUSER UNLESS NOTED OTHERWISE.
- 3. SEE SPECIFICATION FOR GRILLE, REGISTER, AND DIFFUSER FINISHES.
- 4. MAXIMUM STATIC PRESSURE DROP THROUGH GRILLE, REGISTER, OR DIFFUSER SHALL NOT EXCEED 0.1".
- 5. MAXIMUM NC LEVELS FOR GRILLES, REGISTERS, OR DIFFUSERS SHALL NOT EXCEED 25.

KEYED NOTES:

- (1) PROVIDE STAINLESS STEEL DAMPER.

LOUVER SCHEDULE		
UNIT NO.	L-1 THRU L-6	L-7
MANUFACTURER	RUSKIN	RUSKIN
MODEL NO.	EME220DD	ELF6375DX
SERVICE	NAT VENT-INTAKE	EXHAUST
AIRFLOW (CFM)	600	2,380
SIZE WxH (IN)	48x24	48x18
FREE AREA (FT²)	3.22	3.15
FREE AREA VEL. (FPM)	185	755
STATIC PRESSURE (IN W.C.)	-	0.06
REMARKS	(1)	

KEYED NOTES:

- (1) WIND DRIVEN RAIN RESISTANT STATIONARY LOUVER. EXTRUDED ALUMINUM CONSTRUCTION.

SPLIT SYSTEM CONDITIONING AND HEAT PUMP UNIT SCHEDULE			
EVAPORATOR UNIT (INDOOR UNIT)			
UNIT NO.	DSE-1		
LOCATION	100 - CONCESSION		
MANUFACTURER	CARRIER		
MODEL NO.	GVQ		
TYPE	HEAT PUMP		
CONFIGURATION	HIGH WALL		
SUPPLY CFM (MEDIUM SPEED)	-		
OUTSIDE AIR	0		
FILTER TYPE	-		
FAN MOTOR	VOLTS	120	
	PHASE	1	
	HP	-	
	DRIVE	DIRECT	
NO. OF SPEEDS	4		
AIR COOLED CONDENSING UNIT / HEAT PUMP (OUTDOOR UNIT)			
UNIT NO.	DSHP-1		
MANUFACTURER	CARRIER		
TYPE	HEAT PUMP		
MODEL NO.	GVQ		
NOMINAL CAPACITY	3.0		
SEER	22.0		
UNIT ELECTRICAL DATA	VOLTS	240	
	PHASE	1	
	MCA	24	
	MOCP	40	
SERVES	DSE-1		
REMARKS	(1)(2)		

KEYED NOTES:

- (1) PROVIDE UNIT WITH ALL REQUIRED REFRIGERANT LINESETS AND ACCESSORIES FOR A COMPLETE OPERATING SYSTEM.
- (2) ALTERNATE BID ONLY.

ELECTRIC CABINET UNIT HEATER SCHEDULE			
UNIT NO.	ECUH-1	ECUH-1	
SERVICE	300 - MOTHERS	400 - FAMILY	
LOCATION	300 - MOTHERS	400 - FAMILY	
MANUFACTURER	QMARK	QMARK	
MODEL NO.	CDF-542	CDF-542	
CABINET LENGTH (IN)	23	23	
CABINET HEIGHT (IN)	23	23	
CABINET DEPTH (IN)	7	7	
CABINET RECESS (IN)	0	0	
KW INPUT	4.0	4.0	
MBH	13.7	13.7	
CFM	1,400	1,400	
SPEEDS	-	-	
FAN HP	-	-	
VOLTS/PHASE	240/1	240/1	
AMPS	16.7	16.7	
BOTTOM ABOVE FLOOR (IN)			
REMARKS	(1)	(1)	

KEYED NOTES:

- (1) CEILING MOUNTED CABINET UNIT HEATER.

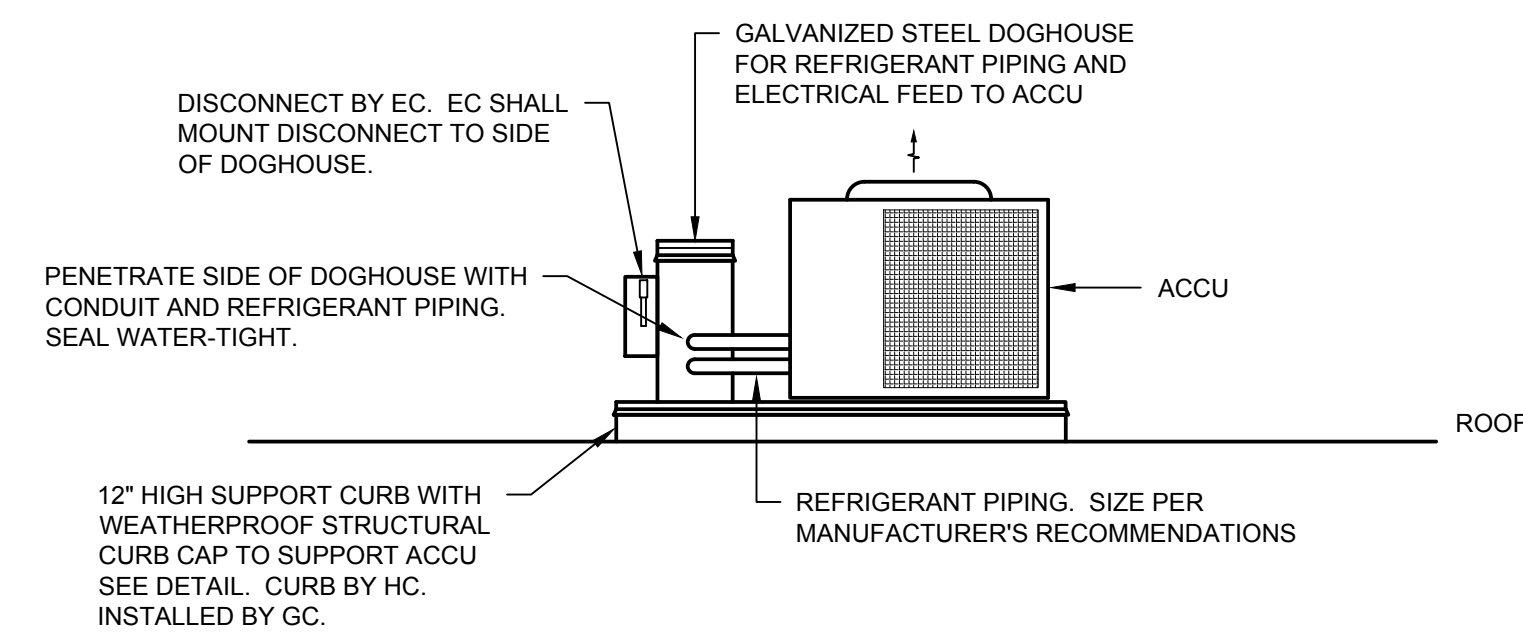
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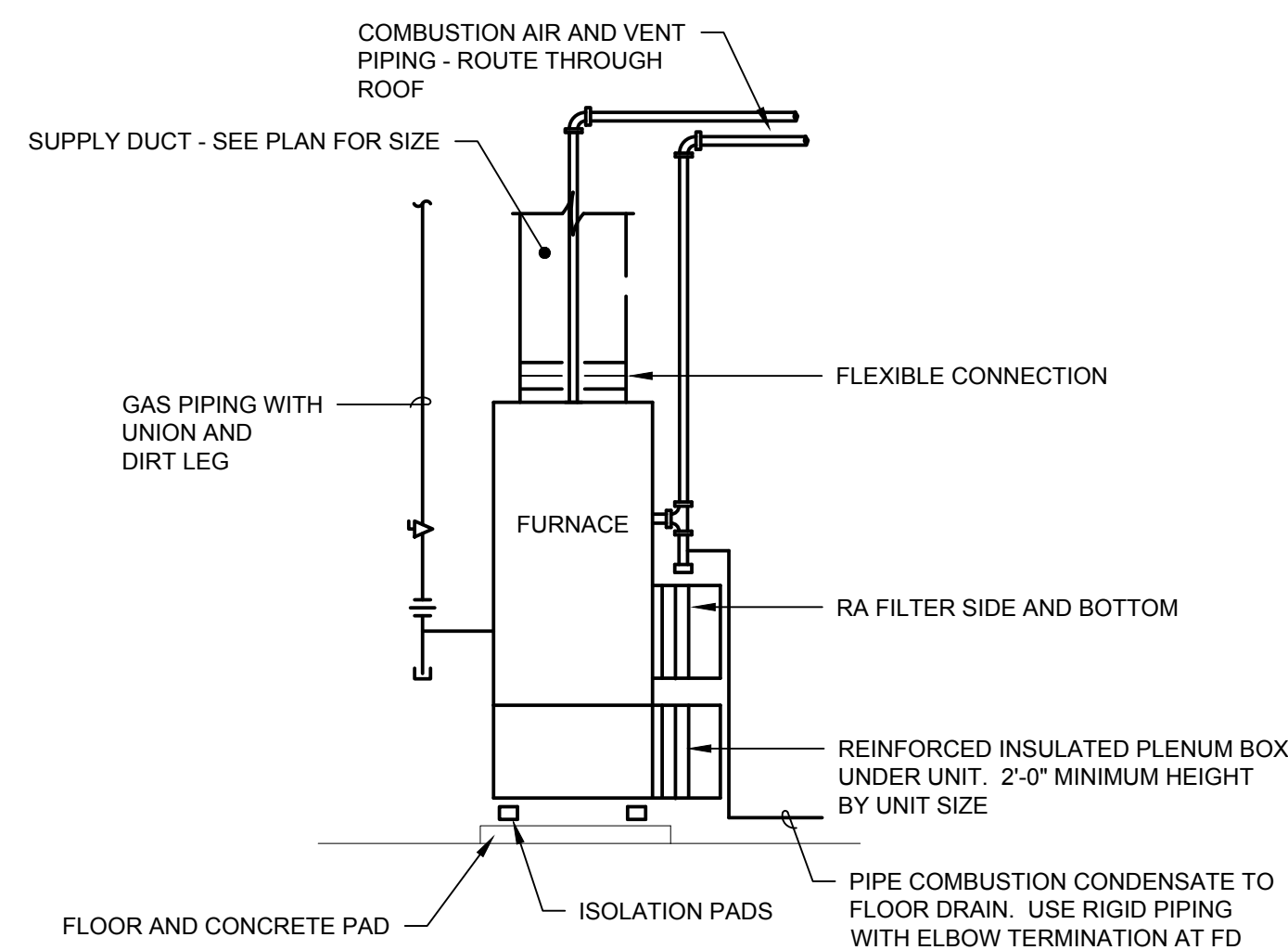
JDR
ENGINEERING, INC.
5525 NOBEL DRIVE
SUITE 110
MADISON, WI 53711
PH: 608.277.1728 FAX: 608.271.7046
JDR PROJECT NO. 160205

