

RFB NO. 318037



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. 318037 PRINTING AND SERVICES REMODEL CITY COUNTY BUILDING 210 MARTIN LUTHER KING JR. BLVD MADISON, WISCONSIN

Due Date / Time: **TUESDAY, OCTOBER 30, 2018 / 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:

RYAN SHORE, PROJECT MANAGER
TELEPHONE NO.: 608/266-4475
FAX NO.: 608/267-1533
E-MAIL: SHORE@COUNTYOFDANE.COM

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LEGAL NOTICE

INVITATION TO BID

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

2:00 P.M., TUESDAY, OCTOBER 30, 2018

RFB NO. 318037

PRINTING AND SERVICES REMODEL

CITY COUNTY BUILDING

210 MARTIN LUTHER KING JR. BLVD

MADISON, WI

Dane County is inviting Bids for construction services for interior remodeling of the Dane County Printing and Services Department at City County Building.

Request for Bids document may be obtained after **2:00 p.m. on Tuesday, September 18, 2018** by downloading it from bids-pwht.countyofdane.com. Please call Ryan Shore, Project Manager, at 608/266-4475, or our office at 608/266-4018, for any questions or additional information.

All Bidders must be pre-qualified as a Best Value Contractor before award of Contract. Complete Pre-qualification Application for Contractors at countyofdane.com/pwht/BVC_Application.aspx or obtain one by calling 608/266-4029.

A pre-bid tour will be held Wednesday, September 26, 2018 at 10:00 a.m. at the City County Building, starting in Room GR113. Bidders are strongly encouraged to attend this tour.

PUBLISH: SEPTEMBER 18 & SEPTEMBER 25, 2018 - WISCONSIN STATE JOURNAL
SEPTEMBER 18 & SEPTEMBER 25, 2018 - 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

INSTRUCTIONS TO BIDDERS

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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 on September 26, 2018 at 10:00 AM at City County Building, 210 Martin Luther King Jr. Blvd, Madison, in Room GR113. Attendance by all bidders is optional, however bidders and subcontractors are strongly encouraged to attend.
- D. Visits at other times can also be arranged. Coordinate site access activities with Amanda DePagter & Todd Draper, 608/266-4350.
- E. 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. 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 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. Not Applicable.

16. INFORMATIONAL BIDS

- A. Not Applicable.

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

Name of Bidding Firm: _____

BID FORM

BID NO. 318037

**PROJECT: PRINTING AND SERVICES REMODEL
CITY COUNTY BUILDING**

**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:

Interior remodel of the Dane County Printing and Services Department at City County Building. 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

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

Addendum No(s). _____ through _____

Dated _____

Dane County Printing and Services must have this project completed by September 1, 2019. Assuming this Work can be started by January 14, 2019, what dates can you commence and complete this job?

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

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

(Name of Corporation, Partnership or Person submitting Bid)

Select one of the following:

1. A corporation organized and existing under the laws of the State of _____, or
2. A partnership consisting of _____, or
3. A person conducting business as _____;

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

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

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

SIGNATURE: _____
(Bid is invalid without signature)

Print Name: _____ Date: _____

Title: _____

Address: _____

Telephone No.: _____ Fax No.: _____

Email Address: _____

Contact Person: _____

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

BID CHECK LIST:

These items **must** be included with Bid:

- Bid Form Bid Bond Fair Labor Practices Certification
 Project Experience / Reference Summary

BIDDERS SHOULD BE AWARE OF THE FOLLOWING:

DANE COUNTY VENDOR REGISTRATION PROGRAM

All bidders are strongly encouraged to be a registered vendor with Dane County. Registering allows vendors an opportunity to receive notifications for RFBs & RFPs issued by the County and provides the County with up-to-date company contact information. Complete a new form or renewal online at:

danepurchasing.com/Account/Login?

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:
countyofdane.com/pwht/BVC_Application.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 25.09 is as follows:

- (1) 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 Controller 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. 318037

Authority: 2018 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 Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR provide Printing and Services Remodel, 210 Martin Luther King Jr. Blvd., Madison, WI ("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, Quote], [General Conditions of Contract, 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 _____ (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, Conditions of Contract], and to make payments on account thereof as provided in Article entitled, "Payments to Contractor" of the [General Conditions of Contract, 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 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.

7. 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.

8. 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.

9. 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: _____

Signature: _____

Name _____
and Title: _____

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

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or BROKER:

OWNER'S REPRESENTATIVE:

(Architect, Engineer or other party:)

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

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

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

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

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

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

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

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

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

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

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

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

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

- .1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
- .2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and
- .3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

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

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

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

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

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

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

§ 14 Definitions

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

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

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

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

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

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

§ 16 Modifications to this bond are as follows:

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.

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 times 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.
- 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. Use "Dane County, Wisconsin Contractor Wage Affidavit" form 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. Not Used.

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. Not Used.

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 \$1,000,000 or less. Therefore, if project completed value is more than \$1,000,000, 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 Architect / Engineer 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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AIA Document G703™ – 1992

Continuation Sheet

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

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

| A 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> |
|---|--------------------------|----------------------|--|------------------|---|---|--|---|
| | | | D FROM PREVIOUS APPLICATION <i>(D-E)</i> | E THIS PERIOD | | | | |
| <p>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.</p> <p>AIA Document G703™ – 1992. Copyright © 1963, 1965, 1966, 1967, 1970, 1978, 1983 and 1992 by The American Institute of Architects. All rights reserved. WARNING: This AIA® Document is protected by U.S. Copyright Law and International Treaties. Unauthorized reproduction or distribution of this AIA® Document, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under the law. Purchasers are permitted to reproduce ten (10) copies of this document when completed. To report copyright violations of AIA Contract Documents, e-mail The American Institute of Architects' legal counsel, copyright@aia.org.</p> | | | | | | | | |

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. Lump Sum Allowances for Work
 8. Coordination
 9. Cutting and Patching
 10. Conferences
 11. Progress Meetings
 12. Job Site Administration
 13. Submittal Procedures
 14. Proposed Products List
 15. Shop Drawings
 16. Product Data
 17. Samples
 18. Manufacturers' Instructions
 19. Manufacturers' Certificates
 20. Quality Assurance / Quality Control of Installation
 21. References
 22. Interior Enclosures
 23. Protection of Installed Work
 24. Parking
 25. Staging Areas
 26. Occupancy During Construction and Conduct of Work
 27. Protection
 28. Progress Cleaning
 29. Products
 30. Transportation, Handling, Storage and Protection
 31. Product Options
 32. Substitutions
 33. Starting Systems
 34. Demonstration and Instructions
 35. Contract Closeout Procedures
 36. Final Cleaning
 37. Adjusting
 38. Operation and Maintenance Data
 39. Spare Parts and Maintenance Materials

40. As-Built and Record Drawings and Specifications

1.2 SUMMARY OF THE WORK

- A. Project Description: Perform the Work as specified and detailed in Construction Documents package. Contractor to provide construction services for the remodel of the Printing and Services office in the City-County Building
- B. Work by Owner:
 - 1. Test & removal of any asbestos containing materials.
- C. Permits: Prior to commencement of the Work, Contractor to secure any and all necessary permits for completion of the Work and facility occupancy.

1.3 CONTRACTOR USE OF PREMISES

- A. Limit use of premises to allow work by others and work by Owner.
- B. Coordinate utility outages and shutdowns with Owner.

1.4 APPLICATIONS FOR PAYMENT

- A. Submit one (1) original copies with “wet” signatures of each application on AIA G702™ and G703™ forms or approved contractors invoice form.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: Monthly.
- D. Submit Applications for Payment to Public Works Project Manager for approval & processing for payment.

1.5 CHANGE PROCEDURES

- A. 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: there are no alternates proposed for this project.

1.7 LUMP SUM ALLOWANCES FOR WORK

A. Not Applicable.

1.8 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. Refer to Drawings for recommended work sequence and duration.
- E. Contractor shall provide Public Works Project Engineer with work plan that ensures the Work will be completed within required time of completion.
- F. Public Works Project Manager may choose to photograph or videotape site or workers as the Work progresses.

1.9 CUTTING AND PATCHING

- A. Employ 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.

1.10 CONFERENCES

- A. Project shall have pre-bid conference; see Instructions to Bidders.
- B. Owner will schedule preconstruction conference after Award of Contract for all affected parties.
- C. Contractor shall submit Construction Schedule at pre-construction meeting.

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

1.11 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at minimum of one (1) per week, at time to be determined with Public Works Project Manager.
- B. Preside at meetings, record minutes, and distribute copies within two (2) business days to those affected by decisions made.
- C. Attendance at progress meetings by General Contractor, subcontractors, or their authorized representative, is mandatory.
- D. Contractors shall give verbal reports of progress on the Work, discuss schedule for upcoming period and present all conflicts, discrepancies or other difficulties for resolution.
- E. Day & time of progress meetings to be determined at pre-construction meeting.

1.12 JOB SITE ADMINISTRATION

- A. Contractor shall have project superintendent on site minimum of four (4) job appropriate no. hours per week during progress of the Work.
- B. Architect / Engineer shall have representative on site four (4) hours per week on average during progress of the Work.

1.13 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.

1.14 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.

1.15 SHOP DRAWINGS

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

1.16 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.

1.17 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.

1.18 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.

1.19 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.

1.20 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.

1.21 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.

1.22 INTERIOR ENCLOSURES

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

1.23 PROTECTION OF INSTALLED WORK

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

1.24 PARKING

- A. To be determined based on availability and need .
- B. All contractors and their employees shall cooperate with General Contractor and others in parking of vehicles to avoid interference with normal operations and construction activities.
- C. Do not obstruct existing service drives and parking lots with equipment, materials and / or vehicles. Keep accessible for Owner's use at all times.

1.25 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.

1.26 OCCUPANCY DURING CONSTRUCTION AND CONDUCT OF WORK

- A. All construction material and salvage material shall be removed from facility or secured at day's end.
- B. All contractors are expected to leave work areas in conditions; such that area can be occupied immediately upon leaving area.
- C. Smoking is prohibited on Dane County property.
- D. Owner reserves right at any time to dismiss from premises any Contractor or construction personnel that do not uphold requirements of this Section.

- E. Owner shall not be held liable for any lost time, wages, or impacts to construction schedule by any Contractor or construction personnel dismissed for failure to uphold requirements of this Section.
- F. Areas of existing facility will be occupied during period when the Work is in progress. Work may be done during normal business hours (7:00 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.
- G. 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.
- H. Contractor shall, at all times, provide approved, safe walkways and facility entrances for use by Owner, employees and public.
- I. Contractor shall provide adequate protection for all parts of facility, its contents and occupants wherever the Work under this Contract is to be performed.
- J. 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.
- K. 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.
- L. Contractor is not responsible for providing & maintaining temporary toilet facilities.

1.27 PROTECTION

- A. Contractor shall protect from damage, mechanical, electrical & plumbing equipment, walks and driveways and pay for any damage to same resulting from insufficient or improper protection.

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 maybe 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 photograph or 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.

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 two (2) bound, hard-copy operation and maintenance manuals that include all systems, materials, products, equipment, mechanical and electrical equipment and

systems supplied and installed in the Work. Provide electronic version of operation and maintenance manual also.

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 project 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 may 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 fifteen (15) business days of Bid Due date. Copy of blank WMP form is in this Section. Submittal shall include cover letter and WMP form with:

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

1.5 REUSE

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

1.6 RECYCLING

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

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

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

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

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

1.7 MATERIALS SORTING AND STORAGE ON SITE

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

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

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

1.8 LISTS OF RECYCLING FACILITIES PROCESSORS AND HAULERS

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

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

WASTE MANAGEMENT PLAN FORM



Contractor Name: _____

Address: _____

Phone No.: _____ Recycling Coordinator: _____

| MATERIAL | ESTIMATED QUANTITY | DISPOSAL METHOD (CHECK ONE) | | RECYCLING / REUSE COMPANY OR DISPOSAL SITE |
|--------------------------------------|------------------------------|-----------------------------|--------------|--|
| Salvaged & reused building materials | _____ cu. yds. _____ tons | _____ Recycled | _____ Reused | 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: _____ |
| Fluorescent Lamps | _____ cu. ft. _____ lbs. | _____ Recycled | _____ Reused | Name: _____ |
| Foam Insulation | _____ cu. ft. _____ lbs. | _____ Recycled | _____ Reused | Name: _____ |
| Carpet Padding | _____ cu. ft. _____ lbs. | _____ Recycled | _____ Reused | Name: _____ |
| Glass | _____ cu. yds. _____ tons | _____ Recycled | _____ Reused | Name: _____ |
| Other | _____ | _____ Recycled | _____ Reused | Name: _____ |

SECTION 02 41 19

SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Demolition and removal of selected portions of building or structure.
 - 2. Salvage of existing items to be reused or recycled.
- B. See Section 01 74 19 – Recycling regarding construction waste management.

1.2 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed.

1.3 SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate detailed sequence of selective demolition and removal work, with starting and ending dates for each activity, interruption of utility services, use of elevator and stairs, and locations of temporary partitions and means of egress.
- B. Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective demolition operations.
- C. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI A10.6 and NFPA 241.

- C. Predemolition Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner. Owner will remove hazardous materials under a separate contract.
- D. Storage or sale of removed items or materials on-site is not permitted.
- E. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

1.6 WARRANTY

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, preconstruction videotapes and templates.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems: Maintain services/systems indicated to remain and protect them against damage during selective demolition operations.
- B. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
 - 1. Arrange to shut off indicated utilities with utility companies.
 - 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 - 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 5. Dispose of demolished items and materials promptly.
- B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.6 CLEANING

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Loose bearing and leveling plates
4. Steel weld plates and angles for casting into concrete not specified in other Sections.
5. Miscellaneous steel trim.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.

1.2 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.3 SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.

C. Welding certificates.

1.4 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications 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 dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
 - 2. Provide allowance for trimming and fitting at site.

1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 METALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Bars (Pickets): Hot-rolled, carbon steel complying with ASTM A 29/A 29 M, Grade 1010.

- D. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- E. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- F. Stainless Steel: AISI 304.
- G. Bar Grating: NAAMM MBG 531.
- H. Castings: Either gray or malleable iron unless otherwise indicated.
 - 1. Gray Iron: ASTM A 48/A 48M, Class 30.
 - 2. Malleable Iron: ASTM A 47/A 47M.
- I. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).
- J. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.
- K. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- L. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts
- D. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- E. Anchor Bolts: ASTM F 1554, Grade 36.
- F. Eyebolts: ASTM A 489.
- G. Machine Screws: ASME B18.6.3.
- H. Lag Bolts: ASME B18.2.1.

- I. Wood Screws: Flat head, ASME B18.6.1.
- J. Plain Washers: Round, ASME B18.22.1.
- K. Lock Washers: Helical, spring type, ASME B18.21.1.
- L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
 - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 - 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Galvanized Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
- E. Non-shrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
- F. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, non-corrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent

construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts if units are installed after concrete is placed.

C. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

2.7 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.

B. Galvanize loose steel lintels located in exterior walls.

C. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

2.8 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Prime shelf angles located in exterior walls with zinc-rich primer.

D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Prime plates with zinc-rich primer.

2.10 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Prime exterior miscellaneous steel trim with zinc-rich primer.

2.12 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

2.13 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- B. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
- C. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123 M for other steel and iron products.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 - 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- C. Install pipe columns on concrete footings with grouted base plates. Position and grout column base plates as specified in "Installing Bearing and Leveling Plates" Article.
 - 1. Grout base plates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use non-shrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use non-shrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

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SECTION 07 05 33

FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior identification markings for fire and smoke assemblies per IBC 703.6.

1.2 REFERENCE STANDARDS

A. Wisconsin Commercial Building (2009 IBC).

1.3 SUBMITTALS

A. Section 01 3300 – Submittal Procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

PART 2 - PRODUCTS

2.1 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of IBC.

B. IBC 703.6 Marking and Identification. Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:

1. Be located in accessible concealed floor, floor-ceiling or attic spaces;
2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition.
3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.
 - a. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify all substrate surfaces are ready to receive work.

3.2 INSTALLATION

- A. Locate markings as required by IBC.
- B. Install neatly, with horizontal edges level.
- C. Protect from damage until Substantial Completion; repair or replace damaged markings.

END OF SECTION

SECTION 07 84 13

PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, penetrations in smoke barriers, and penetrations in horizontal assemblies, including both empty openings and openings containing penetrating items.

1.2 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
 - a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Penetrations located in construction containing fire-protection-rated openings.
 - d. Penetrating items larger than 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
 - 3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings indicated at both ambient temperatures and 400 deg F.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.

3. For penetrations involving insulated piping, provide through-penetration firestop systems that do not require removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition indicated.
 1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
 2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For Installer.
- D. Product Certificates: Signed by manufacturers of through-penetration firestop system products certifying that products furnished comply with requirements.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Installation Responsibility: Assign installation of penetration firestopping and fire-resistive joint systems in Project to a single qualified installer.
- C. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, from a single manufacturer.
- D. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Penetration firestopping tests shall be performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 2. Through-penetration firestop systems are identical to those tested per ASTM E 814. Provide rated systems bearing classification marking of qualified testing and inspecting agency.
- E. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- F. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.
- G. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels, identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of opening and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:
 - 1. Grace, W. R. & Co.
 - 2. Johns Manville.
 - 3. 3M; Fire Protection Products Division.
 - 4. Tremco; Sealant/Weatherproofing Division.
 - 5. USG Corporation.
 - 6. Approved Equal.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items, if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 2. T-Rating: At least 1 hour, but not less than the fire-resistance rating of construction penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with rating determined by UL 1479.
 - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Penetration firestopping sealants and sealant primers shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.

- G. Low-Emitting Materials: Penetration firestopping sealants and sealant primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- H. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated

2.3 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with written recommendations of firestop system manufacturer and the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items, foreign materials that could interfere with adhesion of through-penetration firestop systems.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would

otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOPPING SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with through-penetration firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.
- D. Identification: Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so that labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 - 1. The words "Warning – Penetration Firestopping – Do Not Disturb. Notify Building Management of Any Damage."
 - 2. Contractor's name, address, and phone number.
 - 3. Designation of applicable testing and inspecting agency.
 - 4. Date of installation.
 - 5. Manufacturer's name.
 - 6. Installer's name.

3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage an independent inspecting agency to inspect penetration through-firestop systems and to prepare test reports. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
 - 1. Inspecting agency will state in each report whether inspected through-penetration firestop systems comply with, or deviate from, requirements.

- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and installations comply with requirements.

3.5 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce through-penetration firestop systems complying with specified requirements.

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
 - 1. Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 2. Interior joints in horizontal traffic surfaces.
 - 3. Acoustical joint sealants.
 - 4. Refer to Drawings and Joint Sealant Schedule at the end of this Section for specific joint locations and sealant types.
- B. Related Sections include the following:
 - 1. Division 07 Section "Penetration Firestopping."

1.2 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for initial selection: For each type of sealant provide samples of full range of manufacturers available colors.
- C. Samples: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. 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.
- E. Product Test Reports: From a qualified testing agency indicating sealants comply with requirements, based on comprehensive testing of current product formulations.
- F. Warranties: Special warranties listed in this Section.

1.4 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced Installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. **Source Limitations:** Obtain each type of joint sealant through one source from a single manufacturer.
- C. **Preinstallation Conference:** Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project site in original, unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. **Environmental Limitations:** Do not proceed with installation or joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4. deg C).
 - 2. When joint substrates are wet.
- B. **Joint-Width Conditions:** Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. **Joint-Substrate Conditions:** Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 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 or 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 sealer manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance or other requirements specified in this Section within specified warranty period.
 - 1. **Warranty Period:** Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.3 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - 1. Architectural Sealants: 250 g/L.
 - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
 - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
 - 1. Suitability for Immersion in Liquids: Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provides products that comply with 21 CFR 177.2600.
- F. Color of Exposed Joint Sealants: Sealant, generally, shall be the color of the adjacent material which lies in the same plane as the sealant. Verify all colors with Architect prior to installation.

2.4 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

- B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.
- D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food; provide products that comply with 21 CFR 177.2600.
- E. One part polyurethane, two parts polymer, or one part low-modulus silicone sealants at all interior joints, except horizontal surfaces, in which case acceptable products are as follows:
 - 1. Products:
 - a. Sika "Sikaflex-1a".
 - b. Sonneborn "Sololastic NP I or NP II".
 - c. Tremco Manufacturing Company "Dymeric" or "Dymonic".
 - d. Pecora "Dynatrol II".
 - e. G.E. "Silpruf".
 - f. Dow Corning "790".

2.5 SILICONE JOINT SEALANTS

- A. Mildew-Resistant Silicone Joint Sealant: ASTM C 920.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Dow Corning Corporation.
 - c. GE Advanced Materials - Silicones.
 - d. May National Associates, Inc.
 - e. Pecora Corporation.
 - f. Polymeric Systems, Inc.
 - g. Schnee-Morehead, Inc.
 - h. Sika Corporation; Construction Products Division.
 - i. Tremco Incorporated.
 - 2. Type: Single component.
 - 3. Grade: Nonsag.
 - 4. Class: 100/50.

2.6 URETHANE JOINT SEALANTS

- A. Urethane Joint Sealant: ASTM C 920.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. Lyntal, International, Inc.
 - d. May National Associates, Inc.
 - e. Pacific Polymers International, Inc.
 - f. Pecora Corporation.
 - g. Polymeric Systems, Inc.
 - h. Schnee-Morehead, Inc.
 - i. Sika Corporation; Construction Products Division.
 - j. Tremco Incorporated.
2. Grade: Pourable.
3. Class: 50.
4. Uses Related to Exposure: Traffic.

2.7 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems.
 - b. Bostik, Inc.
 - c. May National Associates, Inc.
 - d. Pecora Corporation.
 - e. Schnee-Morehead, Inc.
 - f. Tremco Incorporated.

2.8 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834; application per ASTM C 919. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Manufacturers: Subject to compliance with requirements, provide products manufactured by one of the following:
 1. Accumetric LLC; BOXX 824 Acoustical Sound Sealant.
 2. BOSS 824 Acoustical Sound Sealant.
 3. Grabber Acoustical Sealant GSCS
 4. Pecora Corporation.
 5. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 6. USG Corporation.

- C. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.9 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F. Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.10 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation, tolerances, and other conditions affecting joint sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant.
 - a. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
 2. Remove laitance and form-release agents from concrete.
 3. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
- B. Joint Priming: Prime joint substrates, where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

- A. General: Apply sealant in a neat, weather tight manner. Three (3) sided joints shall be backed with backer rod to provide bond only to two (2) opposite sides.
1. Backer Rod: Polyethylene foam.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
- H. Installation of Preformed Silicone-Sealant System: Comply with manufacturer's written instructions.
- I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.
- J. Acoustical Sealant Installation: Comply with ASTM C 919 and with manufacturer's written instructions.
- K. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.
 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix XI in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
- B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 JOINT SEALANT SCHEDULE

- A. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
 - 1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Urethane.
 - 3. Joint Sealant Color: As selected by Owner from manufacturer's full range of colors.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints (non-fire-rated) on exposed surfaces of interior unit masonry and concrete walls and partitions.
 - d. Joints on underside of plant-precast structural concrete beams and planks.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - f. Other joints as indicated.
 - 2. Joint Sealant: Latex.
 - 3. Joint-Sealant Color: As selected by Owner from manufacturer's full range of colors.
- C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.
 - 2. Joint Sealant: Silicone.
 - 3. Joint Sealant Color: As selected by Owner from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces.
 - 1. Joint Sealant Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.
 - 2. Joint Sealant: Acoustical.
 - 3. Joint-Sealant Color: As selected by Owner from manufacturer's full range of colors.

3.6 CLEANING

- A. Remove masking tape.
- B. Clean adjacent surfaces soiled by sealant installation.

3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired joint sealants are indistinguishable from the original work.

END OF SECTION

SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Standard hollow metal doors and frames.
- B. Related Sections include the following:
 - 1. Division 08 Section "Flush Wood Doors" for wood doors installed in steel frames.
 - 2. Division 09 Section "Painting" for field painting standard hollow metal doors and frames.

1.2 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of hollow metal door and frame and window frame specified.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard hollow metal doors and frames through one source from a single manufacturer.
- C. Fire-Rated Door and Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.
 - 1. Temperature-Rise Limit: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F in 30 minutes of fire exposure.
- D. Smoke-Control Door Assemblies: Comply with NFPA 105.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber.
 - 1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify 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 standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

1.7 COORDINATION

- A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Steelcraft.
 - 2. Curries Company.
 - 3. Firedoor Corporation.
 - 4. Mesker Door.
 - 5. Security Metal Products.
 - 6. Approved equal.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 metallic coating.
- D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.
- E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.
- F. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
- G. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.
- H. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard hollow metal door frames of type indicated.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.
- J. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other impurities.

2.3 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.
- B. Design:
 - 1. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces door complying with ANSI A250.8.
 - a. Fire Door Core: As required to provide fire-protection ratings indicated.
 - 2. Vertical Edges for Single-Acting Doors: Beveled edge unless square edge is indicated.
 - a. Beveled edge: 1/8 inch in 2 inches.

3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick, end closures or channels of same material as face sheets.
 4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 3. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Interior Frames: Fabricated from cold-rolled steel sheet unless otherwise indicated to comply with exterior frame requirements.
1. Fabricate interior frames with mitered or coped corners, welded for field assembly as indicated on drawings.
 2. Steel Sheet Thickness for Interior Doors: 0.053-inch-thick, unless otherwise indicated.
 3. Frames for Wood Doors: 0.053-inch-thick steel sheet.
 4. Frames for Borrowed Lights: 0.053-inch-thick steel sheet.
- C. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:
1. Hinges: Minimum 0.123 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 2. Pivots: Minimum 0.167 inch thick by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
 3. Lock Face Closers, and Concealed Holders: Minimum 0.067 inch thick.
 4. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick.
- D. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.
- E. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

F. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

G. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

2.5 FABRICATION

A. General: Fabricate standard hollow metal doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.

3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.

4. Grout Guards: Provide where mortar might obstruct hardware operation.

5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.

6. Jamb Anchors: Provide number and spacing of anchors as follows:

a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Three anchors per jamb from 60 to 90 inches high.

2) Four anchors per jamb from 90 to 120 inches high.

3) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

1) Four anchors per jamb from 60 to 90 inches high.

2) Five anchors per jamb from 90 to 96 inches high.

3) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

4) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to 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.
- C. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware include cutouts, reinforcement, mortising, drilling and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."
 1. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
 2. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

2.6 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 1. Finish standard hollow metal door and frames after assembly.
- B. Metallic-Coated Steel Surface Preparation: Clean surfaces with non-petroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
 1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
- D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.
 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard hollow metal doors and frames.
 - 1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
 - 2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory.
- B. Prior to installation and with installation spreaders in place, adjust and securely brace standard hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive non-templated mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard hollow metal doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Standard Hollow Metal Frames: Install standard hollow metal frames for doors and other openings of size and profiles indicated. Comply with ANSI/SDI A250.11.
 - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install door silencers in frames before grouting.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.

- e. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
 - f. Apply bituminous coating to backs of frames that are filled with mortar, grout and plaster containing anti-freezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of post-installed expansion anchors if so indicated and approved on Shop Drawings.
 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 5 Section "Unit Masonry Assemblies."
 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
 6. In-Place Concrete or Masonry Construction: Secure frames in place with post-installed expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 7. In-Place Gypsum Board Partitions: Secure frames in place with post-installed expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
 9. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Standard Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Standard Hollow Metal Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to NFPA 105.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard hollow metal doors or frames that are warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- C. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

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SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Solid-core flush wood doors (field installed in steel frames).
2. Factory finishing flush wood doors and wood frames
3. Factory fitting flush wood doors to wood frames and factory machining for hardware.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire-protection ratings for fire-rated doors.

C. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.

1.3 QUALITY ASSURANCE

A. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure: Test at atmospheric pressure After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.
2. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F maximum in 30 minutes of fire exposure.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in cardboard cartons and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top and bottom rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
 - a. Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Jeld-Wen Windows and Doors.
 - 2. Kolbe Windows and Doors.
 - 3. Algoma Hardwoods Inc.
 - 4. Mohawk Flush Doors, Inc.
 - 5. Approved Equal.

2.2 DOOR CONSTRUCTION, GENERAL

- A. Veneer: AWI custom quality wood, plain sliced with book matched hardwood veneer for transparent finish:
 - 1. Wood: Match Existing.
- B. Particleboard Cores: Comply with the following requirements:
 - 1. Particleboard: ANSI A208.1, Grade LD-1.
 - 2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.
 - 3. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated.
- C. Interior Veneer-Faced Doors:
 - 1. Core: Structural composite lumber.
 - 2. Construction: Five plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- D. Fire-Rated Doors:
 - 1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
 - 2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
 - 3. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile matching face veneer, and laminated backing at hinge stiles for improved screw-holding capability and split resistance.
 - 4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.
- E. Mineral-Core Doors:
 - 1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
 - 2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
 - 3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:

1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
 1. Louvers: Factory install louvers in prepared openings.

2.4 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Finish doors at factory that are indicated to receive transparent finish. Field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: AWI conversion varnish system.
 3. Staining: VOC content not more than 250 g/L. Custom stain to match wood clad windows stain color. Provide samples of staining for both birch and maple woods. Provide samples of stained door and wood trim.
 4. Effect: Semi-filled finish.
 5. Sheen: Satin.
 6. Color: Match existing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.

2. Reject doors with defects.

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

3.2 INSTALLATION

A. Hardware: For installation, see Division 08 Section "Door Hardware."

B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors and access panels in corresponding fire-rated frames according to NFPA 80.

C. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Commercial door hardware.
 - 2. Cylinders for doors specified in other Sections.
 - 3. Electrified door hardware.

- B. Related Sections include the following:
 - 1. Division 08 Section "Hollow Metal Doors and Frames."
 - 2. Division 08 Section "Flush Wood Doors."
 - 3. Division 26 for connections to electrical power system.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed finish.
- C. Shop Drawings: Details of electrified door hardware, including wiring diagrams.
- D. Other Action Submittals:
 - 1. Door Hardware Sets: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
 - 2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
 - 1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
- B. Source Limitations: Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications

and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
 - 1. Test Pressure: After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches or less above the sill.
- D. Hardware shall be in strict accord with the applicable provisions of the ADA-ABA Accessibility Guidelines; the International Building Code, Chapter 11 Accessibility; the Wisconsin Administrative Code, Chapter SPS 362.

1.4 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Rough-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- C. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in door and frame schedule.
- B. Designations: Products are identified by using door hardware designations, as follows:
 - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.
 - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- C. Finishes:
 - 1. Match Existing.
 - 2. Closers: Match Existing.
 - 3. Other Hardware: Match finish of lockset/latchset.

2.2 HINGES, GENERAL

- A. Template requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- B. Hinge Base Metal: Unless otherwise indicated, provide the following:
 - 1. Exterior Hinges: Stainless steel, with stainless steel pin.
 - 2. Interior Hinges: Steel, with steel pin.
 - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.
- C. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors and outswinging corridor doors with locks.
- D. Fasteners: Comply with the following:
 - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
 - 2. Wood Screws: For wood doors.
 - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
 - 4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors, wood screws for wood doors. Finish screw heads to match surface of hinges.

2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Manufacturers:
 - 1. Hager Companies (HAG).
 - 2. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
 - 3. Ives Mfg.
 - 4. Select Hinges (SH).
 - 5. Approved Equal.
- D. Hinges:
 - 1. Spring loaded hinges to meet ANSI K81071F; two (2) minimum at entry doors only.
 - 2. Provide one (1) pair hinges on 1-3/4" H.C. doors and one and one-half (1-1/2) pair hinges on all other doors. Any door over 90" requires an additional hinge every 12".
 - 3. Hinges to match lockset finish.
 - 4. Outswing doors shall have non-rising pins.
 - 5. Where hinges are required to swing 180 degrees, furnish hinges of sufficient throw to clear the trim.

2.4 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.

- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
- D. Lock Throw: Comply with testing requirements for length of bolts required for fire labeled doors.
- E. Backset: 2-3/4 inches, unless otherwise indicated.
- F. Strikes: Manufacturer's standard strike with strike box for each latch bolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set.
- G. Lever sets throughout.

2.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
 - 1. Bored Locks: BHMA A156.2.
- B. Bored Locks: BHMA A156.2, Grade 1; Series 4000.
 - 1. Manufacturers: Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
 - 2. Sargent Manufacturing.

2.6 ELECTROMAGNETIC LOCKS

- A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door.
 - 1. Type: Full exterior or full interior, as required by application indicated.
 - 2. Strength Ranking: 1500 lbf.
- B. Electric Strike
 - 1. Electric release latch to be 1639 US26D X 24V – by Precision Hardware, Inc. standard finish; or approved equal.
 - 2. Verify frame type (aluminum, HM).
- C. Electromagnetic Door Holders
 - 1. Edwards 1500 Series.
 - 2. AC type low power drain and UL listed.
 - 3. Wall mounted style.
 - 4. 24 pounds minimum holding force

2.7 EXIT DEVICES

- A. Exit Devices: BHMA A156.3, Grade 1.
- B. Accessibility Requirements: Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Outside Trim: Lever with cylinder; material and finish to match locksets, unless otherwise indicated.
 - 1 Match design for locksets and latchsets, unless otherwise indicated.
- G. Through Bolts: For exit devices and trim fire-rated wood doors.
- H. Manufacturers:
 - 1. SARGENT Manufacturing Company: an ASSA ABLOY Group company (SGT).
 - 2. Von Duprin; an Ingersoll-Rand Company (VD).
 - 3. Schlage.
 - 4. Or approved equal.

2.8 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
 - 1. Number of Pins: Six.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; with interchangeable cores.
- D. Construction Keying: Comply with the following:
 - 1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 4 construction master keys.
 - 2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.
 - a. Furnish permanent cores to Owner for installation.

- E. Manufacturer: Same manufacturer as for locks and latches. See Door Hardware Schedule on Drawings.

2.9 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. System to be approved by Owner.
- B. Keys: Stamp keys with "DO NOT DUPLICATE."

2.10 CLOSERS

- A. Accessibility Requirements: Comply with the following maximum opening-force requirements:
 - 1. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - 2. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
 - 1. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- C. Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for automatic entrance doors serving as a required means of egress.
- D. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- E. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- F. Surface Closers: BHMA A 156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated. Manufacturers:
 - a. Arrow USA; an ASSA ABLOY Group company (ARW).
 - b. Norton Door Controls; an ASSA ABLOY Group company (NDC).
 - c. LCN.
 - d. Sargent.
 - e. Or approved equal.

2.11 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
 - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

- B. Mechanical Door Holders: BHMA A156.16, Grade 1.
- C. Wall Stops and Holders: BHMA A156.8, Grade 1.
- D. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- E. Combination Overhead Stops and Holders: BHMA A156.8, Grade 1.
- F. Silencers for Door Frames: BHMA A156.16, Grade 1; neoprene or rubber; fabricated for drilled-in application to frame.
- G. Manufacturers:
 - 1. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
 - 2. Hager Companies (HAG).
 - 3. IVES Hardware; an Ingersoll-Rand Company (IVS).
 - 4. Or approved equal.

2.12 DOOR GASKETING

- A. Standard: BHMA A156.22.
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide non-corrosive fasteners for exterior applications and elsewhere as indicated.
 - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
 - 2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
 - 3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- G. Manufacturers:
 - 1. Hager Companies (HAG).
 - 2. M-D Building Products, Inc. (MD).
 - 3. National Guard Products (NGP).
 - 4. Pemko Manufacturing Co. (PEM).
 - 5. Reese Enterprises (RE).
 - 6. Sealeze; a unit of Jason Incorporated (SEL).
 - 7. Zero International (ZRO).

8. Or approved equal.

2.13 KICKPLATES

- A. General: 18-8 non-magnetic stainless steel, not less than .050" thick, with beveled edges.
- B. Finish: Satin Chrome.
- C. Size: 8" high x 2" LDW (door width less 2")
- D. Provide at all interior public doors that could be accessible by wheelchair
- E. Manufacturers:
 1. Hager #1905.
 2. Or approved equal.

2.14 MISCELLANEOUS DOOR HARDWARE

- A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.
- B. Miscellaneous Hardware: 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, as required.
- C. Auxiliary Hardware: BHMA A156.16, Grade 1, unless Grade 2 is specified.
 1. Manufacturers:
 - a. Lawrence Brothers, Inc. (LB)
 - b. Rockwood Manufacturing Company (RM).
 - c. Trimco (TBM)
 - d. Rixson Manufacturing.

2.15 FABRICATION

- A. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- B. Fasteners: Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 1. Comply with NFPA 80 for fasteners of door hardware in fire-rated applications.
- C. Finishes: Match existing, or as indicated in Door Hardware Sets.

PART 3 – EXECUTION

3.1 INSTALLATION

- A. Steel Doors and Frames: Comply with DHI A115 Series. Drill and tap doors and frames for surface-applied door hardware according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.
- C. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
 - 3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- D. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- E. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Verify location with Architect.
- F. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- G. Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
 - 2. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- H. Installation
 - 1. Install hardware in accordance with manufacturer's recommendations and instructions.
 - 2. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the fire rating.
 - 3. Install closers on the room side of corridor doors, stair side of stairways, and interior side of exterior doors.

3.2 FIELD QUALITY CONTROL

- A. Hardware shall be in strict accord with the applicable provisions of the ADA-ABA Accessibility Guidelines; the International Building Code, Chapter 11 Accessibility; and the Wisconsin Administrative Code, Chapter SPS 362.
- B. Furnish UL listed hardware for all UL labeled openings in conformance with requirements for the class of opening scheduled.

3.3 DOOR HARDWARE SETS: See Drawings.

END OF SECTION

SECTION 09 22 16

NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.

1.2 SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. STC-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413.

2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal:
 1. Unless indicated otherwise, use 25 gauge for partitions up to 12'-0" high. Partitions over 12'-0" high increase stud gage to 20 gauge.
 2. Unless indicated otherwise, use 20 gauge studs at door jambs and heads.
- C. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:

1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch-deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Dietrich Metal Framing; SLP-TRK Slotted Deflection Track.
 - 2) MBA Building Supplies; FlatSteel Deflection Track.
 - 3) Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - 4) Superior Metal Trim; Superior Flex Track System (SFT).
 - 5) Telling Industries; Vertical Slip Track or Vertical Slip Track II.
 - 6) Approved equal.
- D. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fire Trak Corp.; Fire Trak System attached to studs with Fire Trak Posi Klip.
 - b. Grace Construction Products; FlameSafe FlowTrak System.
 - c. Metal-Lite, Inc.; The System.
 - d. Steel Network Inc. (The); VertiClip SLD or VertiTrack VTD Series.
 - e. Approved equal.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.
 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base-Metal Thickness: As indicated on Drawings.
 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
1. Depth: As indicated on Drawings.