ISSUED

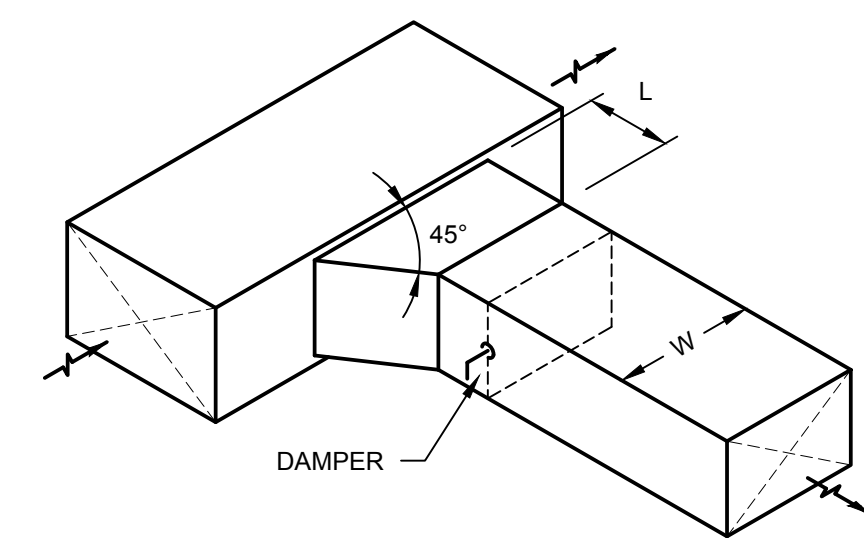
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8 CONDENSING UNIT DETAIL (ALTERNATE BID)
SCALE: NONE

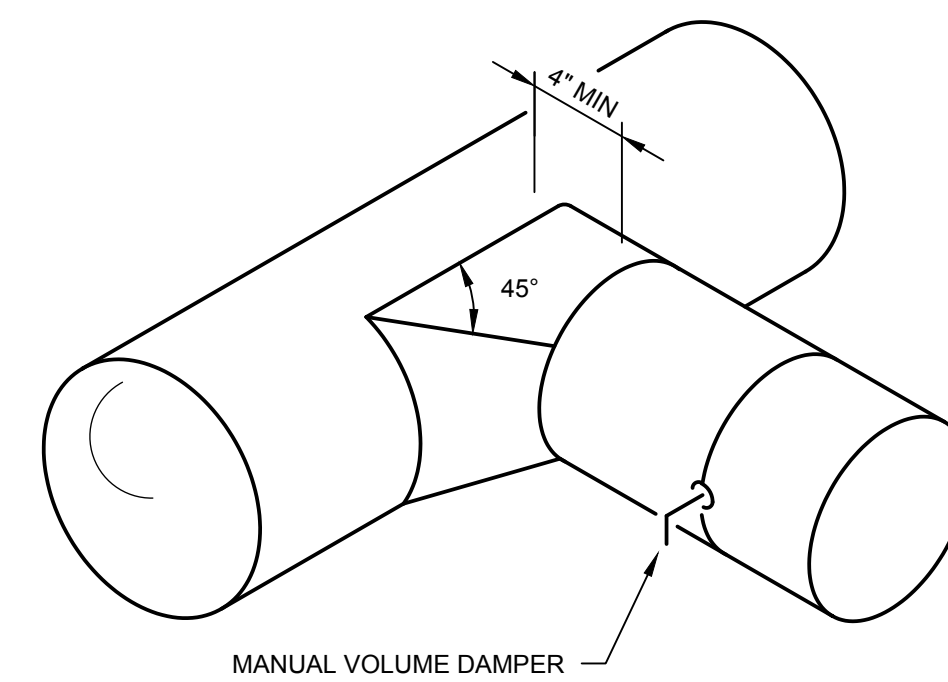


5 SEALED COMBUSTION FURNACE
SCALE: NONE

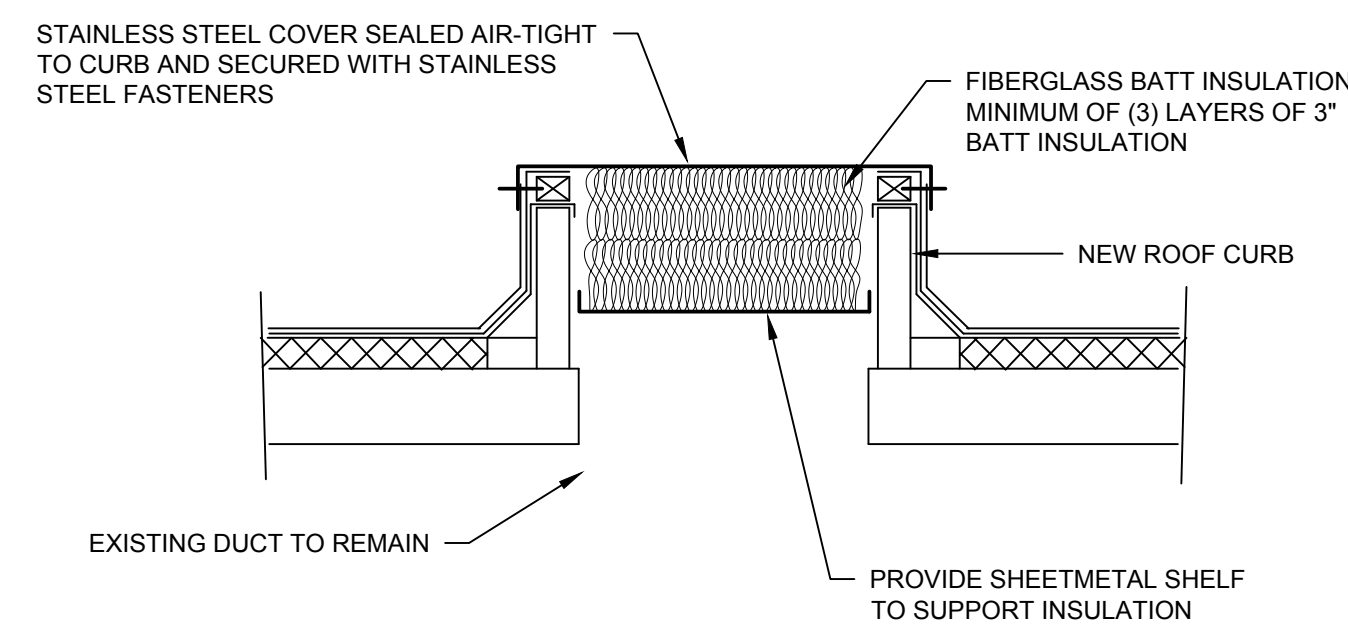


NOTE: L = 1/4W (4" MINIMUM)

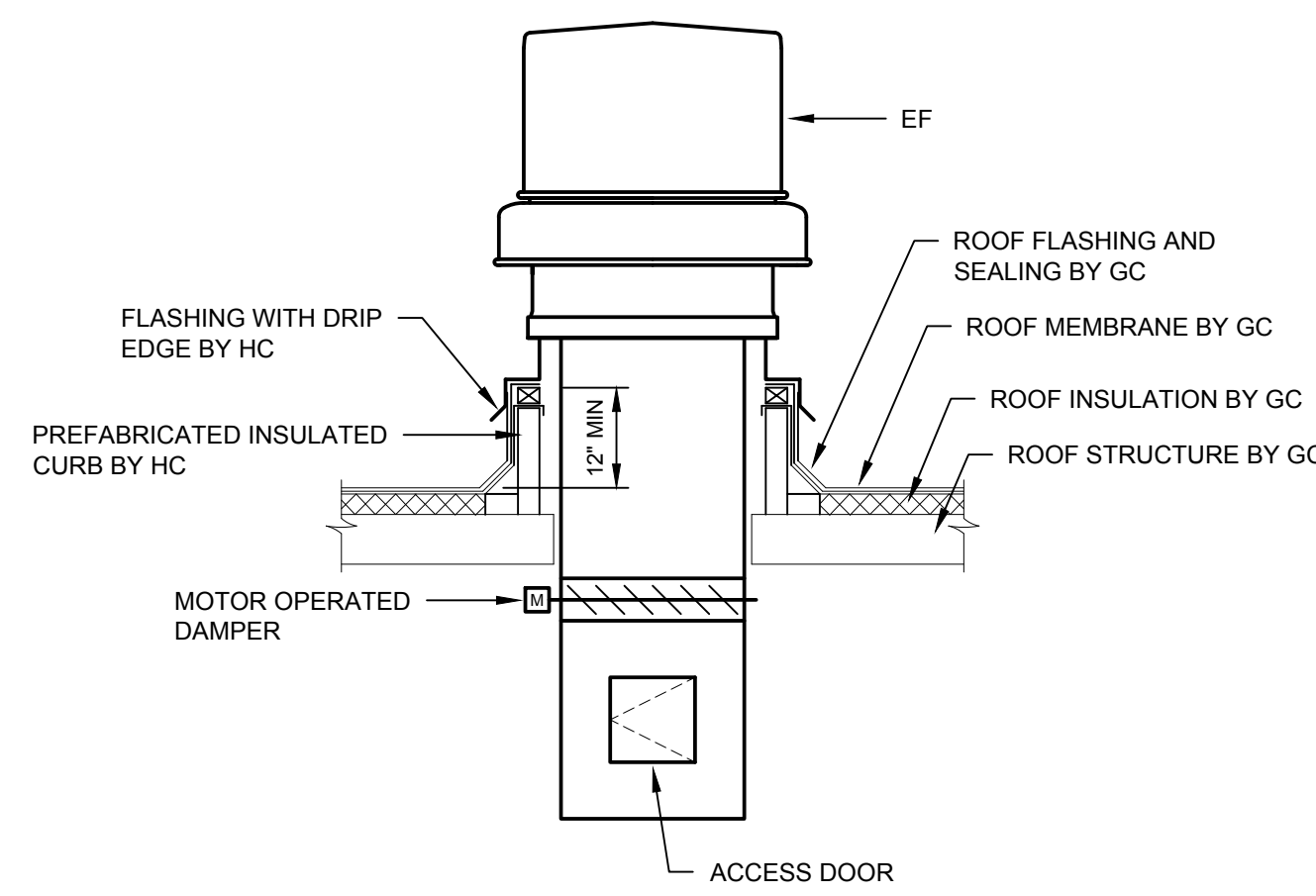
1 BRANCH DUCT TAKEOFF
SCALE: NONE (REVERSE FLOW ARROWS FOR EXHAUST AND RETURN)