2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 AUXILIARY MATERIALS

- A. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.
- B. Isolation Strip at Exterior Walls: Provide asphalt saturated organic felt.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
 - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Interior gypsum board.
2. Sound attenuation blankets.
3. Acoustical sealant.

1.2 SUBMITTALS

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

B. Samples: For the following products:

1. Trim Accessories: Full-size Sample in 12-inch long length for each trim accessory indicated.
2. Textured Finishes: Manufacturer's standard size for each textured finish indicated and on the same backing indicated for Work.

1.3 QUALITY ASSURANCE

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

C. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.

D. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

PART 2 - PRODUCTS

2.1 INTERIOR GYPSUM BOARD

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Temple-Inland.
 - b. American Gypsum Co.
 - c. G-P Gypsum.
 - d. Lafarge North America Inc.
 - e. National Gypsum Company.
 - f. USG Corporation.
- B. Regular Type:
1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- C. Type X:
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- D. Type C (as required by specific UL assemblies):
1. Thickness: 5/8 inch.
 2. Long Edges: Tapered.
- E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- F. Moisture- and Mold-Resistant Type: With moisture- and mold-resistant core and surfaces.
1. Core: 5/8 inch, Type X.
 2. Long Edges: Tapered.
- G. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
1. Configuration: Asymmetrical or hat shaped.
- H. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
1. Products: Subject to compliance with requirements, provide one of the following:

- a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. USG Corporation; DUROCK Cement Board.
- 2. Thickness: As indicated on Drawings.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

2.2 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.3 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. U-Bead: J-shaped; exposed short flange does not receive joints compound.
 - e. Expansion (control) joint.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fry Reglet Corp.
 - b. Gordon, Inc.

- c. Pittcon Industries.
2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
3. Finish: Corrosion-resistant primer compatible with joint compound and finish materials.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings as demonstrated by testing according to ASTM E 90.
 1. Products: Subject to compliance with requirements, provide acoustical joint sealant by one of the following manufacturers:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies Inc.; Smke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 - f. Approved Equal.
 2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 TEXTURED FINISHES

- A. Primer: As recommended by textured finish manufacturer.
- B. Aggregate Finish: Water-based, job-mixed, aggregated, drying –type texture finish for spray application.

1. Products: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. G-P Gypsum: Georgia-Pacific Ceiling Textures/Vermiculite.
 - b. USG Corporation; SHEETROCK Wall and Ceiling Spray Texture (Aggregated).
 - c. Approved equal.
2. Texture: Match Existing.

PART 3 - EXECUTION

3.1 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- D. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

3.2 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 1. Regular Type: As indicated on Drawings.
 2. Type X: Where required for fire-resistance-rated assembly.
 3. Type C: As required by specific UL assemblies.
 4. Ceiling Type: As indicated on Drawings.
 5. Moisture- and Mold-Resistant Type: As indicated on Drawings.

3.3 APPLYING ACOUSTICAL SEALANT

- A. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners.
 - 2. Bullnose Bead: Use at outside corners.
 - 3. LC-Bead: Use where indicated.
 - 4. U-Bead: Use where indicated.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view and under wall coverings, unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in other Division 9 sections.
 - 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in other Division 9 Sections.
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.
- G. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

3.7 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

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SECTION 09 51 23

ACOUSTICAL TILE CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes acoustical tiles and concealed suspension systems for ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Drawn to scale and coordinating acoustical tile ceiling installation with hanger attachment to building structure and ceiling mounted items. Show size and location of initial access modules.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Tile: Set of 12 x 12 inch square Samples of each type, color, pattern, and texture.
 - 2. Submit two samples each, 6 inches long, of suspension system main runner.
- D. Product Test Reports.
- E. Maintenance Data.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of acoustical ceiling tile and supporting suspension system through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics:
 - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
 - b. Identify materials with appropriate markings of applicable testing and inspecting agency.

2. Surface-Burning Characteristics: Provide acoustical tiles with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:

- a. Smoke-Developed Index: 450 or less.

- C. Certificates: Submit manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry the Underwriters Laboratories (UL) classification for NRC, CAC, and AC.

1.4 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Acoustical Ceiling Units: Full-size tiles equal to 3.0 percent of quantity installed.
 2. Suspension System Components: Quantity of each concealed grid and exposed component equal to 3.0 percent of quantity installed.
 3. Hold-Down Clips: Equal to 3.0 percent of amount installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical tiles, permit them to reach room temperature and have a stabilized moisture content within the acoustical tile unit manufacturer's recommended limitations.
- C. Handle acoustical tiles carefully to avoid chipping edges or damaging units in any way.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete and nominally dry, work above ceilings is complete and ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

1.7 COORDINATION

- A. Coordinate layout and installation of acoustical tiles, and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, sprinkler heads and other fire-suppression system components, and partition assemblies.

1.8 WARRANTY

- A. Written warranty executed by the manufacturer, agreeing to repair or replacement of acoustical ceilings that fail within the warranty period. Failures include:
 - 1. Acoustical Tiles: Sagging and warping.
 - 2. Grid Systems: Rusting and manufacturer's defects.
- B. Warranty Period for Acoustical Tiles: Minimum one year from date of Substantial Completion.
- C. Warranty Period for Grid System: Minimum 10 years from date of Substantial Completion.
- D. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 ACOUSTICAL TILES

- A. Product Basis-of-Design: See Drawings.
 - 1. Or Approved Equal.

2.2 ACOUSTICAL TILE CEILINGS, GENERAL

- A. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- B. Tile-Based Antimicrobial Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial solution that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria.
- C. Low-Emitting Materials: Acoustical tile ceilings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension system of types, structural classifications, and finishes indicated that comply with application requirements in ASTM C 635.

2.3 METAL SUSPENSION SYSTEM FOR ACOUSTICAL TILE CEILING

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

1. Armstrong World Industries, Inc.
 2. USG Interiors, Inc.
 3. Chicago Metallic Corporation.
 4. Approved Equal.
- B. Standard for Metal Suspension Systems: Provide metal suspension systems of type, structural, classification and finish indicated which comply with applicable ASTM C 635 requirements. Provide fire resistance rated suspension systems where fire-rated ceilings are required.
- C. Access: upward, with each access unit identified by manufacturer's standard unobtrusive markers.
- D. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- E. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
- F. Concrete Inserts: Inserts formed from hot-dipped galvanized sheet steel and designed for attachment to concrete forms and for embedment in concrete, with holes or loops for attachment at hanger wires.
- G. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 2. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
 3. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.
- H. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- I. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch-thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch-diameter bolts.
- J. Hold-Down Clips: Manufacturer's standard hold-down clips for grid and edge trim.
- K. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical tiles.
- L. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G3 coating designation, with pre-finished 15/16-inch-wide metal caps on flanges.

1. Structural Classification: Intermediate-duty system.
 2. Face Design: Flat, flush.
 3. Cap Material: Steel or aluminum cold-rolled sheet.
 4. Cap Finish: Painted white.
- M. Edge Moldings and Trim: Metal or extruded aluminum of types and profiles indicated, or if not indicated, provide manufacturer's standard molding for corners, edges and penetrations of ceiling that fit type of edge detail and suspension system indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, partitions, walls, and structural framing to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage of ceiling system, and with requirements for installation tolerances and other conditions affecting performance of acoustical tile ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION, GENERAL

- A. General: Install acoustical tile ceilings to comply with ASTM C 636 UBC Standard 25-2, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.
- G. Install acoustical tiles with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut tiles at borders and penetrations to provide a neat, precise fit.
1. For square-edged tiles, install tiles with edges fully hidden from view by flanges of suspension system runners and moldings.
 2. For reveal-edged tiles on suspension system runners, install tiles with bottom of reveal in firm contact with top surface of runner flanges.
 3. For reveal-edged tiles on suspension system members with box-shaped flanges, install tiles with reveal surfaces in firm contact with suspension system surfaces and tile faces flush with bottom face of runners.

4. Paint cut edges of tile remaining exposed after installation; match color of exposed tile surfaces using coating recommended in writing for this purpose by acoustical tile manufacturer.
5. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by tile manufacturer's written instructions, unless otherwise indicated.
6. Install clean-room gasket system in areas indicated, sealing each tile and fixture as recommended by tile manufacturer's written instructions.
7. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Replace damaged and broken tiles.
- B. Clean exposed surfaces of acoustical tile ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

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SECTION 09 65 13

RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Wall base.
 - 2. Molding accessories.
- B. Related Sections include the following:
 - 1. Division 09 Section "Resilient Tile Flooring."
 - 2. Division 09 Section "Tile Carpeting."

1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
 - 1. Johnsonite.
 - 2. Flexco.
 - 3. Armstrong.
 - 4. Approved Equal.

2.2 RESILIENT WALL BASE

- A. Resilient Base Standards: ASTM F 1861.
 - 1. Material Requirement: Type TV (vinyl, thermoplastic).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Flexibility: Will not crack, break, or show any signs of fatigue when bent around a 1/4 inch diameter cylinder.
 - 4. Style: Cove (base with toe).
 - 5. Meets or exceeds the performance requirements for resistance to heat/light aging, chemicals, and dimensional stability when tested to the methods as described in ASTM F 1861.
- B. Thickness: 0.080 inch.
- C. Height: 4 inches.
- D. Lengths: Coils in manufacturer's standard lengths.
- E. Outside Corners: Job formed.
- F. Inside Corners: Job formed.
- G. Locations: See Drawings.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.3 RESILIENT ACCESSORIES

- A. Transition Strips:
 - 1. At dissimilar flooring materials.
 - 2. At direct glue carpet.
 - 3. At other locations as indicated.
 - 4. Color: Match the wall base.

2.3 RESILIENT MOLDING ACCESSORIES

- A. Description: Carpet edge for glue-down applications, reducer strip for resilient floor covering, joiner for tile and carpet, transition strips.
- B. Material: Vinyl.
- C. Profile and Dimensions: As indicated.
- D. Colors and Patterns: As selected by Architect from manufacturer's full range.

2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Supart D (EPA Method 24).
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - 1. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- E. Areas to receive resilient products shall be clean, fully enclosed, weather tight, and maintained at a uniform temperature of at least 65°F for 24 hours immediately before installation.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RESILIENT WALL BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Installation work should not begin until the work of all other trades, especially overhead trades, has been completed.
- C. Areas to receive wall base shall be maintained at a uniform temperature of at least 65°F for 24 hours during and for 24 hours after the installation is completed.
- D. The wall base and adhesives shall be conditioned in the same manner.
- E. Floors and walls shall be clean, dry, free of dust, all paints, wallpaper, and all other foreign materials which may affect proper adhesive bonding.
- F. Wall bases shall not be installed on surfaces that will be exposed to drastic temperature changes or moisture.

- G. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- H. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- I. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- J. Do not stretch wall base during installation.
- K. Vinyl Wall Base: Coiled wall base shall be uncoiled and lay flat for at least 24 hours at 65°F prior to installation.
- L. Job-Formed Corners:
 - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
 - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor coverings that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
 - a. Do not wash surfaces until after time period recommended by manufacturer.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 09 65 19

RESILIENT TILE FLOORING

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Luxury vinyl tile flooring.

B. Related Sections Include:

1. Division 09 Section “Resilient Wall Base and Accessories” for resilient wall base and other accessories installed with resilient tile flooring.

1.2 SUBMITTALS

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

B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: Full-size units of each color and pattern of floor tile required.

D. Maintenance data.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an installer who employs workers for this Project that are trained or certified by floor covering manufacturer for heat-welding techniques required by manufacturer for floor covering installation.

B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.4 PROJECT CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor tile.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

- E. Install floor tile after other finishing operations, including painting, have been completed.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg.

1.6 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish one (1) box for every 50 boxes or fraction thereof, of each type, color, and pattern of flooring installed.

PART 2 – PRODUCTS

2.1 LUXURY VINYL FLOOR TILE

- A. Product Basis-of-Design: See Drawings.
 - 1. Or Approved Equal.
- B. Tile Standard: ASTM F 1700-13a.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- C. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - 1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 – EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by floor covering manufacturer. Proceed with installation only after substrates pass testing.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- D. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern indicated.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Perform the following operations immediately after completing luxury vinyl flooring installation:
 - 1. Remove adhesive and other blemishes from luxury vinyl flooring surfaces.
 - 2. Sweep and vacuum luxury vinyl flooring thoroughly.
 - 3. Damp-mop luxury vinyl flooring to remove marks and soil.
 - a. Do not wash luxury vinyl flooring until after time period recommended by manufacturer.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 - 1. Apply two coat(s).
- C. Cover floor tile until Substantial Completion.

END OF SECTION

SECTION 09 68 13

TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Modular Carpet Tile.

B. Related Sections include the following:

1. Division 09 Section "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 SUBMITTALS

A. Product Data: For the following, including installation recommendations for each type of substrate:

1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.

B. Samples: For each exposed product and for each color and texture specified.

C. Shop Drawings: Show the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
2. Carpet type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.

D. Maintenance Data: For carpet to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile and carpet cushion.

E. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer, certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.
- C. General Terminology and Information Standard: "Carpet Specifier's Handbook" by The Carpet and Rug Institute (CRI).

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.5 PROJECT CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not install carpet tile until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet tile over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tile, install carpet tile before installing these items.

1.6 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Review methods and procedures related to carpet installation, including:
 - 1. Delivery, storage, and handling procedures.
 - 2. Ambient conditions and ventilation procedures.
 - 3. Subfloor preparation procedures, including relative humidity, moisture and alkalinity tests.

1.7 WARRANTY

- A. Special Warranty for Carpet Tile: Manufacturer's standard form in which manufacturer agrees to repair or replace components of carpet tile installation that fails in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.

2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, excess static discharge, and delamination.
 3. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Installation Warranty: Installer's written warranty, co-signed by Contractor, agreeing to provide labor and materials to replace carpet tile and accessories that fail due to installation defects, including inadequate subflooring preparation and adhesion failures.
1. Warranty does not include failure due to vandalism or abuse.
 2. Warranty Period: Five (5) years from date of Substantial Completion.

1.8 EXTRA MATERIALS

- A. All usable pieces of carpet tile remaining after completion of the work shall be left with the Owner at the Project Site.
- B. Provide 3% attic stock.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Basis-of-Design Product: See Drawings.
 1. Or Approved Equal.
- B. Antimicrobial Treatment: Manufacturer's standard.

2.2 ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet cushion manufacturer.
- B. Special Coatings: As recommended by floor adhesive manufacturers to suit indicated resilient products and substrate conditions.
- C. Adhesives: Water-resistant, mildew-resistant, non-staining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet manufacturer.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Vinyl Transition Strips: Vinyl transition strip of width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
 - 1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet and cushion manufacturer.
 - 2. Subfloor finishes comply with requirements specified in Division 3 Section "Cast-in-Place Concrete" for slabs receiving carpet.
 - 3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI 104, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tiles.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile and cushion manufacturer.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. Comply with CRI 104, Section 104 and with carpet tile manufacturers' written installation instructions for the following:
 - 1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."

- B. Comply with carpet tile manufacturer's written recommendations for seam locations and direction of carpet tile; maintain uniformity of carpet tile direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet tile.
- D. Maintain dye lot integrity. Do not mix dye lots in same area.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer and carpet tile adhesive manufacturer.

END OF SECTION

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SECTION 09 91 25

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Gypsum Board.
 - 2. Wood.
 - 3. Steel.
- B. This Section includes surface preparation and the application of paint systems on the following exterior substrates:
 - 1. Steel.
- 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. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

1.2 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
 - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
 - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
 - 3. Semi-gloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
 - 4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 SUBMITTALS

- A. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
- B. Product List: Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

- C. VOC Content Submittal: For all interior paints, product data including printed statement of VOC content.

1.4 QUALITY ASSURANCE

- A. MPI Standards:
 - 1. Products: Complying with MPI standards indicated and listed in “MPI Approved Products List.”
 - 2. Preparation and Workmanship: Comply with requirements in “MPI Architectural Painting Specification Manual” for products and paint systems indicated.
- B. Source Limitations:
 - 1. Obtain primers for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver materials to site until having received all written approvals of submitted information and samples.
- B. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
 - 1. Product name or title of material.
 - 2. Product description (generic classification or binder type).
 - 3. Manufacturer's stock number and date of manufacture.
 - 4. Contents by volume, for pigment and vehicle constituents.
 - 5. Thinning instructions.
 - 6. Application instructions.
 - 7. Color name and number.
 - 8. VOC content.
- C. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
 - 1. Keep storage area neat and orderly. Remove oily rags and waste daily.
- D. Take all precautions to insure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and applications of paint.

1.6 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.

- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.
- D. Do not apply paint to surfaces in hot sunlight.

1.7 SEQUENCING AND SCHEDULING

- A. Schedule cleaning and painting so that contaminants from cleaning process will not fall onto newly-painted surfaces.

1.8 EXTRA MATERIALS

- A. Furnish an additional 5 percent, but not less than one (1) gallon of each type/color of paint applied.
- B. All containers shall be sealed for storage and identified with appropriate labels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Sherwin-Williams Company.
 - 2. Benjamin Moore & Co.
 - 3. Diamond Vogel.
 - 4. Hallman Lindsay
 - 5. Approved Equal.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility:
 - 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer based on testing and field experience.
 - 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable. Use products with low V.O.C. content when available.
- C. VOC Content of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24); these requirements do not apply to paints and coatings that are applied in a fabrication or finishing shop:
 - 1. Flat Paints, Coatings, and Primers: VOC content of not more than 50 g/L.
 - 2. Nonflat Paints, Coatings and Primers: VOC content of not more than 150 g/L.
 - 3. Nonflat Topcoat Paints: VOC content of not more than 150 g/L.
 - 4. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
 - 5. Anti-Corrosive and Anti-Rust Paints Applied to Ferrous Metals: VOC content not more than 250 g/L.

2.3 METAL PRIMERS

- A. Waterborne Galvanized-Metal Primer: MPI #134.
 - 1. VOC Content: E Range of E1.Environmental Performance Rating: EPR 1.

2.4 OTHER PRIMERS/SEALERS

- A. Interior Latex Primer/Sealer.
 - 1. VOC Content: E Range of E1.
 - 2. Environmental Performance Rating: EPR 1.

2.5 INTERIOR PAINTS

- A. Latex; MPI INT 9.2M.
- B. VOC Content: E Range of E1.

2.6 EQUIPMENT

- A. Provide all brushes, rollers, ladders, scaffolding and other equipment of any kind to properly execute each type of work.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
 - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Maximum Moisture Content of Substrates:
 - 1. Gypsum Board: 12 percent.
 - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
- E. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
 - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
- C. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
 - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- D. Gypsum Board: Fill minor irregularities with patching material and sand to smooth level surfaces taking care not to raise nap of paper.

- E. Wood: After cleaning surfaces, sand surfaces exposed to view smooth and dust off. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried. Hand sandpaper to smooth surface; sanding in direction of grain.
- F. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
 - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
 - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
 - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- G. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
 - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 6. Sand lightly between each succeeding varnish coat.
- B. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity and to prevent hazardous accumulations of dust, fumes, vapors or gases.
- C. Do work under adequate illumination and dust-free conditions.
 - 1. Apply paint by brush, roller or spray methods except where particular method will produce unsatisfactory results. Where spray method is used on concrete block, follow with roller to work paint into voids.
- D. Materials.
 - 1. Do not open containers until required for use.
 - 2. Stir materials thoroughly and keep at uniform consistency during application.

- E. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
 2. Omit primer over metal surfaces that have been shop primed and touchup painted.
 3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
 4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- F. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
 2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
 3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- G. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- J. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for all final coats.
- K. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

- M. At completion of construction activities of other trades, touch-up and restore damaged or defaced painted surfaces.

3.4 CLEANING

- A. During the progress of this work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.
- B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
 - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 INTERIOR PAINT SCHEDULE

- A. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
 - 1. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.
 - a. Prime Coat: Interior latex primer/sealer.
 - b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
 - c. Topcoat: Institutional low-odor/VOC interior latex.
 - i. Walls: Match existing.
 - d. Colors: As selected by Architect from manufacturer's standard range.
- B. Steel Substrates:
 - 1. Latex over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex enamel (semigloss).

3.7 STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

- A. Stained Woodwork: Provide the following stained finishes over new interior woodwork:

1. Waterborne Clear Acrylic Over Stain Systems: MPI INT 6.3W. Two finish coats of waterborne clear acrylic varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.
 - a. Filler Coat: Open-grain wood filler.
 - b. Stain Coat: Interior wood stain. (Semitransparent)
 - c. Match Architects sample.
 - d. Sealer Coat: Clear sanding sealer.
 - e. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.
- B. Natural-Finish Woodwork: Provide the following natural finishes over new interior woodwork:
 1. Waterborne Acrylic Clear Over Stain System: MPI INT 6.3Q. Two finish coats of waterborne clear acrylic varnish over a sanding sealer. Provide wood filler on open-grain wood before applying first varnish coat.
 - a. Filler Coat: Open-grain wood filler.
 - b. Sealer Coat: Clear sanding sealer.
 - Finish Coats: Waterborne clear acrylic

3.8 EXTERIOR PAINT SCHEDULE

A. Steel Substrates:

1. Water-Based Light Industrial Coating System: MPI 163.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Light industrial coating, exterior, water-based, matching topcoat.
 - c. Topcoat: Light industrial coating, exterior, water-based, semigloss.

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SECTION 12 36 23

PLASTIC-LAMINATE-CLAD COUNTERTOPS

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Countertops and backsplashes.

1.2 REFERENCES

- A. Plastic Laminate: National Electrical Manufacturers Association (NEMA) Publication No. LD3-1991.
- B. Particle Board Core: ANSI A208.1-1993.
- C. Fiberboard Core: ANSI A208.2.

1.3 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who specialize in fabricating products similar to those required for this Project and whose products have a record of successful in-service performance with a minimum of three (3) years documented experience. Shop is a certified participant in AWI's Quality Certification Program.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's catalog information edited to indicate specific products and related accessories to be provided for this project.
- B. Shop Drawings: Show layout of casework, typical details of construction and finish selections. Locate rough-in for services required and show methods of compensating for minor variations in actual job conditions within specified tolerances. Include details of fastening to all other work, countertop layout for each location, details of countertop construction including backsplash, endsplash and edge details, plastic laminate selections previously made by Architect and type of core substrate material. Field measure for all countertops.
- C. Samples: Plastic laminate surfacing as selected by the Architect.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver casework items only when proper storage conditions will be available. Store casework in protected area until ready for installation.
- B. Maintain optimum humidity and temperature conditions after receipt of materials.

- C. Store in manner to allow free circulation of air around all items.
- D. Maintain temperature of casework storage areas between 50 to 75 degrees Fahrenheit.

PART 2 – PRODUCTS

2.1 COUNTERTOPS

- A. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following manufacturers:
 - a. Wilsonart.
 - b. Formica.
 - c. Pionite.
 - d. Approved Equal.
 - 2. Products and Colors: As selected by Architect / Owner from manufacturer's standard range.

2.2 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 1. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.
- B. Plastic Laminate Countertops:
 - 1. High-Pressure Decorative Laminate Grade: HGS.
 - 2. Colors, Patterns, and Finishes: As selected by Architect / Owner from manufacturer's standard range.
 - 3. Provide backer sheets on underside of all countertops, regardless of core thickness or unsupported area.
 - 5. Post-rolled leading edge and integral 4 inch backsplash.

PART 3 – EXECUTION

3.1 DELIVERY

- A. Store and install in a ventilated building not exposed to extreme temperature and/or humidity.

3.2 EXAMINATION

- A. Verify adequacy of backing and support framing.

- B. Verify location and sizes of utility rough-ins associated with work in this Section.

3.3 INSTALLATION

- A. Install components plumb, level, and true according to approved Shop Drawings and manufacturer's published installation instructions. Use tools acceptable to manufacturer. Anchor securely by screwing through supports into underside of countertop.
- C. Form joint seams with seam adhesive. Seams shall be inconspicuous in completed work. Seams in locations shown on approved Shop Drawings and acceptable to manufacturer. Promptly remove excess adhesive.
- D. Install backsplashes where indicated on Drawings. Adhere to countertops with construction adhesive approved by manufacturer. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- E. Provide all necessary fillers, panels, end panels, scribes required to make complete installation as detailed.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- G. All finishes must be smooth, uniform in color and match approved sample.
- H. Prior to final inspection, examine installation of the work of this section. Repair or replace all defects found. Leave installation clean, undamaged, and ready for use.

3.4 PROTECTION, REPAIRING AND CLEANING

- A. Replace damaged and defective work.
- A. Use no acids or harsh abrasives.
- B. Leave surfaces clean and without defects.

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**SECTION 21 00 00
FIRE PROTECTION SYSTEMS**

PART 1 - GENERAL

1.1 SCOPE

- A. The work indicated on this project involves modification of an existing automatic fire sprinkler system. The contractor shall coordinate all work, including system drainage, with building facility personnel.
- B. Fire Protection Contractor shall furnish all required calculations, design, drawings, material, equipment, labor and related items required to complete the work indicated on drawings and specifications.
 - 1. Fire Protection Contractor shall secure necessary approvals for work with Madison Fire Department and other local authorities prior to starting work.
- C. The work under this Section includes, but is not limited to the following:
 - 1. Provide all components for modification of the existing NFPA 13 wet automatic sprinkler system. Include, as required, shutoff valves, drain valve, test valve(s), piping, and all necessary components to leave a complete, operational, and approved system.
 - 2. Draining of existing 1st floor fire protection system serving affect area to accomplish work required.
 - 3. The modified existing wet automatic sprinkler system to provide complete, NFPA 13 compliant and approved automatic sprinkler system(s) to give fire suppression coverage to all remodeled areas and rooms.
 - 4. Coordination of work with all other trades.
- D. The Fire Protection Contractor shall acquire all approvals, as necessary, from Fire Department, and Local and State Agencies.

1.2 RELATED WORK

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

1.3 REFERENCE STANDARDS

- A. Local and State Codes and Regulations.
 - 1. National Fire Codes (NFC) published by NFPA; latest edition of standards listed: NFPA 13 -Sprinkler Systems
 - 2. Local City of Madison Fire Department requirements.

1.4 QUALITY ASSURANCE

- A. Substitution of Materials: Refer to Division 1 of the Project Manual.

1.5 DESIGN STANDARDS

- A. Sprinkler system shall be designed and hydraulically calculated by the Contractor.
- B. Hydraulically calculate the sprinkler system pipe sizing to provide densities as listed on the drawings.

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1.7 SUBMITTALS

A SHOP DRAWINGS

Submit shop drawings of all fire sprinkler system components.

B. PLANS

Submit contractor-prepared plans/drawings indicating:

1. Submit electronic PDF prints per NFPA 13 of complete, installation plans, working plans, shop drawings, hydraulic calculations, and manufacturer's data on devices, etc., indicating by model and number to be used, to the Architect/Engineer for review and approval.
2. Contractor shall obtain the necessary insurance underwriters, State and Local Fire Department approvals prior to submitting shop drawings.
3. Submittals shall be sent to the local Fire Chief or Fire Marshal for review prior to the Architect/Engineer. Include copy of approval letter in submission to Architect/Engineer.
4. No work shall commence until all approvals have been obtained. Contractor to allow sufficient time for the approvals.
5. Prepare drawings at minimum scale of 1/8" per foot for plans and 1/4" per foot or larger for details. Show all piping, lighting, equipment, ductwork, sprinklers, hangers, roof construction and occupancy of each area, including ceiling and roof heights.
6. Installation shall be coordinated with the latest architectural, structural, mechanical, plumbing and electrical drawings.
7. Contractor shall submit drawings to Engineer which have been reviewed and stamped "approved" by the authority having jurisdiction. No work shall commence until all approvals have been obtained. Allow sufficient time for the approvals.

C. AS-BUILT DRAWINGS

1. Maintain at the site an up-to-date marked set of as-built drawings which shall be corrected and delivered to the Architect upon completion of the work.
2. Furnish the Architect one(1) reproducible print and electronic PDF copy of corrected shop drawings, including plans, revised to show "as built" conditions.

PART 2 - PRODUCTS

2.1 PIPE

- A. Carbon steel pipe, black, thickness per NFPA 13, conforming to ASTM A53, A135, A795.
- B. Fire rated CPVC piping with solvent joints where approved by NFPA 13.
- C. Flexible stainless steel piping at sprinkler head terminations, UL listed and conforming to NFPA 13.

2.2 FITTINGS

- A. Malleable iron, Class 150, threaded, ANSI B16.3.
- B. Malleable or ductile iron, grooved end, 1000 lb/in² working pressure rating, UL listed or FM approved for automatic sprinkler.
- C. Ductile or malleable iron, plain end with EPDM gasket, carbon steel bolts or locking lugs UL listed

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or FM approved for automatic sprinkler, Grinnell "Sock-it" or Victaulic "FIT"

- D. Carbon steel, butt-welded, class 150, ASTM A234.
- E. Carbon steel, Class 150, flanged, ASTM A105.
- F. Fire rated CPVC, where applicable and approved by NFPA.

2.3 JOINTS

- A. Tapered pipe threads, with Teflon tape, ANSI B2.1.
- B. Mechanical coupling, EPDM gasket, UL listed or FM approved for automatic sprinkler.
- C. Solvent welded CPVC joints, where applicable and approved by NFPA.

2.4 SPRINKLERS

A. GENERAL

- 1. Manufacturer: Products of the following manufacturers determined to be equal by the Architect/Engineer will be accepted: Central Sprinkler Corporation, Tyco, Reliable, Star Sprinkler, Victaulic and Viking.
- 2. Fusible link or glass bulb type, cast brass or bronze construction. Provide heads with nominal 1/2" discharge orifice except where greater than normal density requires large orifice.
- 3. Select fusible link or glass bulb temperature rating to not exceed maximum ambient temperature rating allowed under normal conditions at installed location. Provide ordinary temperature (165 degree) glass bulb type.
- 4. White finished brass cover plate on concealed heads rated for 200 degree and 165 degree with cap.

B. FINISHED AREAS

- 1. Provide semi-recessed sprinkler heads in all office areas as shown, centered in lay-in ceiling tiles.

C. UNFINISHED AREAS

- 1. Provide upright sprinkler heads in all areas without suspended ceiling systems.

D. RATINGS

- 1. Provide standard response, ordinary hazard 165 degree rated heads in finished areas as indicated.
- 2. Use higher temperature-rated sprinkler heads in areas near heat sources, elevator equipment rooms, and elevator shafts.

E. VALVES

- 1. Manufacturers: Kennedy, Milwaukee, Nibco, Stockham, Victaulic, Viking, and

**SECTION 21 00 00
FIRE PROTECTION SYSTEMS**

Watts.

F. BALL VALVES:

1. 2" and smaller: Bronze, 2-piece, threaded or sweat ends, standard port, blowout proof stem, chrome plated ball, glass reinforced seats, UL approved @ 250 psi. Watts No. B-6000 UL.

G. GATE VALVES:

1. 2" and smaller: Outside screw and yoke gate valves, 175 psig, bronze body, bronze mounted, screwed bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.
2. 2-1/2" and larger: Outside screw and yoke gate valves, 175 psig, cast iron body, bronze mounted, bolted bonnet, rising stem, solid wedge, with normally open tamper switch with double wire leads.

H. BUTTERFLY VALVES:

1. 2" and smaller: Bronze body butterfly valve, 175 psig, geared operator, visible position indicator, normally open tamper switch with double wire leads, Buna or Viton seat, stainless steel disc and stem.

I. DRAIN VALVES:

1. 3/4" min. two or three piece bronze body ball valve; threaded ends, chrome plated bronze ball; glass filled teflon seat; teflon packing and threaded packing nut; blowout-proof stem; 400 psig WOG, with hose thread outlet and cap.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install new portions of sprinkler system in accordance with requirements of NFPA 13 and local regulations of the local fire marshal.
- B. Modified system shall meet local regulations of the local fire marshal and NFPA 13 requirements.

3.2 TESTING

- A. Hydro-statically pressure test the fire sprinkler system piping as required in NFPA 13. Keep records of all testing for submission in Operation and Maintenance Manuals.

END OF SECTION

SECTION 22 00 00
PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Work Included: Provide plumbing where shown on the Drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to:
1. Domestic Hot and Cold Water Piping.
 2. Drain, Waste, and Vent Systems.
 3. Plumbing Fixtures and Trim.
- B. Related Work:
1. Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
 2. Cutting and patching existing walls and floors for plumbing piping are the responsibility of this contractor.
 3. Arrange for X-ray of proposed penetrations locations in structural floor prior to starting of drilling of holes -- coordinate locations with General Contractor and Owner prior to starting.
- C. Work of Other Sections:
1. Openings for new Plumbing work in new construction walls, floors, roof, ceiling, etc. shall be provided by the General Contractor. Location and size of these openings shall be the responsibility of the Plumbing Contractor.

1.02 GENERAL PROVISIONS

- A. This specification Section is a general description of the work requirements. The particular descriptions are not intended to be all-inclusive. Bidders shall also refer to the Drawings.
- B. Prior to submitting a bid, the Contractor shall call the Engineer's attention (in writing only) to any materials or items of work believed to be inadequate. Bidders are required to visit the premises, take measurements, inspect existing conditions and limitations, and obtain first hand information necessary to submit a bid. The intent of the Contract is to obtain complete system installations, tested, ready for operation. No extras will be allowed because Contractor's misunderstanding of the scope work involved.
- C. Everything essential for the completion of the work implied to be covered by these Specifications to make the system ready for normal and proper operation must be furnished and installed by this Contractor. Accordingly, any omission from either the plans or the Specifications, or both of details necessary for the proper installation and operation of the system shall not relieve this Contractor from furnishing such detail in full and proper manner.
- D. The Drawings show various details indicating the general arrangement of the plumbing work, sizes and locations of piping, equipment, etc. The said Drawings with figures, lettering, etc., shall be considered a part of these Specifications and no charge or alternation shall be made in any case unless ordered by the Engineer.
- E. In addition to the Plumbing work, refer to the Plumbing work shown on the general Construction Drawings of the building as being part of this Contract, unless specified to be done by other contractors.

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1.03 QUALITY ASSURANCE

- A. Use adequate number of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
- B. Without additional cost to the Owner, provide such other labor and materials as required to be complete the work of the Section in accordance, with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in the Contract Documents.
- C. In acceptance or rejection of installed work, the Architect or Engineer shall make no allowance for lack of skill on the part of the Workmen.
- D. For the actual field fabrication, installation and testing of the Plumbing work, use only thoroughly trained and experienced workmen complete familiar with the items required and manufacturer's current recommended methods of installation.

E. Reference Standards:

| | |
|------|---|
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ASSE | American Society of Sanitary Engineering |
| ASTM | American Society of Testing and Material |
| FM | Factory Mutual |
| MCA | Mechanical Contractors Association |
| NEC | National Electric Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| NSF | National Sanitation Foundation |

1.04 CODES AND PERMITS

- A. This contractor must comply with building codes and other ordinances in force where the building is located as far as same apply to his work.
- B. Plumbing work shall meet all Federal, State, Local Codes, ordinances and utility regulations.
 - 1. In the event of conflict between or among specified requirements and pertinent regulations, the more stringent requirement will govern when so directed by the Engineer.
- C. Plumbing Contractor must secure permits from proper offices and pay all legal fees as may be necessary for fulfilling the requirements of these specifications.
- D. Submit one (1) copy of all permits to the Owner.

1.05 COORDINATION

- A. Cooperate and coordinate with other trades to assure that all systems pertaining to the Plumbing work shall be installed in the best feasible arrangement. Coordinate as required with all other trades to share space in common areas and to provide the maximum of access to each system.

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- B. Arrange plumbing work in neat, well organized manner with piping and similar services running with primary lines of building construction, and with minimum of 8 foot overhead clearance, where possible.
- C. Locate equipment properly to provide easy access, and arrange entire plumbing work with adequate access for operation and maintenance.
- D. Give right-of-way to piping, which must slope for drainage.
- E. Where Plumbing work is to connect to existing, the Contractor must field verify all connection points before beginning any rough-in work. Verify gravity flow lines and proper invert elevations required prior to starting piping installation.

1.06 PLUMBING SYSTEM IDENTIFICATION

- A. General: Provide adequate marking of plumbing system and control equipment to allow identification and coordination of maintenance activities and maintenance manuals.
 - 1. Furnish and install adequate marking, tagging and labeling of all *accessible and exposed* Plumbing equipment, piping and control devices, per ANSI A13.1-1981. Accessible locations shall include all ceiling spaces above accessible ceilings.
- B. Piping: Identify piping once every 30 feet at each branch, at termination of lines, and near valve or equipment connections. Place flow directional arrows at each piping system for identification of flow direction. Provide lettering of the appropriate size to convey information on wrap-around signage, adhesive-backed or paint stenciled labels.
- C. Valves: Identify all valves with 1-1/2" diameter polished brass tags with stamp-engraved labels or plastic laminate tags. Prefix or color-code tags for each generic piping service. Prepare and submit valve tag schedule, listing location, service and tag description, and incorporate in Instruction Operations Manual.

1.07 FLOOR, WALL, ROOF AND CEILING OPENINGS

- A. The General Contractor will be required to leave openings in ceiling, floors, walls, roof, partitions, etc., as required to install the Plumbing work specified or shown on the Drawings. The Plumbing Contractor is responsible for correct size and location of his openings. Where penetrations through existing construction are required, they shall be the responsibility of the Plumbing Contractor.
 - 1. Pipe Sleeves: Schedule 40 black steel pipe, 1" larger than carrier pipe.
- B. The Plumbing Contractor shall set sleeves and anchors for all equipment, etc., and shall provide watertight seals on pipes through exterior walls, floors and roof and where noted on the Drawings.
- C. Pack annular space between sleeves and pipe with fiberglass insulation and seal with approved caulking materials. Where penetrations occur through fire-rated walls or floors, provide UL listed assembly for fire stopping and sealing penetrations. Seal openings with UL approved fire-resistive fire stop caulk/sealant .
 - 1. Fireproof plastic piping through fire-rated construction per approved UL listed assembly.
- D. Provisions for openings, holes and clearances through walls, floors, ceilings and partitions to be made in advance of construction of such parts of the building.

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- E. If the Plumbing Contractor should neglect to inform the General Contractor of his opening requirements and that portion of the Building construction has been completed, the Plumbing Contractor shall pay the General Contractor for providing such openings.
- F. Make arrangements with various other contractors for all special framing, spacing and chases. Mason will leave chases in mason work, but Plumbing Contractor is responsible for correct size and location.