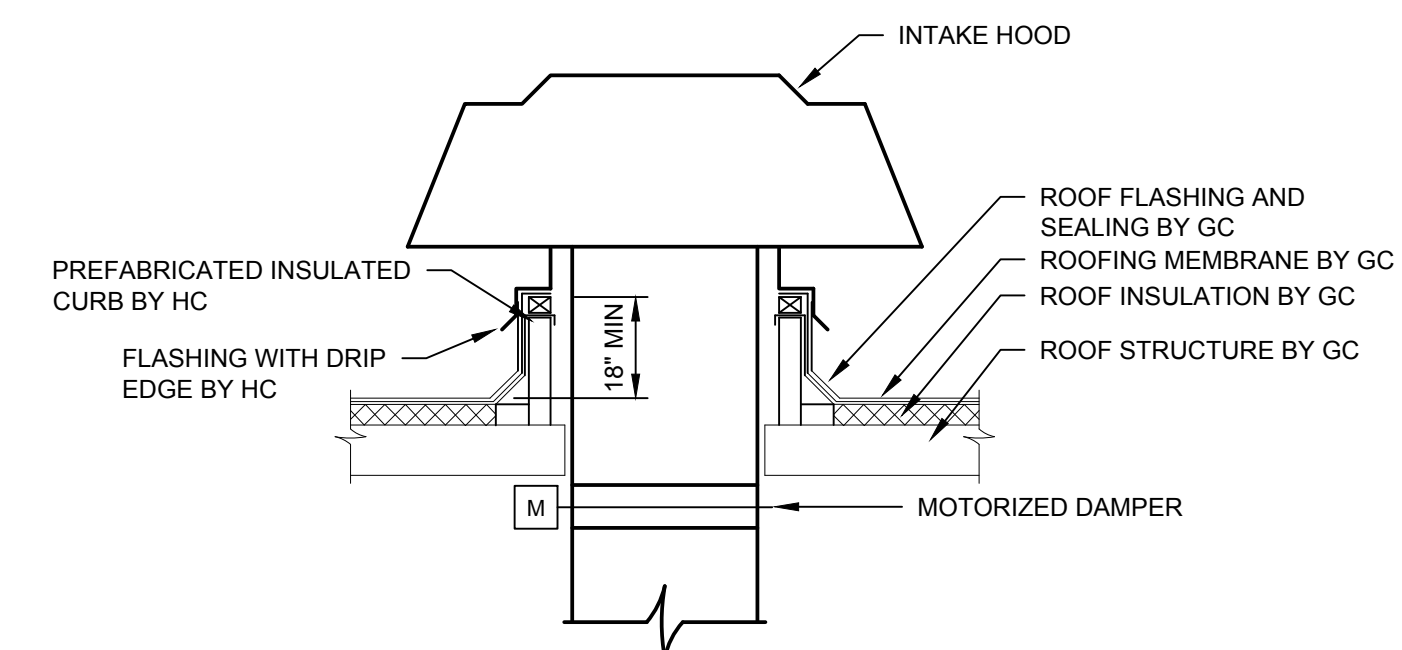
2 BRANCH DUCT TAKEOFF DETAIL
SCALE: NONE



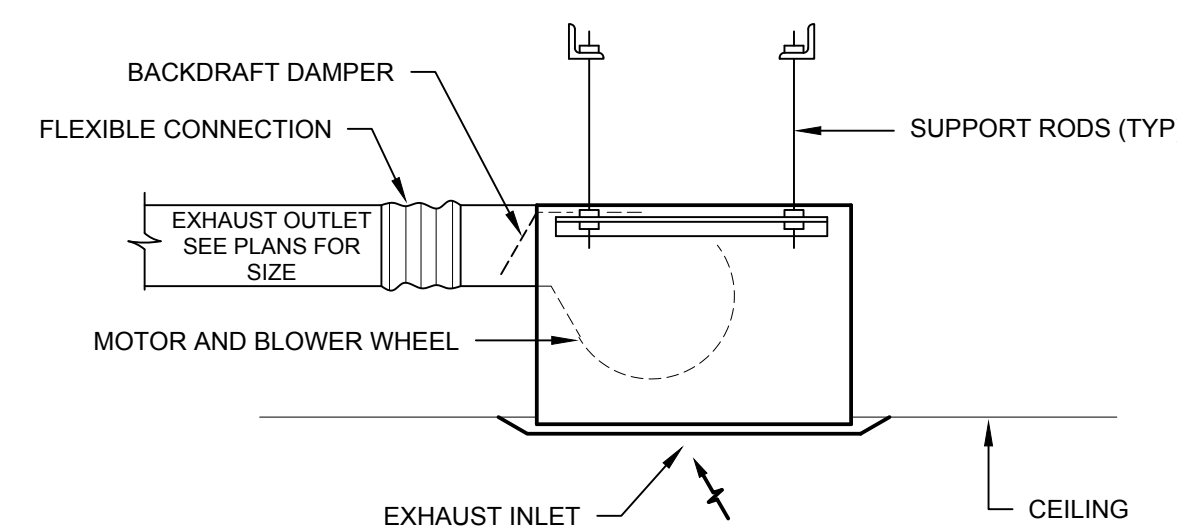
9 CURB CAP DETAIL
SCALE: NONE
BASE BID (RH-2 NOT INSTALLED)



6 ROOF EXHAUST FAN
SCALE: NONE

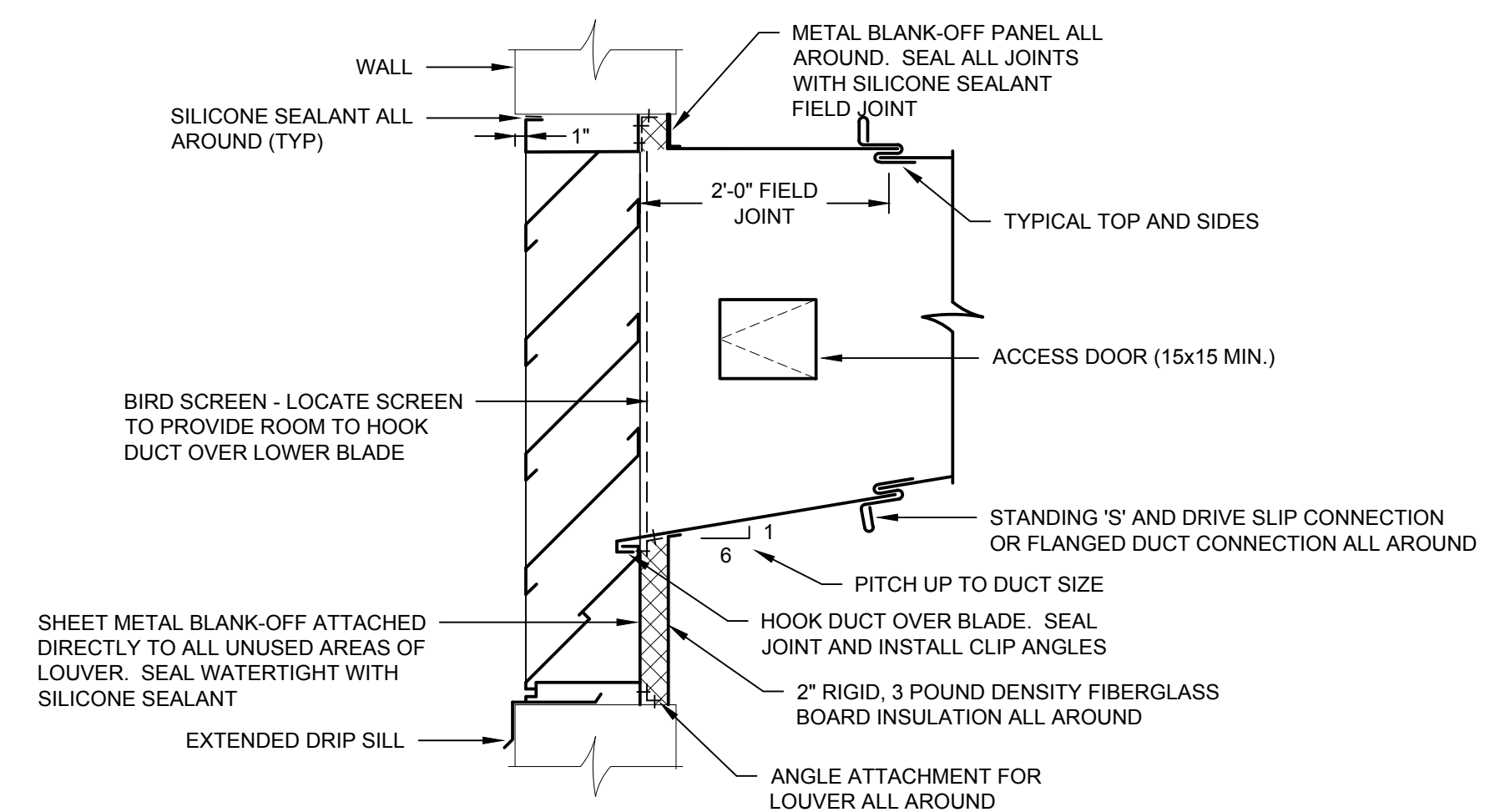


3 INTAKE HOOD
SCALE: NONE



NOTE: VERTICAL DISCHARGE WHERE INDICATED ON DRAWINGS.

7 CEILING MOUNTED EXHAUST FAN
SCALE: NONE



NOTE: ALL DUCT JOINTS, CORNERS AND SEAMS SHALL BE SEALED WITH SILICONE SEALANT OR SOLDERED LEAK TIGHT.

4 LOUVER INSTALLATION DETAIL
SCALE: NONE

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DETAILS- HVAC

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11.29.16

M900

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PROJECT

HENRY VILAS ZOO
NEW RESTROOM FACILITY
1246 VILAS PARK DRIVE
MADISON, WISCONSIN

DRAWING

SYMBOLS, ABBREVIATIONS,
RISER DIAGRAM & SHEET
INDEX

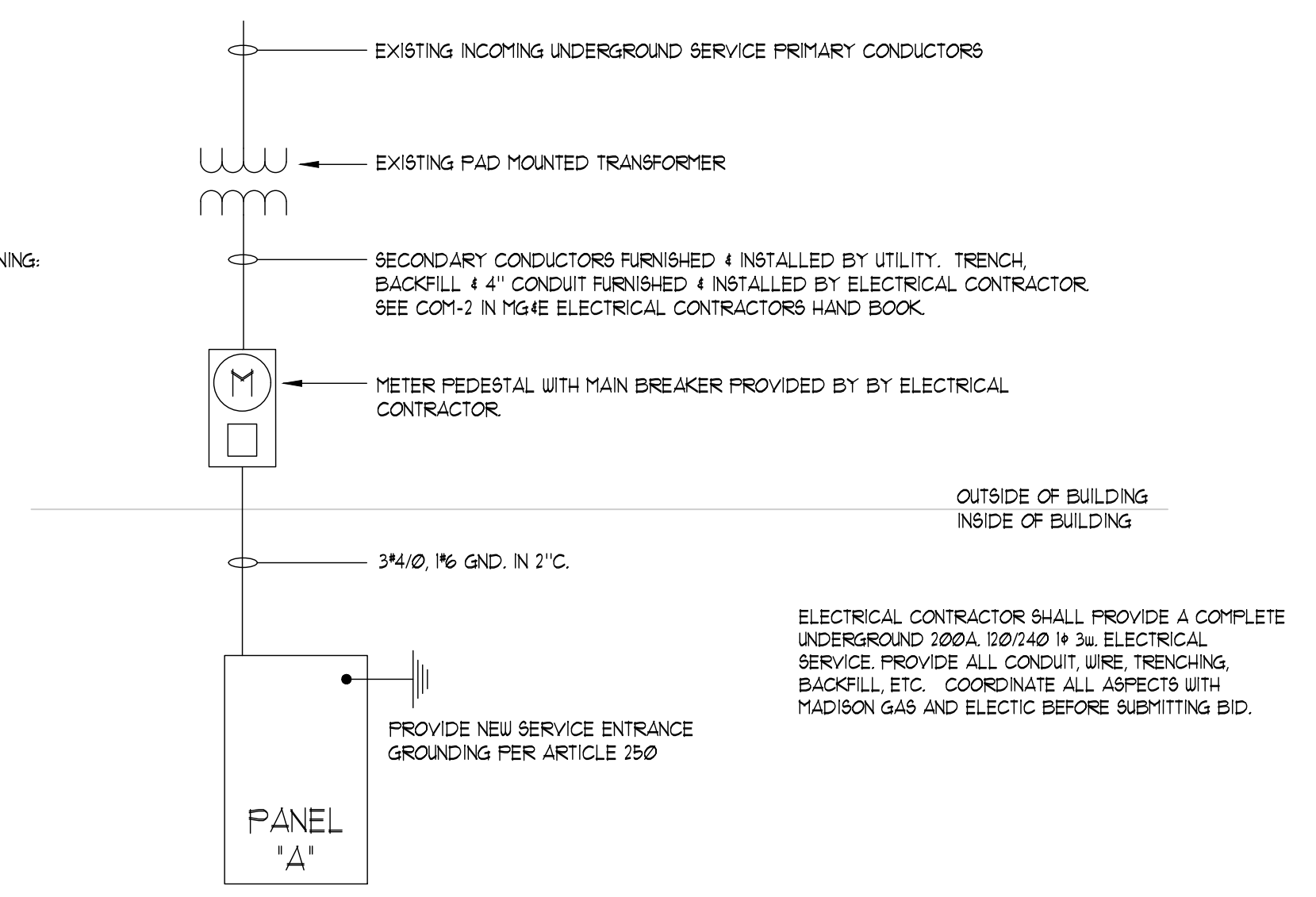
DATE
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E000



- PROVIDE A SIMILAR HINGED 12U WALL RACK CONTAINING:
- 2U FIBER OPTIC PATCH PANEL
 - 1U 24 PORT CAT6 PATCH PANEL
 - GROUND BAR (RS TO SERVICE GND.)
 - DUPLEX RECEPTACLE (CKT. A-3)

WALL MOUNTED DATA RACK
SCALE: NONE



POWER RISER - 200A 120/240 VOLT 1-PHASE, 3-WIRE
SCALE: NONE

ELECTRICAL SYMBOLS

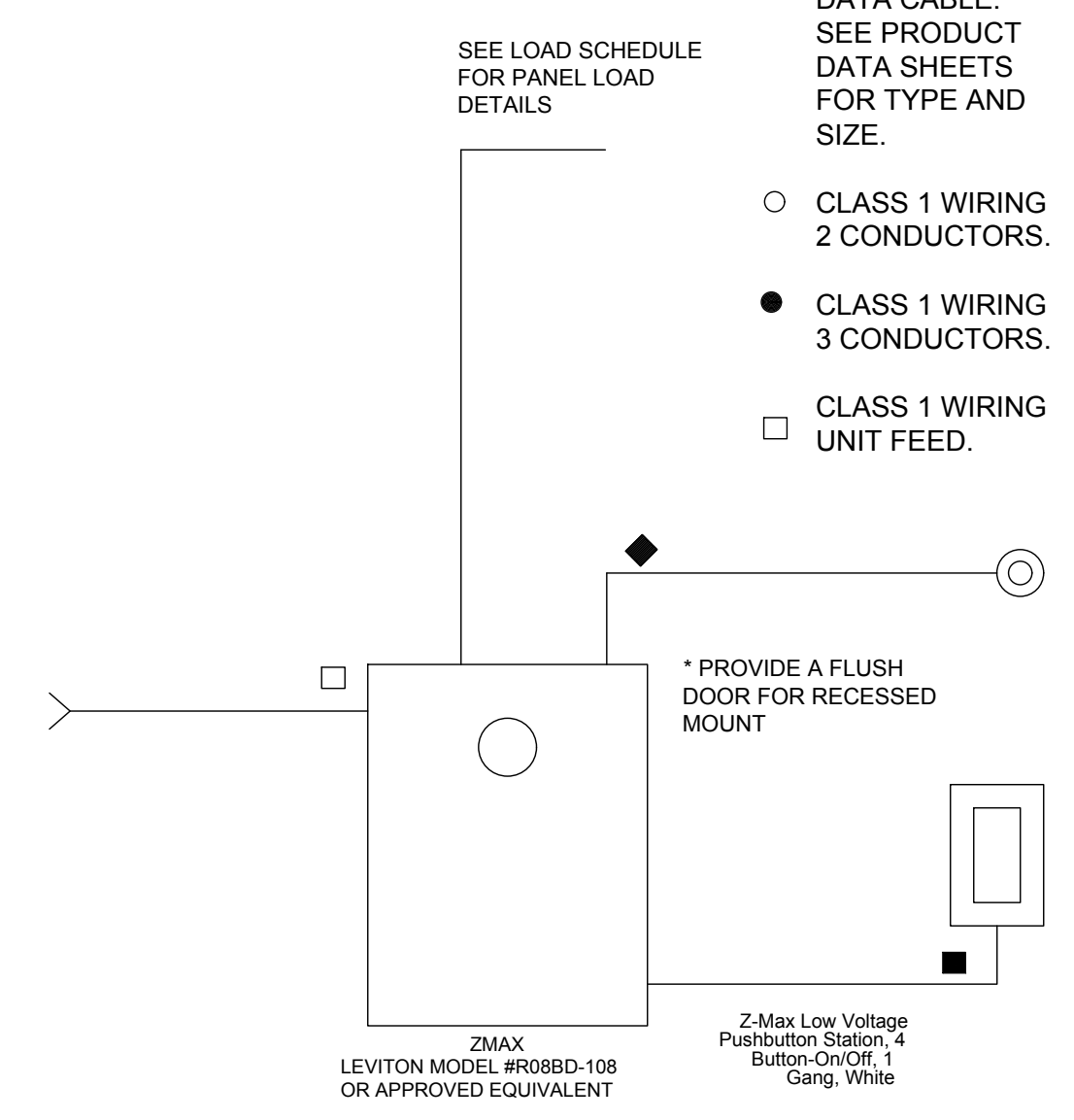
- LED UP/DOWN OR DOWN ONLY WALL BRACKET
- LED RECESSED DOWNLIGHT
- LED GROUND MOUNTED UPLIGHT
- LED WALL MOUNTED FIXTURE
- LED RECESSED UPLIGHT
- SINGLE POLE TOGGLE SWITCH (3) THREE WAY (K) KEY (OS) OCCUPANCY SENSOR MOUNT 48" ABOVE FLOOR TO TOP OF BOX.
- EMERGENCY BATTERY UNIT, WALL MOUNTED
- WALL MOUNTED EXIT SIGN WITH EMERGENCY BATTERY HEADS
- WALL MOUNTED EXIT SIGN
- OCCUPANCY SENSOR
- SWITCH AND DUPLEX RECEPTACLE IN SAME BOX - MOUNT 48" ABOVE FLOOR TO TOP OF BOX.
- DUPLEX RECEPTACLE 15" ABOVE FLOOR TO BOTTOM OF BOX OR HEIGHT AS INDICATED
- DUPLEX RECEPTACLE ON WALL NEAR WINDOW SILL MOUNT AS HIGH AS POSSIBLE WEATHERPROOF, GFI
- DOUBLE DUPLEX RECEPTACLE 15" ABOVE FLOOR TO BOTTOM OF BOX OR HEIGHT AS INDICATED
- DUPLEX RECEPTACLE HORIZONTAL ABOVE COUNTER
- DEAD FRONT GFCI
- SPECIAL OUTLET
- MOTOR
- DISCONNECT SWITCH
- JUNCTION BOX
- CONTACTOR
- TIME CLOCK
- VOICE/DATA/POB OUTLET
- HAND HOLE
- ELECTRICAL PANEL
- DETAIL NUMBER
- NOTE OR DETAIL SYMBOL
- SHEET LOCATION