1.08 CUTTING AND PATCHING

- A. General: Refer to Division 1 General Requirements.
- B. Perform all cutting and patching required for complete installation of the HVAC systems, unless specifically noted otherwise. Provide all materials required for patching unless otherwise noted.
 - 1. All cutting and patching necessary of structural members to install any Plumbing work shall not be done without permission, and then only carefully done under the direction of the Architect/Structural Engineer and General Contractor.
- C. The Contractor shall not endanger any work of other trades by demolition, cutting, digging or otherwise. Any cost caused by defective or ill-timed cutting and patching work shall be borne by the contractor responsible. Each contractor requiring cutting and patching shall hire men skilled in such cutting and patching to do the work.
 - 1. All patching work in existing areas shall match existing work and restore the finish to its original condition in material, quality, texture, finish and color unless specifically noted or scheduled otherwise.

1.09 TESTS AND INSPECTIONS:

- A. All plumbing tests shall be conducted in the presence of and to the satisfaction of the Governing Authorities, Architect/ Engineer, and Owner or his authorized representative.
- B. The Plumbing Contractor shall be responsible for applying tests and ordering inspections as required by Federal, State and local Code and Inspection authorities.
 - 1. All work shall remain exposed until it has been tested, inspected and approved.

1.10 TEMPORARY SERVICES

- A. Provide temporary services for all plumbing services to the existing facility to maintain function of sanitary, storm, natural gas and water services during the construction period.

1.11 EQUIPMENT ACCESS

- A. General: All valves, equipment and accessories shall be installed to permit access to equipment for maintenance, servicing or repairs. Relocation of piping, or equipment to accomplish equipment access shall be completed by this Contractor at no additional cost.
- B. Location: Provide access doors where equipment is located in chases or inaccessible locations. Access panels shall be furnished by this Contractor and installed by the specific trade responsible for the material in which the access panels are installed.
- C. Construction: Access doors in fire-rated construction must have UL label. Access doors shall be of size to provide adequate access to equipment concealed in wall, ceiling and furred-in spaces. Milcor

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or approved equal, 14-gauge steel frame and door, prime-coated, except stainless steel in areas subject to excessive moisture.

1.12 GUARANTEE

- A. All material and workmanship must be new and first class in every respect; the plumbing equipment must be turned over to the owner in complete working order and free from mechanical or performance defects.
- B. The Plumbing Contractor must guarantee all labor and materials for one (1) year from the completion of the plumbing system. Maintain and repair plumbing equipment for the above period, unless such defects are clearly the result of bad management after plumbing system is turned over to the Owner.
- C. Before final acceptance of the plumbing work, the Plumbing Contractor shall have the entire apparatus and system in complete and satisfactory operation and shall maintain same in satisfactory and continuous operation for a period of ten days prior to the date of acceptance; fuel to be furnished by Owner.

1.13 SUBMITTALS

- A. Refer to Division 1 for additional submittal requirements.
- B. The Plumbing Contractor will be held responsible for correction of work deemed necessary by the Engineer due to proceeding with the work without shop drawings that have the Architect/Engineers final approval.
- C. Shop drawings shall include data on physical dimensions, gauges, materials of construction and capacities.
 - 1. Incomplete drawings will be disapproved.
- D. This Contractor will be responsible for all figures and dimensions shown on the shop drawings. Approval of shop drawings describing equipment that cannot fit in the space allotted does not relieve this Contractor from providing equipment that will meet the space requirements.
- E. Submit electronic PDF copies of shop drawings to the Architect/Engineer for approval, with complete detail for all equipment, materials, etc., to be furnished and installed for this project as follows:
 - 1. Valves.
 - 2. Pipe and piping specialties.
 - 3. Insulation systems.
 - 4. Plumbing fixtures.
 - 5. Instructions and O&M manuals(2 copies).
 - 6. As-built Drawings(1 copy).

1.14 HOUSEKEEPING AND CLEANUP

- A. Periodically as work progress and/or as directed by the Architect/Engineer, the Contractor shall remove waste materials from the building and leave the area of the work room clean. Upon completion of work remove all tools, scaffolding, broken and waste materials, etc., from the site.

1.15 INSTRUCTIONS AND MANUALS

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- A. Upon completion of the installation, but before final acceptance of the system, the Plumbing Contractor shall instruct the Owner on the care and operation of all parts of the Plumbing system.
- B. Assemble two (2) complete sets of manufacturer's printed operating and maintenance instructions for all mechanical equipment and installed under this contract. Prepare in bound copies complete with index tabs. Information must include parts lists, equipment warranties, and wiring diagrams. Submit bound copies to Architect for disbursement.

1.16 AS-BUILT DRAWINGS

- A. During construction maintain a set of prints showing installed as-built work for the project.
- B. Upon completion of construction before final acceptance, provide a set of as-built drawings to the Architect/Engineer.

PART 2 - PRODUCTS

2.01 DOMESTIC WATER PIPE SCHEDULE

A. Above Ground Piping:

- 1. Type 'L' copper water tube, H(hard drawn) temper, ASTM B88; with cast copper fittings, ANSI B16.18; wrought copper fittings, ANSI B16.22; lead-free(less than 0.2%) solder, ASTM B32; flux ASTM B813.

2.02 DRAIN, WASTE AND VENT PIPE SCHEDULE

A. Interior Above Ground:

- 1. Cast iron soil pipe and fittings, hub and spigot, service weight, ASTM A74; with casketed neoprene joints.
- 2. Hub-less cast iron soil pipe and fittings, CISPI 301; with no-hub couplings, CISPI 310.
- 3. PVC plastic pipe, Schedule 40, Class 12454-B(PVC 112), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; socket fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.
- 4. Galvanized steel vent pipe, Schedule 40, zinc-coated, ASTM 120 or 53 Grade B; malleable iron threaded fittings, zinc-coated.
- 5. Type "DWV" copper water tube, H(hard drawn) temper, ASTM B88; with cast copper drainage fittings(DWV), ANSI B16.23; wrought copper drainage fittings(DWV) , ANSI B16.29; lead-free(less than 0.2%) solder, ASTM B32; flux, ASTM B813.

2.03 VALVES

A. Approved Manufacturers:

- 1. Conbraco Apollo;
- 2. Milwaukee;
- 3. Watts;
- 4. Nibco.

B. Check valves:

- 1. 2" and smaller: Bronze, screwed, Y-pattern, 200# WOG, swing check type.

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C. Ball valves:

1. 2" and smaller: Two or Three piece, bronze-body, chrome-plated bronze ball, Teflon seat and packing, 400 pig WOG, with stem extensions on insulated piping. Appollo 70-200 series.

2.04 PIPE HANGERS

A. Piping:

1. Split ring hangers with supporting rods.
2. Adjustable clevis.

B. Multiple or Trapeze Hangers:

1. Steel channels with welded spacers and hanger rods.

C. Copper Pipe Supports:

1. All supports, fasteners, clamps, etc. directly connected to copper piping shall be copper-plated or polyvinylchloride(PVC)-coated.
2. Where steel strut supports are used, provide isolation collar between supports/clamp and copper piping.

D. Approved Manufacturers: Fee and Mason, B-line, Grinnell or approved equal.

2.05 CLEANOUTS

A. Interior Floors: Smith 4930-PB square nickel-bronze top.

B. Finished walls: Smith #4532 stainless steel with access plate and screw.

C. Approved Manufacturers: Josam, Smith, Wade, Zurn or approved equal.

2.06 ACCESS

A. General: All piping, conduit and accessories shall be installed to permit access to equipment for maintenance. Any relocation of piping, equipment or accessories required to provide maintenance access shall be accomplished by the Contractor at no additional cost.

B. Removable Access Plates: Where only hand access is sufficient for valve access, provide removable plate-type access unit of minimum size which will facilitate required access.

1. Provide units of type, style, design, material and finish appropriate for location and exposure in each instance.
2. In exposed surfaces of occupied spaces provide round plate units, flush floor units and frameless low-profile wall units, primed-for-paint in painted surfaces and polished chrome or stainless steel finish in other surfaces.

C. Walls:

1. Smith #4767 flush wall stainless steel cover plate with screw latch lock in finished tile walls at wet locations.

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2. Smith #4760 or #4765 with bonderized prime-coated steel face and screw latch lock in walls of other finished rooms.

D. Ceilings:

1. Provide Smith #4765 flush ceiling bonderized prime-coated steel face with screw latch lock.

E. Floors:

1. Smith #4910 with aluminum or nickel-bronze non-skid top.

2.07 WATER HAMMER ARRESTORS

- A. Provide Smith #5000 series or equal, stainless steel or air chambers at each fixture group utilizing a flush valve or fast closing solenoid valve, as sized and recommended by the manufacturer.
- B. *Approved Manufacturers:* Josam, PPP, Smith, Wade, Zurn or approved equal.

2.08 HANDICAPPED INSULATION

- A. Where shown on the Drawings or required by governmental agencies having jurisdiction, provide "Truebro" insulation system or approved equal on exposed hot and cold water supply piping, waste tailpiece and trap at lavatories requiring ADA compliance.

2.09 PIPE INSULATION

- A. General: Provide composite piping insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with ratings not exceeding flame spread of 25 and a smoke developed of 50 in active return air plenums. Ratings in all other areas shall not exceed a flame spread of 25 and a smoke developed of 150 (test method ASTM E-84). Comply with all codes regarding the use of foam insulation.
- B. Insulate piping located in interior space, including (but not necessarily limited to) the following services:
1. Interior cold and hot domestic water piping.
- C. Insulate each piping system with one of the following types and thickness of insulation, except as otherwise indicated (Installer's option where more than one type is indicated).
1. Fibrous Glass: Minimum density 3 lb./cu.ft., thermal conductivity of not more than 0.23 at 75 degrees F mean temperature, suitable for temperatures to 450 degrees F. Kraft-reinforced, foil-vapor barrier, laminate all-service jacket, factory applied to insulation with a self-sealing pressure sensitive adhesive lap, maximum permeance of 0.02 perms and minimum beach puncture resistance of 50 units.
2. Elastomeric Insulation: Closed-cell type, with minimum nominal density of 5.5 lbs./cu.ft., thermal conductivity shall be not more than 0.27 at 75 degrees F mean temperature, and maximum water vapor transmission of 0.17 perm/inch. The material shall be suitable for a temperature range from 220 degrees F to minus 40 degrees F.

D. Insulation Installation Schedule:

| <u>Service</u> | <u>Pipe Size</u> | <u>Insulation Thickness</u> |
|---------------------|------------------|-----------------------------|
| 1. Hot Water Piping | Less than 1" | 1" |

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2. Cold Water Piping Less than 1" 1/2"

2.10 FIXTURES AND EQUIPMENT

- A. General: Provide plumbing fixture, trim, and equipment as shown on the "*Fixture and Equipment Schedule*" on the Contract Drawings, and as specified herein.
- B. All vitreous chinaware and porcelain fixtures shall be select quality.
1. All wastes and supplies for fixtures, except as otherwise specified or required, shall turn back into walls.
- C. All trim, except as otherwise specified, shall be constructed of brass. Finish shall be polished chrome, except where concealed (inside cabinets, etc.).
- D. Faucets shall have replaceable control assemblies or replaceable washers and seats.
- E. Exposed waste fittings shall be constructed of 17 gauge tubular brass. Slip joints are permitted only on the fixture side of the trap.
- F. All fixtures with non-accessible traps such as bathtubs, showers, floor drains, shall have a completely removable stopper or grate in order to be accessible for cleanout.
- G. Quarter-turn (1/4) ball valve type fixture stops shall be installed at each fixture. It is the Contractor's option to install straight or angle type. All stops are to have a minimum of 1/2" inlets with flexible riser and loose key handles where exposed to the public.
1. All shower/bath valves are to have integral stops.
2. All loose stops shall be from the same manufacturer.
- H. Approved manufacturer's for Stainless Steel Sinks:
1. Dayton/Just.
2. Elkay.
- I. Approved manufacturers for Sink and Lavatory Fittings:
1. American Standard.
2. Chicago faucet.
3. Delta.
4. T&B Brass.
5. Symmons.
- J. Approved manufacturers for Supplies, Stops and Traps:
1. McQuire Manuf.
2. Brass Craft.
3. Chicago Faucet.
4. Dearborn Brass.

2.11 OTHER MATERIALS

- A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

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PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

- A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 PLUMBING SYSTEM LAYOUT

- A. Lay out the plumbing system in careful coordination with the Drawings, determining proper elevations for all components of the system and using only the minimum number of bends to produce a satisfactorily functioning system.
- B. Follow the general layout shown on the Drawings in all cases except where other work may interfere.
- C. Lay out pipes to fall within partition, wall, or roof cavities, and to not require furring other than that shown on the Drawings.
- D. Where work is to connect to existing, Plumbing contractor must field verify all connection points before beginning any rough-in work. Verify all connecting invert elevations and flow lines of new work connected to existing gravity drainage.

3.03 INSTALLATION OF PIPING AND EQUIPMENT, GENERAL

- A. General:
1. Proceed as rapidly as the building construction will permit.
 2. Thoroughly clean items before installation. Cap pipe openings to exclude dirt until fixtures are installed and final connections have been made.
 3. Cut pipe accurately, and work into place without springing or forcing properly clearing window, doors, and other openings. Excessive cutting or other weakening of the building will not be permitted.
 4. Show no tool marks or threads on exposed plated, polished, or enameled connections from fixtures. Tape all finished surfaces to prevent damage during construction.
 5. Make changes in directions with fittings; make changes in main sizes with eccentric reducing fittings. Unless otherwise noted, install water supply and return piping with straight side of eccentric fittings at top of the pipe.
 6. Run horizontal sanitary piping at a uniform grade of 1/4" per ft., unless otherwise noted. Run horizontal water piping with an adequate pitch upwards in direction of flow to allow complete drainage.
 7. Provide sufficient swing joint, ball joints, expansion loops, and devices necessary for a flexible piping system, whether or not shown on the Drawings.
 8. Support piping independently at pumps, coils, tanks, and similar locations, so that weight of pipe will not be supported by the equipment.
 9. Pipe the drains from pump glands, drip pans, relief valves, air vents, and similar locations, to spill an open sight drain, floor drain, or other acceptable discharge point, and terminate with a plain and unthreaded pipe 6" above the drain.
 10. Securely bolt all equipment, isolators, hangers, and similar items in place.
 11. Support each item independently from other pipes. Do not use wire for hanging or strapping pipes.
 12. Provide complete dielectric isolation between ferrous and non-ferrous metals.

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13. Provide union and shut off valves suitably located to facilitate maintenance and removal of equipment and apparatus.

B. Equipment access:

1. Install piping, equipment, and accessories to permit access for maintenance. Relocate items as necessary to provide such access, and without additional cost to the Owner.
2. Provide access doors where valves, motors, or equipment requiring access for maintenance are located in wall or chases or above ceilings. Coordinate location of access doors with other trades as required.

3.04 PIPE JOINTS

A. Copper tubing:

1. Cut square, remove burrs, and clean inside of female fitting to a bright finish.
 - a. Apply solder flux with brush to tubing.
 - b. Remove internal parts of solder-end valves prior to soldering.
2. Provide dielectric unions at points of connection of copper tubing to ferrous piping and equipment.
3. For joining copper tubing, use the following:
 - a. Water piping 3" and smaller: 95-5 solder;
 - b. Water piping larger than 3": "Sil-fos" brazing;
 - c. Underground: "Sil-fos" brazing.

B. Screwed piping:

1. Deburr cuts.
 - a. Do not ream exceeding internal diameter of the pipe.
 - b. Thread to requirements of ANSI B2.1.
2. Use Teflon tape on male thread prior to joining other services.
3. Use litharge and glycerin on joint prior to cleaning for air and oil piping.

C. Leaky joints:

1. Remake with new material.
2. Remove leaking section and/or fitting as directed.
3. Do not use thread cement or sealant to tighten joint.

3.05 PIPE SUPPORTS

- A. Support suspended piping with clevis or trapeze hangers and rods.

- B. Space hangers and support for horizontal steel pipes according to the following schedule:

| <u>Pipe size:</u> | <u>Maximum spacing on centers:</u> |
|---------------------|------------------------------------|
| 1-1/4" and smaller: | 8'-0" |
| 1-1/2" to 3": | 10'-0" |

- C. Space hangers and supports for horizontal copper tubing according to the following schedule:

| <u>Tube size:</u> | <u>Maximum spacing on centers:</u> |
|-------------------|------------------------------------|
| 1" and smaller: | 6'-0" |
| 1-1/2": | 7'-0" |

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- D. Provide sway bracing on hangers longer than 18".
- E. Support vertical piping with riser clamps secured to the piping and resting on the building structure. Provide at each floor unless otherwise noted.
- F. Provide insulation continuous through hangers and rollers. Protect insulation by galvanized steel shields.
- G. Arrange pipe supports to prevent excessive deflection, and to avoid excessive bending stress.

3.06 SLEEVES AND OPENINGS

- A. Provide sleeves for each pipe passing through walls, partitions, floors, roofs, and ceilings.
 - 1. Set pipe sleeves in place before concrete is placed.
 - 2. For uninsulated pipe, provide sleeves two pipe sizes larger than the pipe passing through, or provide a minimum of 1/2" clearance between inside and outside of the pipe.
 - 3. For insulated pipe, provide sleeves of adequate size to accommodate the full thickness of pipe covering, with clearance for packing and caulking.
- B. Caulk the space between sleeve and pipe or pipe covering, using a noncombustible, permanently plastic, waterproof, non-staining compound which leaves a smooth finished appearance, or pack with noncombustible asbestos cotton, or fiberglass to within 1/2" of both wall faces, and provide the waterproof compound described above.
- C. Finish and escutcheons:
 - 1. Smooth up rough edges around sleeves with plaster or spackling compound.
 - 2. Provide 1" wide chrome or nickel plated escutcheons on all pipes exposed to view where passing through walls, floors, partitions, ceilings, and similar locations.
 - a. Size the escutcheons to fit pipe and covering.
 - b. Hold escutcheons in place with set screw.

3.07 CLEANOUTS

- A. Secure the Architect's approval of locations for cleanouts in finished areas prior to installation.
- B. Provide cleanouts of same nominal size as the pipes they serve; except where cleanouts are required in pipes 4" and larger provide 4" cleanouts.
- C. Make cleanouts accessible. After pressure tests are made and approved, thoroughly graphite the cleanout threads.

3.08 VALVES

- A. Provide valves in water and gas systems. Locate and arrange so as to give complete regulation of apparatus, equipment, and fixtures.
- B. Provide valves in at least the following locations:
 - 1. In branches and/or headers of water piping serving a group of fixtures.
 - 2. On both sides of apparatus and equipment.
 - 3. For shutoff of risers and branch mains.

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PLUMBING SYSTEMS

4. For flushing and sterilizing the system.
 5. Where shown on the Drawings.
- C. Locate valves for easy accessibility and maintenance.

3.09 PLUMBING FIXTURE INSTALLATION

A. Installation:

1. Set fixtures level and in proper alignment with respect to walls and floors, and with fixtures equally spaced.
 2. Provide supplies in proper alignment with fixtures and with each other.
- B. Grout wall and floor mounted fixtures watertight where the fixtures are in contact with walls and floors.
- C. Caulk deck-mounted trim at the time of assembly, including fixture and casework mounted. Caulk self-rimming sinks installed in casework.