ABBREVIATIONS

- AFF ABOVE FINISHED FLOOR
- AFG ABOVE FINISHED GRADE
- BFG BELOW FINIAL GRADE
- BOL BUILT-IN OVERLOAD
- C CONDUIT
- CKT CIRCUIT
- CB COMBINATION STARTER
- D DEDICATED
- DD DOUBLE DUPLEX
- EC ELECTRICAL CONTRACTOR
- EWC ELECTRIC WATER COOLER
- ER EXISTING TO BE REMOVED
- ERL EXISTING RELOCATED (NEW LOCATION)
- ETL EXISTING TO BE RELOCATED (OLD LOCATION)
- EX EXISTING TO REMAIN
- FACP FIRE ALARM CONTROL PANEL
- GC GENERAL CONTRACTOR
- GFI GROUND FAULT INTERRUPTER
- HV HEATING AND VENTILATION CONTRACTOR
- IG ISOLATED GROUND
- IR IN ROOM
- IU IN UNIT
- MAN MANUAL STARTER
- MAG MAGNETIC STARTER
- MCA MINIMUM CIRCUIT AMPACITY
- NIC NOT IN CONTRACT
- NL NIGHT LIGHT
- NJ NEAR UNIT
- PB PUSHBUTTON
- PC PLUMBING CONTRACTOR
- PW FIRE-WIRED
- RV REDUCED VOLTAGE STARTER
- RAI REMAIN AS IS
- SC SEPARATE CIRCUIT
- SS SPEED SWITCH
- SW SWITCH
- TC TIMECLOCK
- TS THERMOSTAT
- UM UNIT MANUFACTURER
- UP WEATHERPROOF

SYMBOL KEY

- △ TWO POWER CONDUCTORS AND DATA CABLE. SEE PRODUCT DATA SHEETS FOR TYPE AND SIZE.
- CLASS 1 WIRING 2 CONDUCTORS.
- CLASS 1 WIRING 3 CONDUCTORS.
- CLASS 1 WIRING UNIT FEED.
- #18 AWG MINIMUM CLASS 2 WIRING. SEE INPUT SCHEDULE FOR QTY OF CONDUCTORS.
- ◆ #18 AWG MINIMUM CLASS 2 WIRING 3 CONDUCTORS PER DEVICE.



LIGHTING CONTROL PANEL (LCP) SYSTEM
SCALE: NONE

LIGHTING CONTROL NOTES

- LC1. CONTACTORS ARE SHOWN WITH TYPICAL LOADS AND CIRCUIT ASSIGNMENTS.
- LC2. ELECTRICAL CONTRACTOR SHALL FURNISH AND INSTALL ALL WIRING CONNECTIONS, TERMINATIONS, EQUIPMENT, RELAYS, SWITCHES, CABINETS, AUXILIARY CONTACTS, ETC. FOR A COMPLETE, FULLY OPERATIONAL AND CODE COMPLIANT LIGHTING CONTROL SYSTEM.
- LC3. ALL COMPONENTS FOR THIS LIGHTING CONTROL SYSTEM SHALL BE FURNISHED AND INSTALLED BY THE ELECTRICAL CONTRACTOR.
- LC4. ALL COMPONENTS SHALL BE UL LISTED AND LABELLED.

Z-MAX CABINET CIRCUIT SCHEDULE						PANEL LOCATION:		DATA CLOSET							
120VAC, 1 PHASE						PANEL DESCRIPTION:		8 Relay Cabinet, Master CM - 120							
						CATALOG NUMBER:		R08BD-108							
						PANEL FEED:		PANEL ID: Z-MAX							
								MOUNTING: Surface							
RELAY NO.	TYPE	EM	LUMANET CHANNEL	LOAD VAC	LOAD WVA	CIRCUIT DESCRIPTION	FIXTURE TYPE	RELAY NO.	TYPE	EM	LUMANET CHANNEL	LOAD VAC	LOAD WVA	CIRCUIT DESCRIPTION	FIXTURE TYPE
1	S	N	---	120V	116	EXTERIOR LIGHTS	"C" AND "E"	2	S	N	---	120V	1022	CONCESSIONS / WOMEN'S AREA	"B"
3	S	N	---	120V	900	HOLIDAY LIGHTS	EXTERIOR RECEPTACLES	4	S	N	---	120V	1203	MEN'S AREA	"B"
5	S	N	---	120V	180	PICNIC SHELTER RECEPTACLE	EXTERIOR RECEPTACLE	6	S	N	---	120V	180	PICNIC SHELTER RECEPTACLE	EXTERIOR RECEPTACLE
7	S	N	---	120V	180	PICNIC SHELTER RECEPTACLE	EXTERIOR RECEPTACLE	8	S	N	---	120V	180	PICNIC SHELTER RECEPTACLE	EXTERIOR RECEPTACLE

NOTE:
1. TIME SCHEDULE (TIME "OFF" / TIME "ON") SHALL BE PROGRAMMED WITH OWNER'S INPUT

ELECTRICAL SHEET INDEX	
SHEET NUMBER	SHEET NAME
E000	SYMBOLS, ABBREVIATIONS & SHEET INDEX
E010	SITE PLAN - ELECTRICAL
E100	FLOOR PLANS - ELECTRICAL
E200	ELECTRICAL SCHEDULES

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GENERAL NOTES:

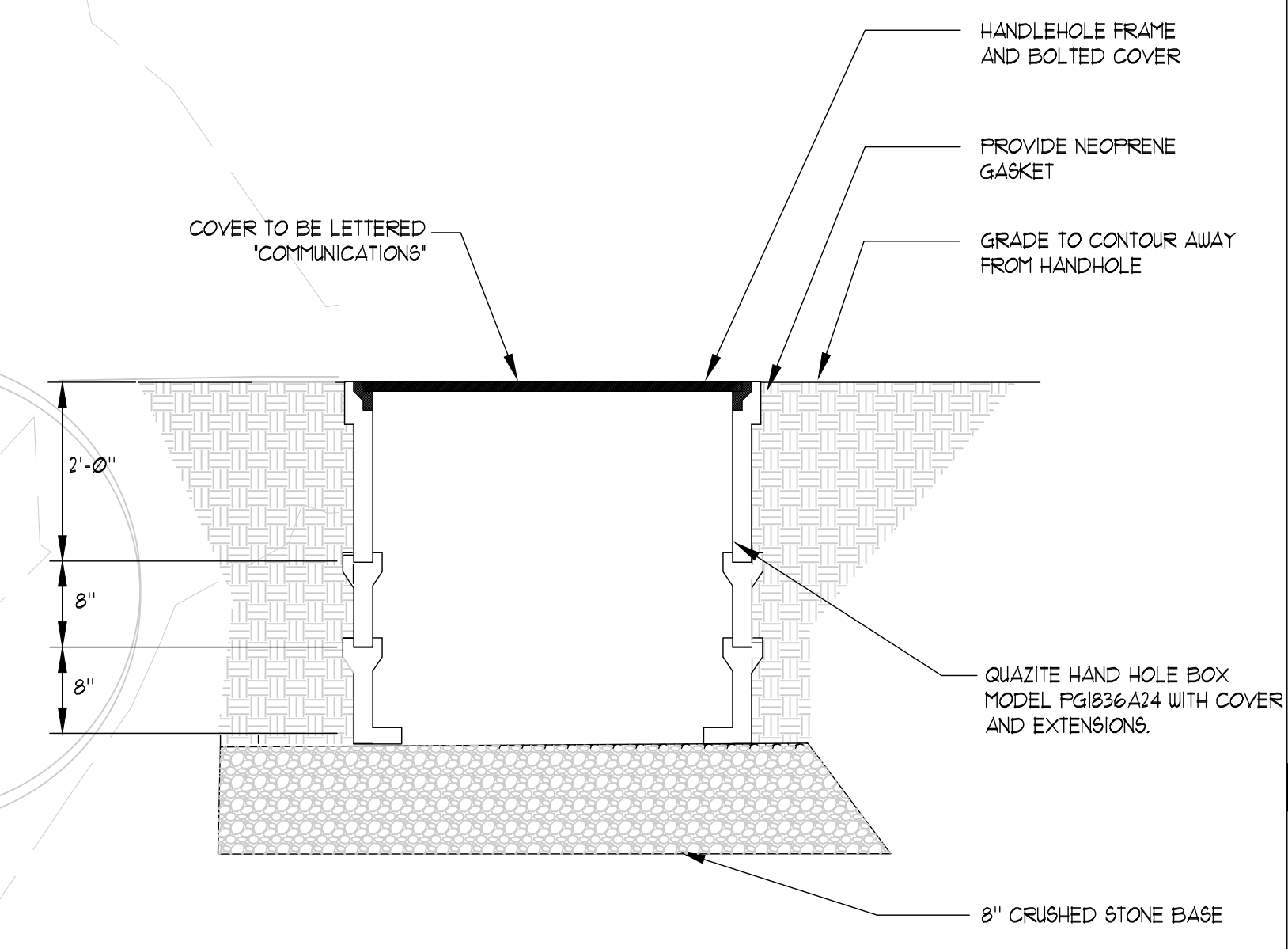
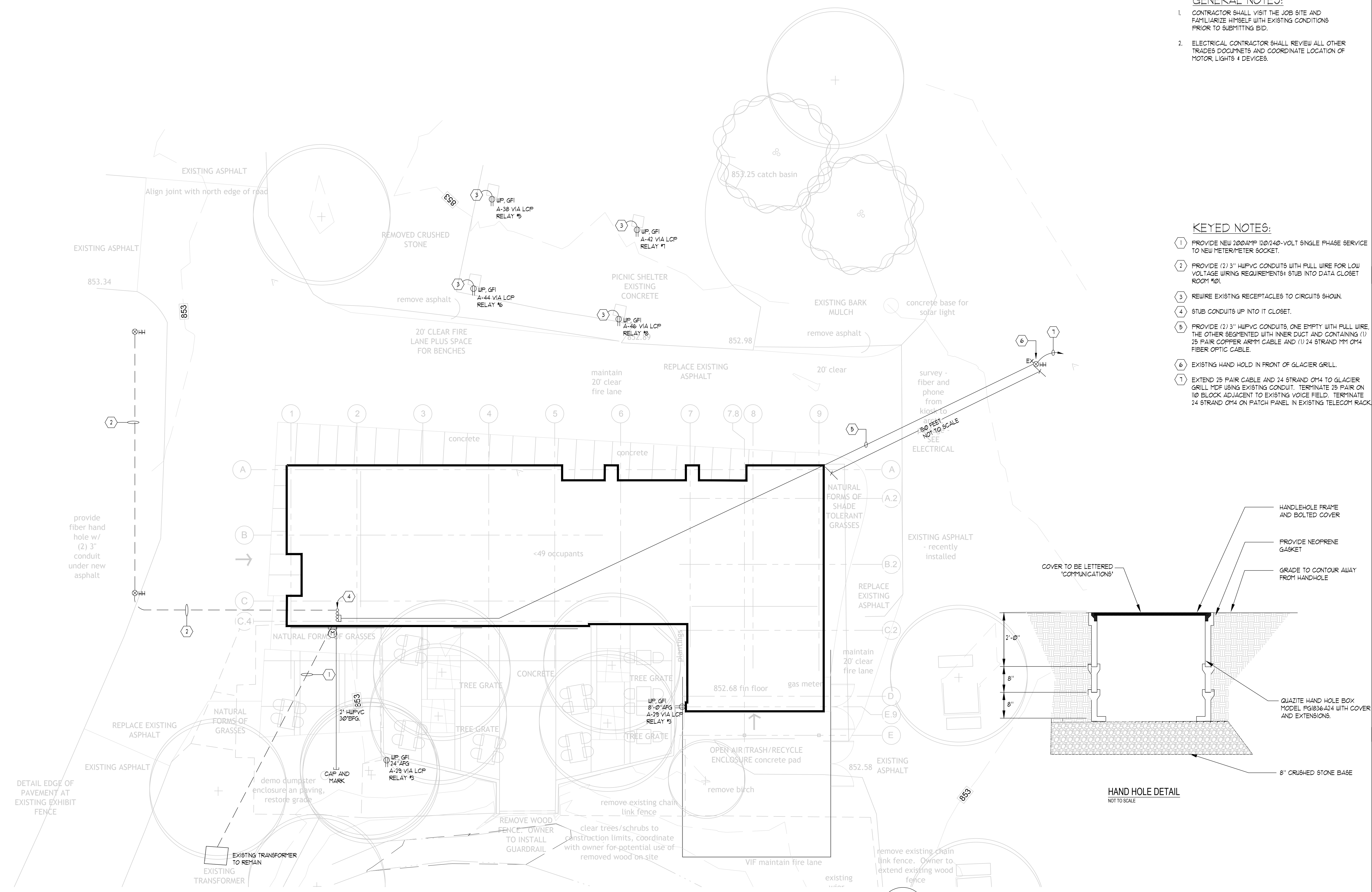
1. CONTRACTOR SHALL VISIT THE JOB SITE AND FAMILIARIZE HIMSELF WITH EXISTING CONDITIONS PRIOR TO SUBMITTING BID.
2. ELECTRICAL CONTRACTOR SHALL REVIEW ALL OTHER TRADES DOCUMENTS AND COORDINATE LOCATION OF MOTOR, LIGHTS & DEVICES.

KEYED NOTES:

1. PROVIDE NEW 200AMP 120/240-VOLT SINGLE PHASE SERVICE TO NEW METER/METER SOCKET.
2. PROVIDE (2) 3" HUPVC CONDUITS WITH FULL WIRE FOR LOW VOLTAGE WIRING REQUIREMENTS; STUB INTO DATA CLOSET ROOM #01.
3. REWIRE EXISTING RECEPTACLES TO CIRCUITS SHOWN.
4. STUB CONDUITS UP INTO IT CLOSET.
5. PROVIDE (2) 3" HUPVC CONDUITS, ONE EMPTY WITH FULL WIRE, THE OTHER SEGMENTED WITH INNER DUCT AND CONTAINING (1) 25 PAIR COPPER 48MM CABLE AND (1) 24 STRAND MM1 OM4 FIBER OPTIC CABLE.
6. EXISTING HAND HOLD IN FRONT OF GLACIER GRILL.
7. EXTEND 25 PAIR CABLE AND 24 STRAND OM4 TO GLACIER GRILL MDF USING EXISTING CONDUIT. TERMINATE 25 PAIR ON 10' BLOCK ADJACENT TO EXISTING VOICE FIELD. TERMINATE 24 STRAND OM4 ON PATCH PANEL IN EXISTING TELECOM RACK.

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1 SITE PLAN - ELECTRICAL
1/8"=1'-0"

PROJECT
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DRAWING
SITE PLAN - ELECTRICAL

DATE
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E010

GENERAL NOTES:

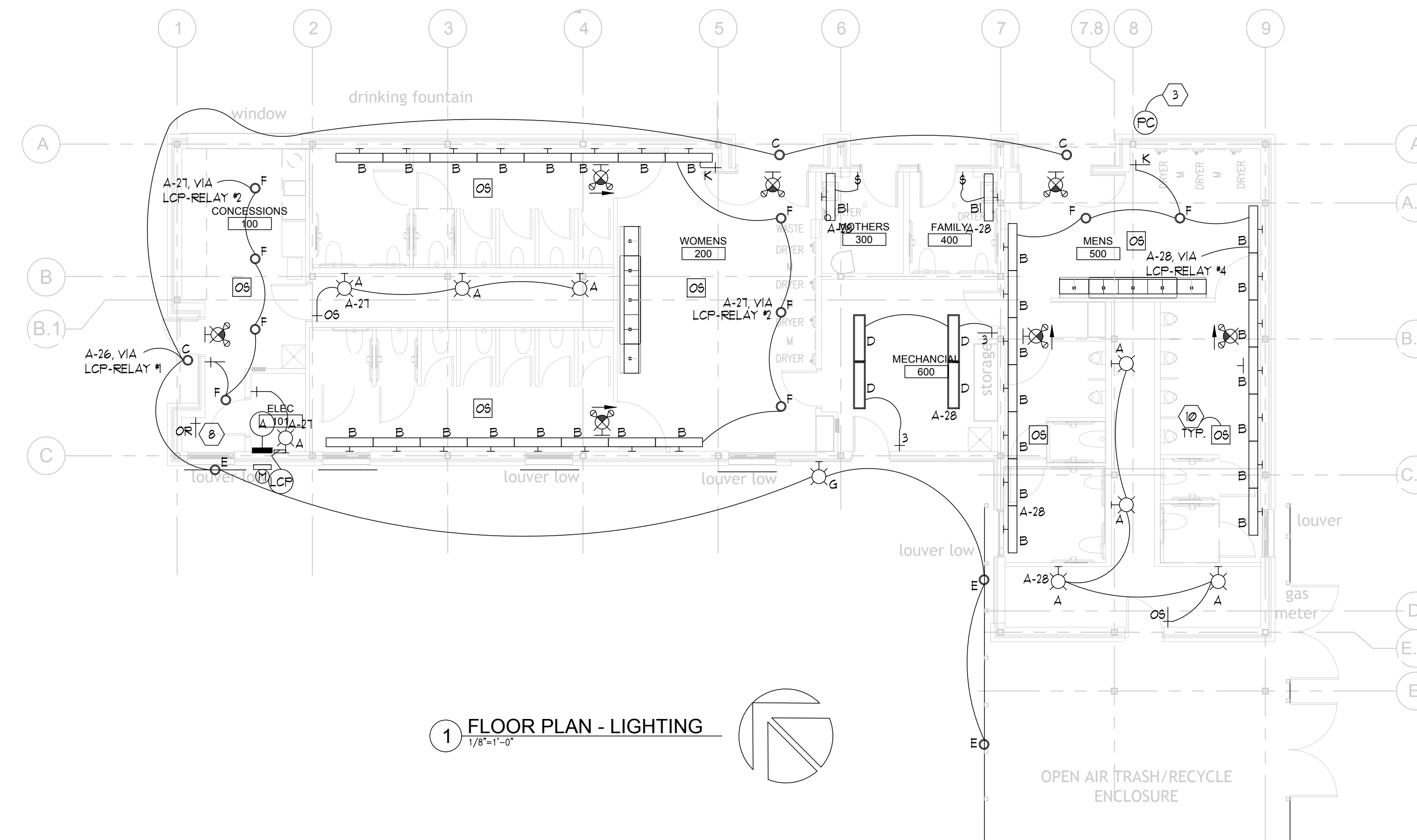
1. ALL EXIT SIGN AND EMERGENCY BATTERY UNITS SHALL BE WIRED TO THE LOCAL LIGHTING CIRCUIT AHEAD OF SWITCH SERVING AREA.
2. WHERE VOICE/DATA/FOS OUTLETS ARE SHOWN LOCATED NEXT TO A RECEPTACLE/DOUBLE DUPLEX RECEPTACLE, THAT IS TO BE MOUNTED ABOVE THE COUNTER, THE VOICE/DATA/FOS OUTLET SHALL ALSO BE MOUNTED ABOVE COUNTER AT SAME HEIGHT.
3. WHERE REQUIRED TO ELECTRIC STRIKES/MAGNETIC LOCKS (FOR SECURE DOORS), OBTAIN 120-VOLT POWER FROM THE NEAREST RECEPTACLE CIRCUIT. COORDINATE WHERE ANY 120-VOLT CIRCUITS MAY BE NEEDED WITH CONSTRUCTION MANAGER.
4. NUMBER DESIGNATIONS ADJACENT TO SPECIAL OUTLET SYMBOLS DENOTE IDENTIFIER TAG. SEE SPECIAL OUTLET SCHEDULE ON SHEET E-501.
5. ALL EXTERIOR WEATHER-PROOF RECEPTACLES MUST HAVE A "LOCKABLE" COVER-PLATE.