3.10 DISINFECTION OF WATER SYSTEMS

A. Disinfect hot and cold water systems.

1. Perform disinfection under the Architect's observation. Notify the Architect at least 48 hours prior to start of the disinfection process.
 2. Upon completion of disinfecting, secure and submit the Certificate of Performance, stating system capacity, disinfectant used, time and rate of disinfectant applied, and resultant residuals in ppm at completion.
 3. Use disinfectant method approved by the Architect.
- B. When disinfection operation is completed, and after final flushing, secure an analysis by a laboratory approved by the Architect, based on water samples from the system, showing test negative for coli-aerogene organisms. Provide a total plate count of less than 100 bacteria per cc, or equal to the control sample.
- C. If analysis results are not satisfactory, repeat the disinfection procedures and retest until specified standards are achieved.

3.11 OTHER TESTING AND ADJUSTING

- A. Provide personnel and equipment, and arrange for and pay the costs of, all required tests and inspections required by governmental agencies having jurisdiction.
- B. Where test show materials or workmanship to be deficient, replace or repair as necessary, and repeat the tests until the specified standards are achieved.
- C. Adjust the system to optimum standards of operation.

END OF SECTION

SECTION 23 05 00
HVAC GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. HVAC work includes:

1. Furnish all labor and materials necessary for the complete installation of heating, ventilating and air conditioning system as shown on the drawings and/or specified herein.
2. Drawings: Refer to H-Series drawings for graphic representations, schedules and notations showing HVAC work.
3. Specifications: Applicable portions of Division 1 govern all work under this Section. Refer to Division 23 Sections for primary technical specifications of HVAC work, as listed below:

| | |
|----------|---------------------------------|
| 23 05 00 | HVAC General Provisions |
| 23 05 90 | Testing Adjusting and Balancing |
| 23 06 00 | Pipe and Pipe Fittings |
| 23 06 30 | Piping Specialties |
| 23 09 10 | Supports and Anchors |
| 23 10 00 | Valves |
| 23 25 00 | Mechanical Insulation |
| 23 63 00 | Water Treatment |
| 23 74 00 | Terminal Air Distribution Units |
| 23 84 00 | Ductwork |
| 23 86 00 | Ductwork Accessories |
| 23 87 00 | Air Outlets and Inlets |
| 23 89 50 | Variable Frequency Drives |
| 23 90 00 | Controls and Instrumentation |
| 23 90 10 | DDC Points List |
| 23 96 00 | Starting of Mechanical Systems |

4. HVAC demolition and remodeling.
5. Equipment structural supports, prime painted.
6. Motors for all HVAC equipment.
7. Secure and pay all fee
8. Test, adjust and balance HVAC systems.
9. Cutting and patching existing conditions for HVAC equipment by the HVAC Contractor.

1.2 RELATED DOCUMENTS

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

B. Work by HVAC Contractor :

1. Field painting of all exposed piping, ductwork, hangers, supports and related metal work, unless noted specifically in the Drawings or Specifications herein.
2. Building provisions for all recesses and chases intended as equipment space for ductwork and piping in new construction.
3. Lintels and openings for ducts and piping through existing walls, floors and ceilings.
4. Line voltage (greater than 100 volts) wiring, conduit and connections.
5. All equipment starters not furnished as integral part of HVAC equipment.

D. Coordination of Work:

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1. General: Contract Documents are diagrammatic in showing certain physical relationships which must be established within HVAC work, and in its interface with other work including electrical work, and that such establishment is the exclusive responsibility of the Contractor.
2. Arrange HVAC work in neat, well organized manner with piping and similar services running parallel with primary lines of building construction, and with minimum of 7 foot overhead clearance where possible.
3. Give right-of-way to piping which must slope for drainage.
4. Advise other trades of openings required in their work for subsequent move-in of large units of HVAC work.
5. Install all sensor wells, dampers and valves provided by the Temperature Control Sub-Contractor.
6. Variable frequency drives provided by the HVAC Contractor and wired by the Electrical Contractor.

1.3 SHOP DRAWINGS AND SAMPLES

- A. The Contractor shall submit to the Architect for approval, shop drawings, giving details, dimensions, capacities, accessories, wiring diagrams, etc., of all materials as indicated in respective specification sections.
- B. All shop drawings shall include proper identification of equipment by name and/or number, as indicated in the specification and/or shown on the plans.
- C. Shop drawings shall be submitted for approval as soon as practicably possible after award of contract. Shop drawings must be approved before installation of materials and equipment. Drawings shall be submitted in accordance with the requirements outlined in Division 1 of the Specifications.
- D. The examination and approval of shop drawings shall not relieve the Contractor from any obligation to perform the work strictly in accordance with the Contract Drawings and Specifications. The responsibility for errors in shop drawings shall remain with the Contractor.
- E. Electronic shop drawing submittals require file labeling to match specification section contained and all equipment identified properly compatible with construction documents. All shop drawings improperly labeled and identified will be returned for corrections.

1.4 QUALITY ASSURANCE

- A. Qualifications of Installers: For the actual fabrication, installation and testing of work under this Section, use only thoroughly trained and experienced workmen completely familiar with the items required and the manufacturer's current recommended methods of installation.
- B. In acceptance or rejection of installed work, the Architect will make no allowance for lack of skill on the part of the workmen.
- C. Reference Standards: Specifically, for HVAC work in addition to standards specified in individual work section, the following standards are imposed, as applicable to work in each instance:

| | |
|--------|---|
| AABC | Associated Air Balance Council |
| ADC | Air Diffusion Council |
| AGA | American Gas Association |
| AMCA | Air Movement and Control Association |
| ANSI | American National Standard Institute |
| ARI | Air Conditioning and Refrigeration Institute |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society of Testing and Materials |
| AWS | American Welding Society |

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| | |
|--|--|
| IEEE | Institute of Electrical and Electronics Engineers |
| MICA | Midwest Insulation Contractors Association |
| MSS | Manufacturer's Standardization Society |
| NBS | National Bureau of Standards |
| NEBB | National Environmental Balancing Bureau |
| NEC | National Electrical Code |
| NEMA | National Electric Manufacturer's Association |
| NFPA | National Fire Protection Association |
| SMACNA | Sheet Metal and Air Conditioning Contractor's National Association |
| UMC | Uniform Mechanical Code |
| UL | Underwriter's Laboratories |
| All federal, state, local codes, ordinances and utility regulations. | |

D. Environmental design conditions for all occupied areas are as follows:

| | <u>Winter</u> | <u>Summer</u> |
|----------|---------------|-------------------------|
| Inside: | 70 degrees F | 74 deg. F 50% RH |
| Outside: | -15 degrees F | 91 deg. dbF/74 deg. wbF |

E. Approval of Materials: Refer to General Conditions, Supplementary General Conditions and other requirements of Division 1 for approval of materials and requirements of substituted equipment.

1.5 JOB CONDITIONS

A. Building Access: Arrange for the necessary openings in the building to allow for admittance of all HVAC equipment.

B. Temporary Services: No service shall be interrupted or changed without the prior approval of the Owner. Refer to Division 1 requirements.

C. Compatibility: Provide products which are compatible with other products of HVAC work, and with other work requiring interface with HVAC work. Provide products with proper or correct power characteristics, fuel-burning characteristics and similar adaptation for Project. Coordinate selections from among options for compatibility of products. Design and layout is based on equipment scheduled on drawings or in specifications.

1. Contractor shall coordinate installation of equipment supplied by other approved equal manufacturers and shall make necessary field modifications to allow for installation of this equipment at no additional expense to the Owner.

D. Record Drawings: Refer to Division 1 requirements.

1.6 REMODELING REQUIREMENTS

A. Prebid Survey: HVAC Contractor shall survey the job site before submitting his bid to determine the extent of areas requiring demolition, relocating and remodeling. The extent of equipment and materials to be removed. Routings for existing and new piping services and systems. Examine accessibility, material storage and working space available.

B. Maintenance of Service: The building will be continuously occupied during the construction period except as noted. Special efforts shall be made to avoid interference with building functions. Consult with the Owner prior to performing work in public areas of building or to turn off services, so that Owner can advise as to most suitable time for the necessary interruptions. All such work and interruptions to services shall be performed at times, which are approved by the Owner.

C. Demolition: Carefully examine the present building site, together with all of the drawings and specifications. Within areas involving remodeling, each Contractor shall be responsible for removal

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of, relocation of, or revisions to existing equipment, wiring, piping, fixtures and all other existing facilities under appropriate headings of his work, which is necessary to accomplish the final arrangement indicated on the Architect's plans. To assist the Contractor in meeting the above requirement, the drawings note certain of these items, but the absence of such notes shall not limit the responsibility of each Contractor to perform all work as described in this paragraph.

- D. Disposition of Demolition Materials and Equipment: Materials demolished or removed shall become the property of the Contractor and shall be removed from the site, except items, which are to be reused or are specifically noted as remaining the property of the Owner.
- E. Cutting or Patching Existing Facility:
 - 1. HVAC Contractor will be required to do all remodeling, cutting and/or construction removal and all patching or construction replacement as required for his work except for specific cutting and patching described in the documents as being performed by a specific Contractor.
 - 2. HVAC Contractor shall not endanger any work by any demolition, cutting, digging or otherwise. Any cost caused by defective or ill-timed work shall be borne by the contractor responsible.
 - 3. HVAC Contractor requiring cutting and patching shall hire men skilled in such cutting and patching to do the work.
 - 4. All new work in existing areas shall match existing work in material, quality, texture, finish and color unless specifically noted or scheduled otherwise.

1.7 DEMOLITION

- A. The Contractor is responsible for removal and relocation of all existing HVAC equipment and related items affected by the remodeling area.
- B. To assist the Contractor in meeting the above design intent, the drawings note certain of these items, but the absence of such notes shall not limit responsibility of the Contractor to perform all demolition work as required to accomplish new design plan.
- C. Contractor shall coordinate his remodeling efforts with the building functions and avoid interference wherever possible. All such interruptions of existing services shall be performed at times which are approved by the Postmaster.
- D. Interruption of domestic water service during the course of demolition and new work shall be minimized. Interruptions of domestic water service shall be coordinated and approved by the Postmaster, prior to disconnecting or turning off.
- E. All existing demolished or removed equipment shall be removed from site and disposed of properly at the cost of the Contractor.

PART 2 - PRODUCTS

2.1 ELECTRICAL PROVISIONS OF HVAC WORK

- A. General: The electrical provisions of HVAC work, where indicated to be furnished integrally with HVAC equipment, can be summarized, but not by way of limitation, to include the following: 1) Motors, 2) Motor starters, 3) Control switch, pilot lights, interlocks, and similar devices, and 4) Drip pans to protect electrical work.
 - 1. Temperature Control Sub-Contractor (T.C.C.) shall furnish and install control wiring as part of the Temperature Control Contractor work.

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2. Power wiring, connections to equipment, motor control wiring and related work by Electrical Contractor.
3. Motor starters, disconnects, relays, pushbuttons, pilot lights and related motor control items not furnished integrally with HVAC equipment shall be furnished by Electrical Contractor.
4. Provide equipment list, locations and wiring diagrams to Electrical Contractor for all HVAC equipment requiring electrical connections.

B. Motors:

1. Standards: Where not otherwise indicated, comply with applicable provisions of the NEC, NEMA Standards, and sections of Division 16 of specifications. All motors 1 HP and larger shall be NEMA Premium Efficiency VFD compatible motors meeting or exceeding values tested in accordance with IEEE Standard 112, Method B procedures as stated in NEMA MG 1-12.53a and shall be EPACT approved.
2. Temperature Rating: Class B insulation for 70 degree C temperature rise, except where otherwise indicated or required for service.
3. Phases and Current: 1/6 HP and smaller is Contractor's option; up to 1/2 HP, capacitor-start, 120 or 277 volt, 60 cycle single-phase; 1/2 HP and larger, squirrel-cage induction NEMA rated 208 or 477 volt, three-phase, 60 cycle.
4. Service Factor: 1.15 for motors in drip-proof enclosures, all other enclosures to have minimum 1.0 service factor.
5. Construction: Select motors for conditions in which they will be required to perform: i.e., general purposes, splash proof, explosion proof, standard duty, high torque or other special type as required by manufacturer's recommendations. Enclosures shall be of the type recommended by manufacturer for the specified application.
6. Frames: NEMA Standard for horsepower specified.
7. Bearings: Permanently lubricated and sealed ball bearings, 1/8 HP and less may be shaded pole type permanently oiled unit bearings.
8. Overload Protection: Built-in thermal; with internal sensing device for stopping motor, and for signaling where required.
9. Provide premium efficiency electric motors with shaft grounding rings on all VFD controlled new electric motors.

C. Starters, Switches: All starters shall have thermal overload and low voltage protection, and shall comply with Electrical Division 16 sections of specifications.

D. Wiring Connections:

1. Motors: Wired connections in flexible conduit, except where plug-in electrical cords are indicated and permitted by governing regulations.
2. General Wiring: Comply with applicable provisions of Electrical Division 16 sections of specifications.

E. Drip Pans: Furnish drain pans below piping which passes directly above electrical work. Locate pan immediately below piping and extend a minimum of 6 inches on each side of piping and lengthwise 18 inches beyond equipment. Fabricate of galvanized sheet metal or copper with 2 inch deep watertight pan, copper drain piping and drain valve

2.2 FLOOR, WALL, ROOF AND CEILING OPENINGS

A. Provide sleeves for pipes and ducts passing through masonry, concrete or other similar construction. Openings for pipes shall be 1" larger in diameter than pipe passing through, including insulation, where indicated. Openings for ductwork shall be 1/2" larger on all sides than size of duct passing through, including duct insulation, where indicated. Coordinate additional space requirements for fire or smoke damper installation.

1. Pipe sleeves: Standard weight steel pipe.

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2. Duct sleeves: 24 gauge galvanized sheet metal, unless noted otherwise.
- B. Grout openings between sleeves and concrete or masonry walls and floors with sand-cement mortar consisting of one part portland cement and three parts sand, by volume. Add sufficient water to make a stiff placeable mortar.
- C. Close joints between sleeves and non-masonry walls and floors with suitable caulking applied over polyethylene foam backer, compatible with caulking used.
- D. Pack annular space between sleeves and insulation pipe or ducts with glass fiber blanket insulation and seal with Urethane caulking compound.
- E. Where penetrations occur through fire rated walls or floors, fill annular space with fire-resistive materials in compliance with a UL approved fire rated assembly. Seal annular space through fire rated walls or floors with a UL listed fire resistant sealant and materials in conjunction with the fire rated assembly.

2.3 CUTTING AND PATCHING

- A. General: Perform all cutting and patching required for complete installation of HVAC systems, unless specifically noted otherwise. Provide all materials required for patching unless otherwise noted. All cutting and patching necessary of structural members to install any HVAC work shall not be done without permission, and then only carefully done under the direction of the Architect.
 1. Any floor / ceiling cutting required at the facility requires X-ray of affected areas prior to starting any cutting or coring.
- B. All new work cut or damaged shall be patched and restored to its original condition.

2.4 EQUIPMENT ACCESS

- A. General: All valves, volume dampers, equipment and accessories shall be installed to permit access to equipment for maintenance, servicing or repairs. Any relocation of piping ductwork, equipment or accessories required to provide maintenance access shall be accomplished by the HVAC Contractor at no additional cost to the Owner.
- B. Provide access doors where equipment is located in chases or generally inaccessible. Access doors used in fire-rated construction must have UL label. Minimum access panel size 12" x 12" or of sufficient size to allow total access for maintenance. Coordinate location with General Contractor.
- C. Access panels shall be furnished and installed by the HVAC Contractor in plaster walls, ceilings and related inaccessible surfaces.
- D. Access Doors: Milcor or approved equal, steel frames and door, prime coated, except stainless steel in areas subject to excessive moistures, such as toilet rooms.

2.5 EQUIPMENT SUPPORTS

- A. General: Provide all supporting steel and related materials not indicated on structural drawings as required for the installation of equipment and materials, including angles, channels, beams and hangers.

2.6 EQUIPMENT GUARDS

- A. General: Provide equipment guards over belt-driven assemblies, pump shafts, exposed fans and elsewhere, as indicated in this specification or required by code.

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2.7 CONCRETE FOR HVAC WORK

- A. General: All concrete work necessary for HVAC equipment by the HVAC Contractor.
- B. General Standards: Except as otherwise indicated, comply with applicable provisions of Division 3 for concrete work.
- C. Concrete Equipment Pads: For each piece of HVAC equipment as indicated on the drawings, arrange to install a 4" concrete housekeeping pad a minimum of 2 inches wider than full size of the respective equipment's base. Equipment pads are required for the following equipment.
 - 1. None anticipated for this project.

2.8 PAINTING HVAC WORK

- A. General: All painting of mechanical equipment will be done by the HVAC Contractor unless equipment is hereinafter specified to be furnished with factory applied finish coats. Coordinate the exterior finish painting and color of exterior HVAC equipment with the General Contractor.
 - 1. Exposed ductwork in finished areas outside mechanical rooms shall be cleaned for accepting a paint finish or have factory-applied paint grip finish.
- B. Prime paint all field fabricated metal work under HVAC work, comply with applicable provisions of Division 9.
- C. All equipment shall be provided with factory applied prime finish, unless otherwise specified.
- D. Interior duct surfaces, dampers and other accessories visible through grilles, registers and diffusers shall be painted with flat black paint.
- E. If factory finish on any equipment is damaged in shipment or during construction of the building, the equipment shall be refinished by the Contractor to the satisfaction of the Architect.

2.9 HVAC SYSTEM IDENTIFICATION

- A. General: Provide adequate marking of HVAC system and control equipment to allow identification and coordination of maintenance activities and maintenance manuals. Tag and label HVAC equipment located in exposed or in accessible areas to conform to ANSI A13.1-1981. After painting and/or covering is complete, identify all equipment, piping and ductwork by its abbreviated generic name as shown/scheduled/specified.
- B. Equipment: Identify all major HVAC equipment with plastic-laminate signs or 2" minimum high painted stencils and contrasting background. Provide text of sufficient clarity and lettering to convey adequate information at each location and mount permanently. Identify control equipment by 1-1/2" x 4" plastic nameplates with 1/2" high lettering.
- C. Piping and Ductwork: Identify piping and ductwork once every 30 feet at each branch, at termination of lines, and near valve or equipment connections. Place flow directional arrows at each pipe or duct identification. Provide 2" minimum high letters on wrap-around siphonage, adhesive-backed or paint stenciled.
- D. Valves: Identify all valves with 1-1/2" minimum polished brass stamp-engraved or plastic laminate tags. Prefix or color-code tags for each generic piping service. Prepare and submit valve tag schedule, listing location, service and tag description, incorporate in Instruction Manual. Mount valve tag schedule behind glass in mechanical room at location determined by Owner.

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- E. Operational Tags: Where needed for proper or adequate information on operation and maintenance of HVAC systems, provide tags of plasticized or laminated card stock, typewritten to convey the message.

PART 3 - EXECUTION

3.1 HVAC WORK CLOSEOUT

- A. Lubrication: Upon completion of the work and before turning over to the Owner clean and lubricate all bearings except sealed and permanently lubricated bearings. Use only lubricant recommended by the manufacturer.
- B. Contractor is responsible for maintaining lubrication of all mechanical equipment under his contract until work is accepted by the Owner.
- C. Cleaning: After installation has been completed, Contractor shall clean all systems. All piping and ductwork shall be cleaned both internally and externally to remove all dirt, plaster dust or other foreign materials. All temporary throwaway or replaceable media air filters used during the construction period shall be replaced by new filters or new filter media after construction has been completed and before the building is turned over to the Owner. Check all strainers for clean screens.
- D. All dirt, plaster dust and other foreign matter shall be blown and/or vacuum cleaned from coils, terminal devices, diffusers, registers and grilles. Equipment shall be thoroughly cleaned of all stains, paint spots, dirt and dust.
- E. Housecleaning and Cleanup: Periodically as work progresses and/or as directed by the Architect, the Contractor shall remove waste materials from the building and leave his area of work broom clean. Upon completion of work, remove all tools, scaffolding, broken and waste materials, etc., from the site.