KEYED NOTES:

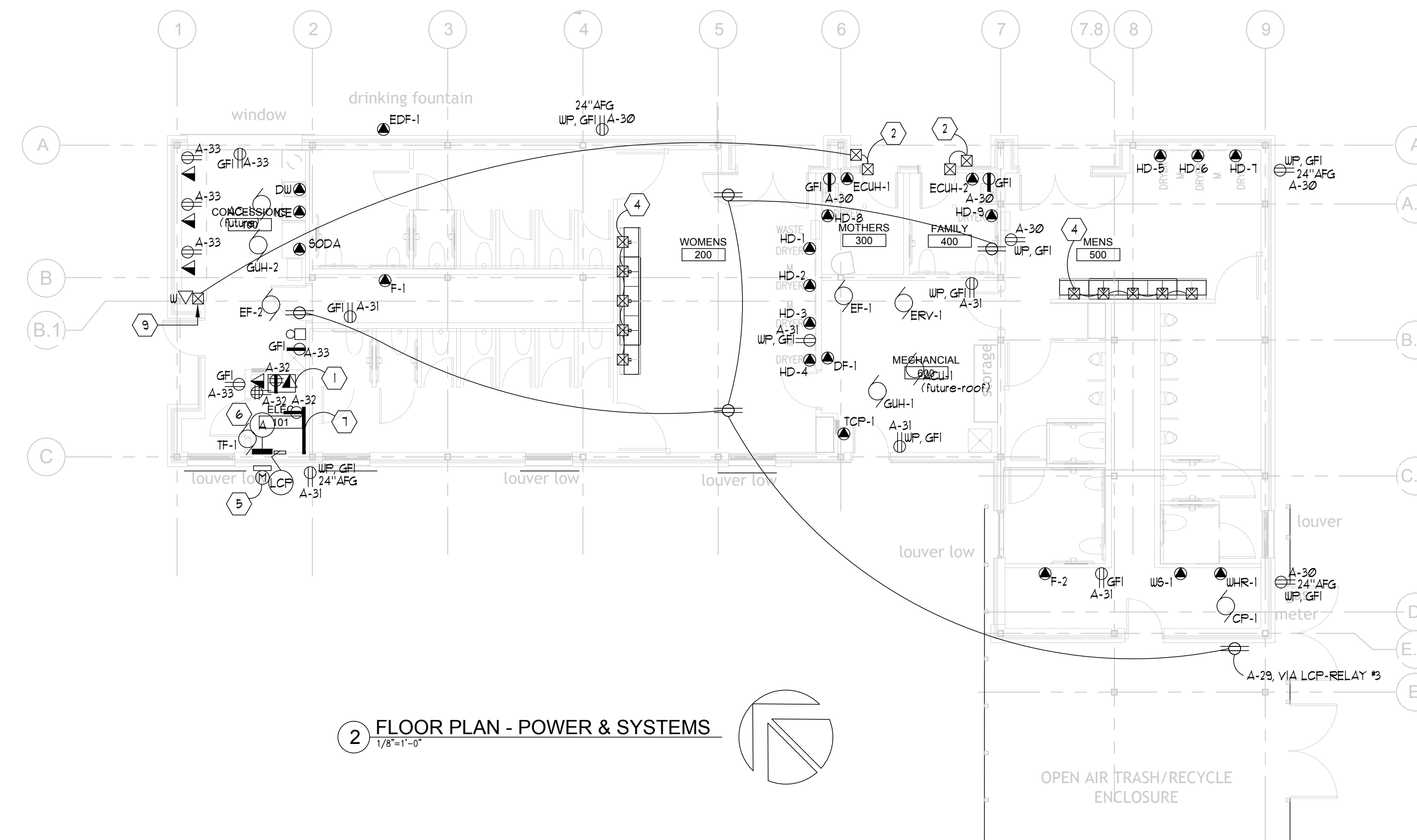
1. WALL MOUNTED DATA RACK BY OWNER-120-VOLT POWER FOR RACK BY ELECTRICAL CONTRACTOR
2. PROVIDE ROUGH-IN FOR A PUSH-BUTTON, ELECTRIC STRIKE, AND ELECTRIC RELEASE BUTTON IN CONCESSION AREA. STUD 3/4" C WITH-IN DOOR FRAME UP TO ACCESSIBLE CEILING SPACE.
3. PROVIDE SWIVEL MOUNT PHOTOCELL. LOCATE HIGH ON WALL JUST BELOW EAVE AND AIM NORTH.
4. PROVIDE JUNCTION BOXES AND CONDUIT ROUGH-IN FOR FUTURE SINK AUTO-MATIC FAUCET CONTROL.
5. COORDINATE EXACT METERING EQUIPMENT REQUIREMENTS + LOCATION WITH MADISON GAS AND ELECTRIC, CM AND ALL OTHER TRADES. MAINTAIN REQUIRED SEPARATION FROM GAS SERVICE.
6. ELECTRICAL CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR MAINTAINING ALL CODE REQUIRED CLEARANCES AND DEDICATED SPACE AROUND AND ABOUT ELECTRICAL EQUIPMENT. COORDINATE WITH ALL OTHER TRADES.
7. PROVIDE ONE (1) SINGLE SHEET OF 4'x4'x3/4" PAINTED WHITE PLYWOOD BACKBOARD. PROVIDE 1% SERVICE GROUND AND TWO (2) 4" SCHEDULE 40 HUPVC MINIMUM OF 36" BFG FROM TELEPHONE BACKBOARD TO PROPERTY LINE WHERE DESIGNATED BY TELEPHONE UTILITY. SEE SHEET E010 FOR ADDITIONAL INFORMATION.
8. PROVIDE A 4-BUTTON OVER-RIDE SWITCH AS MANUFACTURED BY LEVITON TO CONTROL CONCESSION STAND AREA, WOMEN'S RESTROOM AREA, AND MEN'S RESTROOM AREA.
9. PROVIDE ROUGH-IN FOR FUTURE RELEASE LEASE PUSH-BUTTON WITH 3/4" C. UP TO ACCESSIBLE CEILING SPACE.
10. ALL CEILING MOUNTED EXPOSED OCCUPANCY SENSORS MAY BE INSTALLED ON WALLS IN ALLOCATION TO PROVIDE MAXIMUM COVERAGE.

TELE/DATA RACEWAY REQUIREMENTS - ▽

PROVIDE 4" SQUARE JUNCTION BOX FLUSH IN WALL 15" AFF. OR AT HEIGHT INDICATED WITH 3/4" CONDUIT FOR UP TO FOUR (4) CAT. 6 CABLES OR 1" CONDUIT FOR UP TO SIX (6) CAT. 6 CABLES UP TO ACCESSIBLE CEILING SPACE. PROVIDE SINGLE GANG PLASTER RING. VOICE/DATA/FOS CABLING TO BE PULLED BY ELECTRICAL CONTRACTOR.
* BENDING RADIUS IS 125".



1 FLOOR PLAN - LIGHTING
1/8"=1'-0"



2 FLOOR PLAN - POWER & SYSTEMS
1/8"=1'-0"

SPECIAL PURPOSE OUTLET SCHEDULE													
TAG	DRIVING	LOC.	FEED FROM		BREAKER		BRANCH WIRING			POWER		SEE	NOTE
			PANEL	CIRCUIT	SIZE	POLE	NO	SIZE	COND.	VOLT	PH		
HD-1	HAND DRYER	#200	A	1	20	1	2	12	1/2"	120	1	1450W	
HD-2	HAND DRYER	#200	A	3	20	1	2	12	1/2"	120	1	1450W	
HD-3	HAND DRYER	#200	A	5	20	1	2	12	1/2"	120	1	1450W	
HD-4	HAND DRYER	#200	A	7	20	1	2	12	1/2"	120	1	1450W	
HD-5	HAND DRYER	#500	A	9	20	1	2	12	1/2"	120	1	1450W	
HD-6	HAND DRYER	#500	A	11	20	1	2	12	1/2"	120	1	1450W	
HD-7	HAND DRYER	#500	A	13	20	1	2	12	1/2"	120	1	1450W	
HD-8	HAND DRYER	#300	A	39	20	1	2	12	1/2"	120	1	1450W	
HD-9	HAND DRYER	#400	A	41	20	1	2	12	1/2"	120	1	1450W	
EDF-1	ELECTRIC DRINKING FOUNTAIN	BLDG	A	15	15	1	2	12	1/2"	120	1	200W	
ECUH-1	ELECTRIC CABINET UNIT HEATER - 1	#300	A	2, 4	25	2	2	10	3/4"	240	1	4000W	
ECUH-2	ELECTRIC CABINET UNIT HEATER - 2	#400	A	6, 8	25	2	2	10	3/4"	240	1	4000W	
DF-1	DUCT FURNACE - 1	#600	A	10	15	1	2	12	1/2"	120	1	VERIFY	1
F-1	FURNACE - 1	WOMEN'S MECH	A	12	15	1	2	12	1/2"	120	1	VERIFY	
F-2	FURNACE - 2	MEN'S MECH	A	14	15	1	2	12	1/2"	120	1	VERIFY	
TCP-1	TEMPERATURE CONTROL PANEL - 1	MECH ROOM	A	16	15	1	2	12	1/2"	120	1	VERIFY	
WS-1	WATER SOFTENER - 1	MEN'S MECH	A	18	15	1	2	12	1/2"	120	1	VERIFY	2
WHR-1	DOMESTIC WATER HEATER - 1	MEN'S MECH	A	20	15	1	2	12	1/2"	120	1	VERIFY	2
DW	DIPPING WELL	#100	A	35	20	1	2	12	1/2"	120	1	VERIFY	2
ICE	ICE CREAM MACHINE	#100	A	36	20	1	2	12	1/2"	120	1	VERIFY	2
SODA	SODA MACHINE	#100	A	37	20	1	2	12	1/2"	120	1	VERIFY	2

- NOTES:
1. DISCONNECT SWITCH FURNISHED, INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR
2. ELECTRICAL CONTRACTOR SHALL PROVIDE A GFI DUPLEX REEPTACLE

LIGHT FIXTURE SCHEDULE										
TAG	NO	LAMP DATA		DESCRIPTION	LIGHTING FIXTURE		MOUNT	CEILING TYPE	VOLT	SEE NOTE
		TYPE	MAKE		CATALOG NO					
A	-	19-WATTS / 3500K		WALL GLOBE & GUARD	HUBBELL LIGHTING	VW-1A0X-1-VBLU15-VCG-15	WALL	-	120	2
B	-	49-WATTS / 3000 LUMENS / 3500K		LINEAR UP/DOWN WALL LUMINAIRE	VISA LIGHTING	CV1704-LNW3900-WHITE	WALL	-	120	1
B1	-	25-WATTS / 2000 LUMENS / 3500K		LINEAR UP/DOWN WALL LUMINAIRE - DIMMING	VISA LIGHTING	CV1704-LNW2000-WHITE	WALL	-	120	2, 4
C	-	19-WATTS / 1600 LUMENS / 4000K		3.5" DIA RECESSED DOWNLIGHT WITH EMERGENCY BACK-UP	FOCAL POINT	FLC3D-RO-1500L-120-LD1-EMR-LC3-RO-1500L-40K-DNS-WFL-CD-HP	RECESSED	-	120	
D	-	28-WATTS / 3095 LUMENS / 3500K		LINEAR CEILING LUMINAIRE	LITHONIA LIGHTING	WL4-3L-MVOLT-EZ1-LP835	CEILING	-	120	
E	-	7-WATTS / 4000K		RECESSED LED MINI FLOOD LIGHT	B-K LIGHTING	S-CD-VS-LED-466-WFL-MAC	RECESSED	-	120	5
F	-	16-WATTS / 1600 LUMENS / 3500K		4" DIA RECESSED LED DOWNLIGHT	LIGHTFOUR	CA-R-N-120 / CAL-154-35-M-Z10-U / CA-R-0L-CC-WHITE	RECESSED	-	120	
G	-	5-WATTS / 4000K		LED LOUVERED STEP LIGHT	B-K LIGHTING	S-SSL-LED-4102-A9-MAC-C	RECESSED	-	120	5
X	-	LED		EXIT LIGHT WITH EMERGENCY BATTERY HEADS	LITHONIA LIGHTING	LH2M-LED-W-G-HO-SD	WALL	-	120	3
EBU	-	LED		EMERGENCY BATTERY HEADS	LITHONIA LIGHTING	EM2-LED-W-HO-SD	WALL	-	120	3

- NOTES:
1. INSTALL JUNCTION BOX AT 9'-0" AFF
2. INSTALL JUNCTION BOX AT 8'-0" AFF
3. UNIT SHALL BE PROVIDED WITH 90-MINUTE BACK-UP BATTERY POWER PER CODE
4. PROVIDE A 0-10-VOLT DIMMER SWITCH AS MEETING MANUFACTURE'S RECOMMENDATION
5. PROVIDE REMOTE TRANSFORMER LOCATED IN #101

PANEL A																
200 AMPS MLO 240Y/120V VOLT 1 PHASE 3 WIRE SURFACE MOUNTING																
BREAKER	AMPS	POLES	DESCRIPTION	Load Category	CIRCUIT		PHASE LOADS		CIRCUIT		Load Category	DESCRIPTION	BREAKER			
					WATTS	#	A	B	#	WATTS			AMPS	POLES		
20	1	1	SPECIAL OUTLET #HD-1	R	1450	1	3450		2	2000	H	SPECIAL OUTLET #ECUH-1	25	2		
20	1	1	SPECIAL OUTLET #HD-2	R	1450	3	3450	3450	4	2000	H	SPECIAL OUTLET #ECUH-1	-	-		
20	1	1	SPECIAL OUTLET #HD-3	R	1450	5	3450		6	2000	H	SPECIAL OUTLET #ECUH-2	25	2		
20	1	1	SPECIAL OUTLET #HD-4	R	1450	7		3450	8	2000	H	SPECIAL OUTLET #ECUH-2	-	-		
20	1	1	SPECIAL OUTLET #HD-5	R	1450	9	1950		10	500	H	SPECIAL OUTLET #DF-1	15	1		
20	1	1	SPECIAL OUTLET #HD-6	R	1450	11		2700	12	1250	H	SPECIAL OUTLET #F-1	15	1		
20	1	1	SPECIAL OUTLET #HD-7	R	1450	13	2700		14	1250	H	SPECIAL OUTLET #F-2	15	1		
20	1	1	SPECIAL OUTLET #EDF-1	R	200	15		700	16	500	H	SPECIAL OUTLET #TCP-1	15	1		
45	2	2	MOTOR ERV-1	A	4824	17	5324		18	500	H	SPECIAL OUTLET #WS-1	15	1		
-	-	-	MOTOR ERV-1	A	4824	19		6074	20	1250	H	SPECIAL OUTLET #WHR-1	15	1		
30	1	1	MOTOR EF-1	V	1920	21	4800		22	2880	A	(SPARE) MOTOR ACU-1 / AC-1	40	2		
20	1	1	MOTORS TF-1 / GUH-1 / GUH-2	V	511	23		3391	24	2880	A	(SPARE) MOTOR ACU-1 / AC-1	-	-		
20	1	1	MOTOR CP-1	R	250	25	366		26	116	L	LIGHTS - EXTERIOR	20	1		
20	1	1	LIGHTS - INTERIOR	L	1203	27		2225	28	1022	L	LIGHTS - INTERIOR	20	1		
20	1	1	RECEPTACLES - 5 (HOLIDAY)	L	500	29	1580		30	1080	R	RECEPTACLES - 6	20	1		
20	1	1	RECEPTACLES - 6	R	1080	31		1980	32	900	R	RECEPTACLES - 5	20	1		
20	1	1	RECEPTACLES - 6	R	1080	33	2080		34	1000	R	RECEPTACLES - 2	20	1		
20	1	1	SPECIAL OUTLET #DOW	R	1200	35		2450	36	1250	R	SPECIAL OUTLET #C	20	1		
20	1	1	SPECIAL OUTLET #SODA	R	1250	37	2330		38	1080	R	RECEPTACLE - PICNIC SHELTER	20	1		
20	1	1	SPECIAL OUTLET #HD-8	R	1450	39		1585	40	135	V	MOTOR EF-2	20	1		
20	1	1	SPECIAL OUTLET #HD-9	R	1450	41	1630		42	180	R	RECEPTACLE - PICNIC SHELTER	20	1		
20	1	1	SPARE			43			44	180	R	RECEPTACLE - PICNIC SHELTER	20	1		
20	1	1	SPARE			45	180		46	180	R	RECEPTACLE - PICNIC SHELTER	20	1		
20	1	1	SPARE			47		0	48			SPARE	20	1		
20	1	1	SPARE			49	0		50			SPARE	20	1		
20	1	1	SPARE			51		0	52			SPARE	20	1		
20	1	1	SPARE			53	0		54			SPARE	20	1		
20	1	1	SPARE			55		0	56			SPARE	20	1		
100	2	2	EXISTING TENT SERVICE	E	57	0			58			SPARE	20	1		
-	-	-	EXISTING TENT SERVICE	E	59		0	60				SPARE	20	1		
										29840	28185	PANEL TOTAL LOADS =			58025 WATTS	241.771 AMPS

- NOTES:
1) SHARED NEUTRALS ARE NOT ACCEPTABLE THROUGHOUT THIS PROJECT. EACH BREAKER MUST HAVE A SEPARATE NEUTRAL CONDUCTOR FOR EACH CIRCUIT.
2) GFI CIRCUIT BREAKERS MUST BE USED FOR THE CONCESSION AREA
3) CIRCUIT BREAKER #22 / #24 ARE ALTERNATE BID #1

MOTOR WIRING SCHEDULE																							
TAG	DRIVING	LOC.	POWER			FEED FROM		BREAKER		BRANCH WIRING			STARTER				DISCONNECT				SEE NOTE		
			HP	VOLT	PH	PANEL	CIRCUIT	SIZE	POLE	NO	SIZE	COND.	FURN.	INST.	WIRED	LOC.	TYPE	FURN.	INST.	WIRED		LOC.	TYPE
ERV-1	ENERGY RECOVERY VENTILATOR - 1	#600	40.2MCA	240	1	A	17, 19	45	2	2	6	3/4"				IU		EC	EC	EC	NU		
EF-1	EXHAUST FAN - 1	#600	1	120	1	A	21	30	1	2	10	3/4"				IU		EC	EC	EC	NU		
EF-2	EXHAUST FAN - 2	#100	135W	120	1	A	21	20	1	2	12	1/2"				IU		EC	EC	EC	NU	3	
TF-1	TRANSFER FAN - 1	#101	55-WATTS	120	1	A	23	20	1	2	12	1/2"				IU		EC	EC	EC	NU	1	
CP-1	DOMESTIC WATER CIRCULATING PUMP	MEN'S MECH ROOM	2MCA	120	1	A	25	20	1	2	12	1/2"				IU		EC	EC	EC	NU		
GUH-1	GAS UNIT HEATER - 1	#600	1.9MCA	120	1	A	23	20	1	2	12	1/2"				IU		EC	EC	EC	NU		
GUH-2	GAS UNIT HEATER - 2	#100	1.9MCA	120	1	A	23	20	1	2	12	1/2"				IU		EC	EC	EC	NU		
ACU-1	CONCESSION COOLING (FUTURE)	ROOF	24MCA	240	1	A	22, 24	40	2	2	6	3/4"				IU		EC	EC	EC	NU	2	
AC-1	CONCESSION COOLING (FUTURE)	#100	-	-	-	A	22, 24	-	-	2	6	3/4"				IU		EC	EC	EC	NU	2	

- ABBREVIATIONS:
 2SP = 2 SPEED MAGNETIC STARTER
 BOL = BUILT-IN OVERLOAD
 CS = COMBINATION STARTER
 EC = ELECTRICAL CONTRACTOR
 ECP = ELEVATOR CONTROL PANEL
 EV = ELEVATOR CONTRACTOR
 FD = FUSIBLE DISCONNECT
 HV = HVAC CONTRACTOR
 IU = IN UNIT
 LMRS = LOCKABLE MOTOR RATED SWITCH
 MAN = MANUAL STARTER
 MAG = MAGNETIC STARTER
 MCC = MECHANICAL CONTRACTOR
 MCC = MOTOR CONTROL CENTER
 HOA = HAND-OFF-AUTO
 MCA = MINIMUM CIRCUIT AMPS
 MFR = MANUFACTURER
 NFD = NON-FUSIBLE DISCONNECT
 NU = NEAR UNIT
 OU = ON UNIT
 PC = PLUMBING CONTRACTOR
 PL = PILOT LIGHT
 RVS = REDUCED VOLTAGE STARTER
 TCP = TEMPERATURE CONTROL PANEL
 T-STAT = THERMOSTAT
 VFD = VARIABLE FREQUENCY DRIVE
 WP = WEATHERPROOF
 STST = START/STOP

- NOTES:
1. HEATING CONTRACTOR SHALL PROVIDE LINE VOLTAGE REVERSE ACTING THERMOSTAT. ELECTRICAL CONTRACTOR TO WIRE THERMOSTAT AND FAN
2. ALTERNATE BID #1
3. FAN CONTROLLED BY ROOMS LIGHT SWITCH/OCCUPANCY SENSOR