3.2 INSTRUCTION AND MAINTENANCE MANUALS

- A. Instruction Manuals: Upon completion of work, but before final acceptance of the system, furnish to the Engineer for approval, three (3) instruction and maintenance manuals in loose leaf binders. One approved copy shall be returned for use during instructional period. Manual shall have an index of contents and tab for each piece of equipment or system, as well as the following:
1. Manufacturer's O&M instructions, parts list and data sheets.
 2. Copies of all shop drawings.
 3. Wiring diagrams.
 4. Start-up and shutdown procedures.
 5. Composite electrical diagrams, and flow diagrams.
 6. Test records.
- C. Equipment Parts Lists: Include a complete list of all equipment furnished for project, with a tabulation of descriptive data of all the equipment replacement parts proposed for each type of equipment or system. Properly identify each part of part number and manufacturer.
- D. Instruct Owner's maintenance personnel in the operation and maintenance of all equipment, including composite operating cycle of all equipment. Include not less than 8 hours of instruction, using the O&M manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment.

SECTION 23 05 00
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- E. Service Organizations: At time of substantial completion, Contractor shall provide Owner with listing of qualified service organizations, including addresses and telephone numbers for each piece of major equipment.

3.3 RECORD DRAWINGS

- A. Refer to Division 1 for further requirements.
- B. Maintain a record set of as-built drawings for all HVAC work performed. As-built drawings shall be continuously updated as the project progresses and be available for periodic inspection by the A/E.

3.4 GUARANTEE PERIOD

- A. Guarantee all equipment, materials, and workmanship to be free from defects for one year after acceptance by the Owner. Repair, replace or alter systems found defective at no extra cost to the Owner.
- B. At the time of substantial completion, turn over the prime responsibility for operation of HVAC equipment and systems to the Owner's operating personnel. During guarantee period, provide one operating engineer, familiar with the work, to consult with and continue training Owner's personnel on an as-need basis.

END OF SECTION

SECTION 23 05 90
TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. General Requirements: Contractor shall be responsible for providing complete test-adjust-balance (TAB) work of all hydronic and air systems including distribution systems and the equipment and apparatus connected.
- B. Work Included:
1. The extent of TAB work is indicated by the requirements of this section, and also by drawings and schedules, and is defined to include, but is not necessarily limited to, hydronic and air distribution systems, and associated equipment and apparatus of HVAC work.
 2. The work consists of setting speed and volume (flow) adjusting facilities provided for the systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to the work as required by the Contract Documents.
 3. The component types of testing, adjusting and balancing specified in this section include but are not limited to the following HVAC equipment:
 - a. Air handling units and fan units.
 - b. Hydronic distribution.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
1. 23 06 00 Piping Specialties
 2. 23 74 00 Terminal Air Distribution Units
 3. 23 89 50 Variable Frequency Drives
 4. 23 90 00 Controls and Instrumentation
 5. 23 96 00 Starting of Mechanical Systems

1.3 QUALITY ASSURANCE

- A. Tester: Performed by an Independent Trade who is specifically and actively engaged in the balancing business and regularly does such work. Certified by the NEBB (National Environmental Balancing Bureau), AABC (Associated Air Balance Council) or approved equal in those testing and balanced disciplines similar to those required for this project.
- B. Reference Standards: Comply with AABC's Pub. No. 12173, "National Standards for Field Measurements and Instrumentation, Total System Balance", as applicable to HVAC air and hydronic distribution system and associated equipment and apparatus.
- C. Industry Standards: Comply with ASHRAE recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.
- D. Submittals:
1. Submit electronic PDF copies of certified test report and types of instruments used and their most recent calibration data with submission of final test report.

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2. Final test report shall bear the name of the person who recorded the data and the seal of the supervisor of the balancing trade.
- E. Guarantee: Guarantee that all TAB work be performed in accordance with NEBB or AABC standards and that all air systems operate within plus or minus 10 percent of the design flow rates as shown on the plans and/or as scheduled.

1.4 JOB CONDITIONS

- A. Do not proceed with testing, adjusting and balancing work until the work to be TAB'ed has been completed and is operable. Ensure that there is no latent residual work still to be completed.
 1. Do not proceed until the work scheduled for TAB'ing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Patching Materials:
 1. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housing which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes.
 2. At Tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housing.
- B. Test Instruments: Utilize test instruments and equipment for the TAB work required, of the type, precision and capacity as recommended for the following TAB standards: AABC's National Standards for Field Measurements and Instrumentation, Total Balance System.

PART 3 - EXECUTION

3.1 ADJUSTMENT AND TESTING

- A. Tester must examine the installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Notify the Contractor in writing of conditions detrimental to the proper completion of the test-adjust-balance work. Do not proceed with the TAB work until unsatisfactory conditions have been corrected in a manner acceptable to the Tester.
- B. Test, adjust and balance the environmental systems and components, as indicated, in accordance with the procedures outlined in the applicable standards.
- C. Prepare report of the test results including instrumentation calibration reports in format recommended by the applicable standards.
- D. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommended by the original Installer.
- E. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.

SECTION 23 05 90
TESTING, ADJUSTING AND BALANCING

3.2 AIR SYSTEMS

A. Test, adjust and balance systems in accordance with the following procedure:

1. Preliminary:
 - a. Identify and list size, type and manufacturer of all equipment to be tested, including air terminals; check all system components for proper installation and operation.
 - b. Use manufacturer's ratings for all equipment to make required calculations except where field test shows ratings to be impractical.
 - c. Verify that all instruments are accurately calibrated and maintained.
 - d. Install clean filters furnished by the mechanical contractor in all equipment.
2. Central System:
 - a. Test, adjust and record supply fan RPM design requirements within limits of mechanical equipment provided.
 - b. Test and record motor voltage and running amperes including motor nameplate data and starter heater ratings.
 - c. Make Pitot tube traverse of main supply, return and fresh air return ducts, determine and record CFM at fan and adjust fan to design CFM.
 - d. Test and record total system static pressure and suction and discharge static pressure across coils, filters and related air handling sections.
 - e. Test and adjust systems for design recirculated air; CFM.
 - f. Test and record cooling apparatus entering air temperatures; dry bulb and wet bulb.
 - g. Test and record heating apparatus entering and leaving air temperatures; dry bulb.
3. Each Fan:
 - a. Each outlet and inlet average velocity, area, CFM.
 - b. Test and record total system static pressure at suction and discharge of fan coils.
 - c. Fan RPM motor RPM.
 - d. Motor name plate current testing.
 - e. Motor current draw.
4. Distribution: Adjust zones or branch ducts to proper design CFM, supply; return and exhaust.
5. Air Terminals:
 - a. Identify each air terminal from reports as to location and determine required flow reading.
 - b. Test, adjust and balance each air terminal to within 10% of design requirement. Record readings.
 - c. Set minimum and maximum flow rates for VAV terminals at specified supply duct pressures and 90% system diversity(10% terminal units at minimum flow rate).
6. Verification:
 - a. Prepare summation of reading of observed CFM for each system, compare with required CFM and verify that values are within 10% of specified quantities. Determine final coil and filter static pressure drops.
 - b. Verify design CFM at fans as described above.

3.3 HYDRONIC SYSTEMS

A. Test, adjust and balance system in accordance with following procedures:

1. Preliminary:
 - a. List all mechanical specifications of tested equipment verify against contract documents. Check all system components for proper installation and operations. Clean all screens.

SECTION 23 05 90

TESTING, ADJUSTING AND BALANCING

- b. Open all line valves to full open position. Close coil bypass stop valves, then set mixing control valve to full coil flow.
 - c. For each pump, verify rotation, test and record pump shut-off head and test and record pump wide-open head.
 - d. Verify proper water level in expansion tanks and in the system.
 - e. Verify that air vents in high points of water systems are installed and operating freely.
 - f. Verify that all instruments are accurately calibrated and maintained.
2. Central Equipment:
- a. Set and record hot water pumps to proper flow quantity.
 - b. Adjust and record flow of hot and chilled water through boilers and chiller equipment to design quantities.
 - c. Observe and record leaving water temperature and return water temperatures at boiler, chiller equipment and zone water distribution loops. Reset to correct design temperatures.
 - d. Record pump operating suction and discharge pressures. Determine final dynamic head.
3. Distribution:
- a. Balance and record flow to each hot and chilled water hydronic zone and terminal unit. For heating mode and cooling mode (chiller).
 - b. Adjust and record terminal unit flow rates and pressure drops.
 - c. Adjust and record coil flow rates and pressure drops. Verify entering and leaving water temperatures at coil terminals.

3.4 AUTOMATIC CONTROL SYSTEM

- A. Temperature control manufacturer's representative sets and adjusts automatically operated devices to achieve required sequence of operations.
- B. Testing organization verifies all controls for proper calibration and list those controls requiring adjustment by temperature control system installer.

END OF SECTION

**SECTION 23 06 00
PIPE AND PIPE FITTINGS**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of pipe and pipe fitting work is indicated on drawings and by the requirements of this section.
- B. Types of pipe and pipe fittings required for this project include the following:
 - 1. Heating hot water
 - 2. Low Pressure Steam
 - 3. Low Pressure Steam Condensate

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 05 00 HVAC General Provisions
 - 2. 23 06 30 Piping Specialties
 - 3. 23 09 10 Supports and Anchors
 - 4. 23 10 00 Valves
 - 5. 23 63 00 Water Treatment

1.3 QUALITY ASSURANCE

- A. American National Standards Institute, ANSI:
 - 1. B31.1: Power Piping.
- B. Welder Qualifications:
 - 1. Prior to starting any metallic welding, Contractor shall submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau.
- C. Employ piping materials meeting the latest revision of ASTM specifications as listed in this specification.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Where possible, store pipe and tube inside and protected from weather. When necessary to store outside, elevate well above grade and enclose with durable, waterproof wrapping.
- B. Prevent dirt and construction debris from accumulating inside the pipe and pipe fittings, cap open ends whenever possible. Store plastic pipe out of direct exposure to sunlight and support to prevent sagging and bending.

1.5 SUBMITTALS

- A. Submit schedule of pipe and pipe fittings showing manufacturer and catalog number.

**SECTION 23 06 00
PIPE AND PIPE FITTINGS**

- B. Submittal may be in the form of a typewritten list, with proper references, indicating service and pipe or pipe fitting specifications.

PART 2 - PRODUCTS

2.1 HOT WATER SYSTEM

A. 2" and smaller:

1. ASTM A-53 Type F, standard weight, schedule 40, black steel pipe with class 125, standard weight cast iron threaded fittings.
2. ASTM B88 seamless, Type L, hard temper copper tube with wrought copper 95-5 solder-joint fittings.

2.2. LOW PRESSURE STEAM (15 psig and lower)

- A. 2" and Smaller above grade in buildings: ASTM A53, type F, standard weight (schedule 40) black steel pipe with ASTM A126/ANSI B16.4, Class 125 cast iron threaded fittings.

2.3 LOW PRESSURE STEAM CONDENSATE (Steam pressure 15 psig and lower)

- B. 2" and Smaller above grade in buildings: ASTM A53, type F, extra strong (schedule 80) black steel pipe with ASTM A126/ANSI B16.4, Class 125 cast iron threaded fittings.

2.3 DIELECTRIC UNIONS

- A. 1" and smaller: ASTM A197/ANSI B16.3 WOG malleable insulating unions with vulcanized fiber insulating sleeve and neoprene gasket, equal to Stockam Figure 693-1/2, or EPCO model FX or FB dielectric unions with Epconite No. 2 gasket, 250 PSIG at 210 degrees F.
- B. 1-1/2" and larger: EPCO model GX dielectric flange with Epconite No. 2 gasket, 175 PSIG at 210 degrees F.
- C. Clear flow dielectric fittings may be used in lieu of dielectric unions for pipe sizes 2" and smaller.

2.4 UNIONS AND FLANGES

A. 2" and smaller:

1. ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Copper unions with all copper piping. Stainless steel unions with all stainless steel pipings.
2. Use unions of a pressure class equal to or higher than specified for the fittings of the respective piping service.

PART 3 - EXECUTION

3.1 PREPARATION

SECTION 23 06 00
PIPE AND PIPE FITTINGS

- A. Set pipe on end and hammer sides to remove foreign materials before erection. Ream ends of all piping to remove burrs.

3.2 ERECTION

- A. Install all piping parallel to building walls and ceilings and at such heights not to obstruct any portion of window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings or other architectural details before installing piping.
- B. Provide anchors, expansion joints, swing joints and expansion loops so that piping may expand and contract without damage to itself, equipment or building.
- C. Mitered ells, notches tees and "orange peel" reducers are not acceptable. On threaded piping, bushings are not acceptable.
- D. "Weld-o-lets" and "Thread-o-lets" may be used for branch takeoff up to one half (1/2) the diameter of the main.
- E. Install drains throughout the systems to permit complete drainage of the entire system.
- F. Do not install piping through dedicated electrical rooms or spaces unless the piping is serving this room or space.
- G. Install 2" deep galvanized sheet metal drain pans below piping which passes over electrical switching apparatus. Pipe drain pans to an accessible location with a drain valve and hose bibb adapter such that the system may be drained without damage to other equipment, insulation or finished spaces.
- H. Install all valves, control valves and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

3.3 INSTALLATION OF PIPE

- A. Run pipe lines straight and true, parallel to building lines with minimum use of offsets and couplings.
- B. Provide only such offsets as may be required to provide necessary head room or clearance and to provide necessary flexibility in pipe lines.
- C. Changes:
 - 1. Changes in direction of pipe lines made only with fittings or pipe bends.
 - 2. Changes in size shall be made only with fittings.
 - 3. Do not use miter fittings, face of flush bushings or street elbows.
 - 4. All fittings of long radius type, unless otherwise indicated.
- D. Use full and double lengths wherever possible:
 - 1. Cut pipe to exact measurement and install without springing or forcing except in case of expansion loops where cold springing is indicated.

**SECTION 23 06 00
PIPE AND PIPE FITTINGS**

2. Take particular care to avoid creating, even temporarily, undue loads, forces, or strains on valves, equipment or building elements either piping connections or piping supports.

- E. Install piping to allow for expansion and contraction without stressing pipe or equipment connected.

- F. Provide clearance for installation of insulation and for access to valves, air vents, drains, and unions.

- G. Sizing:
 1. Unless otherwise indicated, install all supply piping, including shut-off valves and strainers, to coils, pumps, and other equipment at line size with reduction in size being made only at inlet to control valve or pump.
 2. Install supply piping from outlet of control valve at full size connection in equipment served.
 3. Install outlet piping including dirt pockets or mud legs from equipment full size of connection in equipment served.
 4. Install piping, check valves, strainers, and shut-off valves in these equipment outlet or return lines beyond dirt pockets size of tapping in trap or if no trap, size of equipment connection.

- H. Make reductions in water pipes with eccentric reducing fittings installed to provide drainage and venting.

- I. Branch Take-Offs:
 1. Liquids: From top, bottom, or side of mains or headers at either 45 degrees or 90 degrees from horizontal plane.
 2. Use main sized saddle type branch connections or directly connecting branch lines to mains in steel piping if main is at least 1 pipe size larger than branch for up to 6 inch mains.
 3. Do not project branch pipes inside main pipe.
 4. Provide flanges or unions at all final connections to equipment, traps and valves to facilitate dismantling.
 5. Arrange piping and piping connections so that equipment being served may be serviced or totally removed without disturbing piping beyond final connections and associated shut-off valves.

- J. Pipe Drainage Provision:
 1. Slope water piping 1 inch in 40 feet and arrange to drain at low points.
 2. Closed Systems:
 - a. Equip low points with 3/4 inch valves and hose nipples.
 - b. At high points, provide collecting chambers and high capacity float-operated automatic air vents or manual air vents.

3.4 THREADED PIPE JOINTS

- A. Cut threads so that no more than three threads remain exposed after the joint is made. Ream all pipe ends after cutting and clean before erection. Use a thread lubricant when making joints; no hard setting pipe thread cement or caulking will be allowed.

3.5 COPPER PIPE JOINTS

- A. Remove all slivers and burrs remaining from the tube cut by reaming and filing both pipe surfaces. Clean fitting and tube with emery or sand cloth. Remove residue from the cleaning operation, apply

SECTION 23 06 00
PIPE AND PIPE FITTINGS

flux and assemble joint. Use solder or brazing to secure joint as specified for the specific piping service.

3.6 WATER SYSTEMS

- A. Pitch horizontal mains up at 1 inch in 40 feet in the direction of flow. Install manual air vents at all high points where air may collect. If vent is not in an accessible location, extend air vent piping to the nearest code acceptable drain location with vent valve located at the drain.
- B. Main branches and runouts to terminal equipment may be made at the top, side or bottom of the main provided that there are drain valves suitably located for complete system drainage and manual air vents are located as described above.
- C. Use top connection to main for upfeed risers and bottom connection to main for downfeed risers. Connections at a main may be made with a tee and a 45 degree elbow.
- D. Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping system. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.
- E. Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper air venting. Concentric fittings may be used for changes in vertical pipe sizes.
- F. When other specification sections or piping details do not require a strainer upstream of each control valve, install bottom connections to a main with a capped dirt leg.
- G. Where copper piping is allowed for heating hot water or solar hot water systems, secure all joints and fittings with 95-5 tin-antimony solder or brazing alloys.
- H. Where mechanically formed tee fittings are allowed, form mechanically extracted collars in a continuous operation, consisting of drilling a pilot hole and drawing out the tube surface to form a collar having a height of not less than three times the thickness of the tube wall. The collaring device shall be adjustable.
- I. Notch and dimple the branch tube. Braze the joint. Apply heat properly so that pipe and tee does not distort. Remove distorted connections.

3.7 STEAM AND STEAM CONDENSATE

- A. Pitch mains down 1 inch in 40 feet in the direction of flow. Pitch terminal equipment runouts down 1 inch in 2 feet for proper condensate drainage.
- B. Install drip traps at each rise, at the horizontal termination of each steam main and as needed to prevent water hammer but at a maximum spacing of 250 ft..
- C. Use eccentric fittings for changes in horizontal pipe sizes with the fittings installed for proper condensate drainage. Concentric fittings may be used for changes in vertical pipe sizes.
- D. Make branch connections and runouts at the top of the main or 45 degrees from the top. Condensate connections may be made in the horizontal plane in limited space situations.

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E. Use a minimum of two elbows in each pipe line to a piece of terminal equipment to provide flexibility for expansion and contraction of the piping system. Offset pipe connections at equipment to allow for service, such as removal of the terminal device.

F. Install flanges, taps, vents and drains needed to fill, vent and drain the piping for hydrostatic testing.

3.8 VENTS AND RELIEF VENTS

A. Install vent line and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item.

3.9 COOLING COIL CONDENSATE

A. Trap each cooling coil drain pan connection with a trap seal of sufficient depth to prevent conditioned air from moving through the piping. Extend drain piping to nearest code approved drain locations. Construct trap with plugged tees for cleanout purposes as detailed

3.10 DIELECTRIC UNIONS

A. Install insulating or dielectric unions or flanges at each point where a copper to steel pipe connection is required in the following systems.

1. Cold water or non-potable make-up water lines.
2. Hot water system.
3. Dielectric unions shall not be used at terminal heating/cooling devices.

3.11 UNIONS AND FLANGES

A. Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve.

1. Concealed unions or flanges are not acceptable.

3.12 PIPE SYSTEM LEAK TESTS

A. Conduct pressure test with test medium of air or water unless specifically indicated. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

B. No systems to be insulated until it has been successfully tested. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Minimum test time shall be as scheduled below plus such additional time as may be necessary to conduct the examination for leakage.

C. For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges. Measure and record test pressure at the high point in the system.

D. For air tests, gradually increase the pressure to not more than one half of the test pressure; then increase the pressure in steps of approximately one-tenth of the test pressure until the required test pressure is reached. Examine all joints and connections with a soap bubble solution or equivalent method. The piping system exclusive of possible localized instances at pump or valve packing shall show no evidence of leaking.

**SECTION 23 06 00
PIPE AND PIPE FITTINGS**

E. Pipe Leak Test Requirements:

| <u>System</u> | <u>Test Pressure</u> | <u>Medium</u> | <u>Duration</u> |
|---------------|----------------------|---------------|-----------------|
| Heat Water | 100 PSIG | Water | 8 hours |

3.13 PIPE CLEANING

- A. Flush all water and condensate systems clear of all dirt and foreign matter with all pumps bypassed and all strainers removed from strainer bodies. Provide circulation by means of Trade Supplied portable pumping apparatus.
- B. After initial flushing of a system, use portable pumping apparatus for a continuous 24 hour circulation of a cold water detergent equal to Nalco 2567 cleaner. Flush detergent clear with continuous draining and raw water fill for an additional 12 hours or until all cleaner is removed from the system. Replace strainers and reconnect permanent pumping apparatus.

3.14 INITIAL SYSTEM FILL AND VENT

- A. Fill and vent all systems with proper working fluids.
- B. Fluids to be chemically treated as specified in Water Treatment Section 15639B.

END OF SECTION

**SECTION 23 06 30
PIPING SPECIALTIES**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Thermometers, sockets and test wells.
- B. Pressure gauges.
- C. Pipeline strainers.
- D. Manual and automatic air vents.
- E. Flow sensors.
- F. Thermostatic steam traps.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 05 90 Testing, Adjusting and Balancing
 - 2. 23 06 00 Pipe and Pipe Fittings

1.3 QUALITY ASSURANCE

- A. Standards:
 - 1. American National Standards Institute, ANSI: B31.1: Power Piping.
 - 2. ANSI/ASHRAE 15, "Safety Code for Mechanical Refrigeration".

1.4 SUBMITTALS

- A. Submit shop drawings for all items including all data concerning dimensions, capacities, materials of construction, ratings, ranges, pressure drop and appropriate identification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Construct devices for the highest pressures and temperatures existing in the respective systems in accordance with ANSI specifications.

2.2 THERMOMETERS

- A. Manufacturers: Marsh, Taylor, Trerice, U.S. Gauge, Weksler or Weiss.
- B. Pipeline mounted: Thermometers shall be mercury reading, 9" scale cast aluminum case industrial thermometers with clear acrylic plastic window front and adjustable angle stem to permit easy reading

**SECTION 23 06 30
PIPING SPECIALTIES**

from the floor or operating platform. Furnish with extended necks suitable for insulated piping as required. Thermometers shall be compatible with sockets as specified herein.

C. Panel or remote mounted: Thermometers shall be mercury vapor actuated dial type with remote bulb. Casing shall be 3-1/2" minimum diameter cast metal with double front. Sensing bulbs shall be of length to suit pipe diameter with extended necks as required for insulated piping, suitable for insertion in separable brass sockets as specified herein.

D. The range of thermometers shall be:

| <u>Service</u> | <u>Scale Range</u> | <u>Increment</u> |
|----------------|-------------------------|------------------|
| Hot Water | 30 deg. F to 240 deg. F | 2 deg. F |

E. Thermometers by the temperature control manufacturer meeting the above specification will be acceptable.

2.3 THERMOMETER SOCKETS AND TEST WELLS

A. Sockets and test wells shall be brass with threaded connections suitable for thermometer bulbs and control sensing devices. Socket and test wells length shall be suitable for pipe diameter with extended necks as required to suit pipe insulation.

2.4 PRESSURE GAUGES

A. Manufacturers: Ashcroft, U.S. Gauge, Marsh, Taylor, Trerice, Weksler or Weiss.

B. All gauges shall be suitable for the pressure service intended, with minimum 4-1/2" diameter dial cast aluminum case, double strength glass window, phosphor bronze bourdon tube with bronze bushed brass movement, and recalibration from the front of the gauge dial, 99% accuracy over the middle half of the scale.

1. Gauges shall meet ANSI grade A specifications.
2. Gauges by the temperature control manufacturer meeting these specifications will be acceptable.
3. The range of pressure gauges shall be:

| | <u>Scale Range</u> | <u>Decrement</u> |
|-----------|--------------------|------------------|
| Hot Water | 0 PSIG to 100 PSIG | 1 PSIG |

C. Pressure snubbers shall be 1/4" size and of all bronze construction, 300 PSIG working pressure. Coil siphons shall be 1/4" size and of bronze construction, 150 PSIG working pressure.

D. Brass needle type gauge valves, Trerice model 735-2 or other approved product.

2.5 PIPELINE STRAINERS

A. Manufacturers: Metraflex, Mueller Steam Specialty, Hoffman, Armstrong, Trane, Sarco, Keckley, Illinois.

B. Strainers 2" and smaller: Full pipeline size, "Y" type, 250 psi W.P. steam, cast iron, with screwed ends. Furnish stainless steel strainer with a removable plug type screen retainer unless otherwise indicated on the drawings.

SECTION 23 06 30
PIPING SPECIALTIES

- C. Liquid service: Screens to be brass or stainless steel with 1/32" diameter perforation for sizes thru 2" and 1/16" diameter perforation for sizes over 2" for closed piping systems and 1/8" diameter perforation for open piping systems. Maximum pressure drop to be 4 feet W.G. in clean strainer.

2.6 AIR VENTS

- A. Manual air vents for components and pipe, Bell & Gossett Model 4V or other approved product, 125 PSIG at 210 deg. F. Use 1/2" gate valve for main pipes.
- B. Automatic air vents shall be pilot operated. Spirovent model spirotop, Thrush-Amtrol model 720, Watson McDaniel model 830, B&G model 107 or other approved product.
1. Cast iron or bronze body with non-ferrous internal parts, designed to vent air automatically with float control.
- C. Vents shall be constructed of metal for maximum operating pressure of 150 psi and maximum operating temperature of 250 deg. F and all working parts shall be noncorrosive.
- D. Vents shall have minimum air elimination rate of 36 CFM at 80 PSIG and shall be fully open for the removal of air at all pressures in the operating range from 2 to 150 psi. It shall be tightly sealed against loss of system water and prevent entrance of air in negative pressure situations.

2.7 FLOW SENSORS

- A. Calibrated Balancing Valves:
1. 2" and smaller: Construct valves of all bronze with threaded connections for sizes 2" and below and for 125 PSIG working pressure at a maximum temperature of 250 deg. F. Provide valve with quick disconnect taps with built-in check valve for pressure differential measurement and integral valve setting index.
 2. Select valves for size and pressure drop shown on the drawing and/or schedules. Tag valve plan mark number, flow and pressure drop as specified.
 3. Manufacturers: B&G CB plus calibrated balance valves or approved equal.

2.8 STEAM TRAPS

- A. Manufacturers: Armstrong, Dunham-Bush, Hoffman, Illinois, Nicholson, Spirax Sarco, Yarway. Manufacturers must meet the material specifications below.
- B. Minimum trap size is 3/4 inch for all types.
- C. Thermostatic Traps: Cast iron or semi-steel body and bolted cover, nonasbestos cover gasket, stainless steel bellows type air vent, stainless steel lever and valve assembly, and rated at not less than 15 psig saturated steam. Traps shall be SHEMA rated.

PART 3 - EXECUTION

3.1 PIPELINE STRAINERS

- A. Install strainers in steam and water systems on the entering side of all automatic valves and as shown on the drawings and details.
- B. Install strainers in water systems on the suction side of all pumps and elsewhere as indicated on the plans and/or as scheduled.

**SECTION 23 06 30
PIPING SPECIALTIES**

- C. Install drain valve with hose adapter in each blow off connection and extend drain piping to nearest floor drain.

3.2 THERMOMETERS

- A. Install thermometers in thermometer sockets in locations indicated on the drawings and details.
- B. Install sockets at each point where a temperature sensing device is required under Section 15900B - Controls and Instrumentation, and a thermometer location as shown on the piping drawings and details.

3.3 PRESSURE GAUGES

- A. Install pressure gauges where indicated on the drawings and details.
- B. Install gauges for water service with pressure snubbers and gauge valves.

3.4 PRESSURE GAUGE TAPPING

- A. Install tappings at each point where sensing device is required under Section 15900B - Controls and Instrumentation and at gauge locations as shown on the drawings and details.
- B. Install tappings for water service with pressure snubbers and gauge valves.

3.5 AIR VENTS

- A. Install manual air vents where indicated on the drawings, details and at all high points in water systems where air may collect.
- B. Install automatic air vent at the top of the air separator and where shown on drawings with a shut-off valve between air separator and air vent.

3.6 FLOW SENSORS

- A. Install flow sensors as indicated on the drawings and/or schedules and in accordance with the manufacturer's recommendations.

3.7 STEAM TRAPS

- A. Install on the discharge side of all steam terminals. Do not lift condensate from the discharge of any trap without the written permission of the Architect/Engineer.
- B. Shutoff valves are not required when the trap is at a piece of equipment which has a shutoff valve in the steam line serving it.
- C. Provide a separate trap for each equipment outlet connection.

END OF SECTION

**SECTION 23 09 10
SUPPORTS AND ANCHORS**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Pipe hangers and supports for mechanical system piping.

1.2 RELATED DOCUMENTS

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

- B. Specified Elsewhere:

- | | | |
|----|----------|-----------------------|
| 1. | 23 06 30 | Piping Specialties |
| 2. | 23 20 00 | Vibration Isolation |
| 3. | 23 25 00 | Mechanical Insulation |

1.3 QUALITY ASSURANCE

- A. Standards:

- | | |
|----|---------------------------------|
| 1. | <u>ANSI B31.1:</u> Power Piping |
| 2. | MSS SP58 & SP69 |

1.4 SUBMITTALS

- A. Submit shop drawings for the following:

1. Schedule of all manufactured hanger and support devices, indicating type of device for each pipe size range and type of service, including shielding devices as specified.

1.5 MANUFACTURERS

- A. Grinnell, Fee and Mason, Michigan Hanger, B-Line or Elcen, or approved equal.

- B. Grinnell figures listed as reference only.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless otherwise specified.

- B. Design supports of strength and rigidity to suit loading, service, and in manner, which will not unduly stress the building construction. Where support is from concrete construction, take care not to weaken concrete or penetrate waterproofing. Fasten supports and hangers to building steel framing whenever practical. Do not use perforated iron, chain or wire as hangers.

- C. Where piping can be conveniently grouped to allow the use of trapeze type supports, the supporting steel shall be by means of standard structural shapes or continuous insert channels. Where continuous insert channels are used, pipe-supporting devices made specifically for use with the channels may be

**SECTION 23 09 10
SUPPORTS AND ANCHORS**

substituted for the specified supporting devices provided that similar types are used and all data is submitted for approval.

2.2 EQUIPMENT SUPPORTS

- A. Provide all supporting steel, not indicated on the structural drawings, that is required for the installation of mechanical equipment and materials, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.
- B. Refer to HVAC Drawing details for further requirements.

2.3 PIPE HANGERS AND SUPPORTS

- A. Manufacturers: Grinnell, Fee and Mason, Michigan Hanger, B-Line or Elcen similar to the Grinnell figures listed.
- B. Pipe Hangers Application:
 - 1. 2" and smaller: Adjustable, swivel split ring type Grinnell Fig. 104 or lightweight, adjustable clevis type Grinnell Fig. 65.
 - 2. 2-1/2" and larger: Adjustable clevis type Grinnell Fig 260.
- C. Hangers for copper pipe without insulation shall be either copper plated or PVC coated.
- D. Hot piping 2" and smaller: Hanger may be secured directly to the pipe with insulation system around hanger.

2.4 INSULATION PROTECTION SHIELDS

- A. Application: Insulation protection shields are required on the following piping systems:
 - 1. Cold piping (under 60 deg. F): All sizes.
 - 2. Hot piping (over 120 deg. F): 2-1/2" and larger piping.
- B. Insulation Protection Shields: Grinnell Fig. 167, Fee & Mason or Elcen or other approved product, constructed of galvanized carbon steel. Select shield to accommodate outer diameter of insulation. Shield lengths and gauge shall be as follows:

| <u>Pipe Size</u> | <u>Length</u> | <u>Gauge</u> |
|------------------|---------------|--------------|
| 1/2" thru 2-1/2" | 12" | 18 |
| 3" thru 6" | 18" | 16 |
| 8" thru 12" | 24" | 14 |

2.5 HANGER SUPPORT INSULATION

- A. Application: Piping 2-1/2" diameter and larger in conjunction with insulation protection shields to resist compression of insulation system.
- B. Hanger insulation system shall cover bottom half of pipe at the same thickness as pipe insulation system.

2.6 PIPE HANGER RODS

SECTION 23 09 10
SUPPORTS AND ANCHORS

- A. Support rods shall conform to the latest MSS standards except as modified herein.
- B. Size rods for individual hangers and trapeze support as indicated in the following schedule:

| <u>Pipe size</u> | <u>Maximum Rod Diameter</u> | <u>Load (lbs.)</u> |
|------------------|-----------------------------|--------------------|
| Up to 2" | 3/8" | 610 |
| 2-1/2" and 3" | 1/2" | 1130 |
| 4" and 5" | 5/8" | 1810 |
| 6" | 3/4" | 2710 |
| 8" thru 12" | 7/8" | 3770 |

- C. Furnish rods complete with adjusting and lock nuts.
- D. In piping 4 inches and larger, each valve shall be supported.

2.7 HANGERS AND SUPPORT SPACING

- A. Space pipe hangers and supports in accordance with the following schedule, with exceptions as indicated herein:

| <u>Pipe size</u> | <u>Steel</u> | <u>Copper</u> |
|------------------|--------------|---------------|
| Up thru 1-1/4" | 8'-0" | 6'-0" |
| 1-1/2" and 2" | 10'-0" | 8'-0" |
| 2-1/2" and 3" | 12'-0" | 10'-0" |
| 4" and 5" | 14'-0" | 10'-0" |
| 6" to 12" | 14'-0" | 10'-0" |

- B. Place hangers to meet the requirements of the piping section of this specification, with regard to pitch for drainage and venting, and clearance between services.
- C. Place hangers within one foot of each elbow and at each valve and strainer for piping 4" and above.

2.8 BEAM CLAMPS

- A. Grinnell Fig. 87 Series beam clamps with retaining clip for hanger rods to 5/8". Maximum load 440 lbs.
- B. Grinnell Fig. 228 beam clamps with links for hanger rods 3/4" and above.

2.9 RISER CLAMPS

- A. Grinnell Fig. 261 for steel pipe, CT-121 for copper tubing.

2.10 CONCRETE INSERTS

- A. Grinnell Fig. 285, 281 or 282, poured concrete ceiling insert, suitable for rod diameter and weight supported.
- B. Inserts drilled and placed after concrete pour shall have steel shell with expander plug, not depending on soft lead for holding power.

PART 3 - EXECUTION

SECTION 23 09 10
SUPPORTS AND ANCHORS

3.1 INSTALLATION

- A. Install supports to provide for free expansion of the pipe. Support all piping from the structure using concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.
- B. Coordinate hanger and support installation to properly group piping of all trades.

3.2 INSULATION PROTECTION SHIELDS

- A. Install insulation protection shields at support points for insulated piping as scheduled herein.
- B. Spacing shall be 10'-0" maximum based on insulation with a compressive strength of 15 psi. For insulation with compressive strengths greater than 15 psi, span may be increased proportionally up to a maximum allowable as listed under hanger and support spacing in this section.

END OF SECTION

**SECTION 23 10 00
VALVES**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Valves for mechanical system piping.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

- | | | |
|----|----------|----------------------------------|
| 1. | 23 05 90 | Testing, Adjusting and Balancing |
| 2. | 23 06 00 | Pipe and Pipe Fittings |
| 3. | 23 06 30 | Piping Specialties |

1.3 SUBMITTALS

- A. Submit shop drawings for all valves including all data concerning dimensions, materials of construction and pressure/temperature ratings.
- B. Mark shop drawings clearly for each system and note with the correct cross reference number.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers: Powell, Crane, Nibco, Hammond, Stockham, Lunkenheimer, Milwaukee.

1. Valves shall be of same manufacturer, unless otherwise approved by A/E.
- B. Acceptable manufacturer and Fig. No. are listed under each valve type as the standard for equal quality from approved manufacturers.
- C. Manufacturer's name and pressure ratings clearly mounted on outside of valve body.
- D. All valve packing to be non-asbestos and flexitallic type.

2.2 WATER SYSTEMS VALVES

A. Globe Valves:

1. Valves 2-1/2" and smaller: Bronze body, screwed pattern, renewable composition disc, union or screw-over bonnet, malleable iron hand wheel, 300 psi W.O.G., Mueller Fig. 203-AP or Metraflex No. 700.

B. Check Valves:

1. 2-1/2" and smaller: Bronze body, screwed, regrinding type, horizontal swing, renewable seat and disc, 150 SWP - 200 WOG rated. Nibco Fig. T-413-Y.

SECTION 23 10 00
VALVES

C. Spring Loaded Check Valves:

1. Valves 2-1/2" and smaller: Bronze or iron body, bronze trim, stainless steel spring, screwed, 250 psi WOG, Nibco Fig. T-480Y, Mueller Fig. 203-AP or Metraflex No. 700.

D. Balancing Valves(non-calibrated):

1. Valves 2-1/2" and smaller: Use eccentric plug valves or ball valves with memory stops.

E. Balancing Valves(calibrated):

1. Valves 2-1/2" and smaller: Refer to Section 23 06 30, Piping Specialties, under Flow Sensors and Meters.

F. Ball Valves:

1. Valves 2-1/2" and smaller: Bronze body, screwed, brass or stainless steel ball, full or conventional port, Teflon seat rings, blowout-proof stem, two-piece construction, 600 psi WOG, Apollo No. 70 Series, Milwaukee BA 100/150, Nibco T/S 585-70.
2. Provide valve neck extensions with sufficient length to allow for insulation where insulation is specified.

G. Drain Valves:

1. Bronze, screwed, Buna-N seat discs, hose thread adaptor, 125 psi WOG, Nibco Fig 74, or ball valve as specified above with hose thread adaptor.
2. Minimum drain valve size - 3/4" except where strainer blowdown valves are indicated, drain valve same as blowdown connection size.

H. Combination Shut-off, Check and Balancing Valves:

1. 2" and smaller: Provide check valve and balance valve in series at pump discharge.
3. Design valves to permit repacking under full line pressure.

I. Shut-off and Check Valves: Provide spring-loaded check valve and shut-off (ball or butterfly) valve in series at pump discharge.

2.3 GAUGE VALVES

- A. Trefice Fig. 735, 1/4" brass needle valve, threaded ends, 300 WOG rated.

2.4 LOW PRESSURE STEAM/CONDENSATE (15 psig or less)

- A. GATE VALVES: 2" and smaller: Class 150, bronze body, bronze trim, threaded ends, solid wedge, rising stem, non-asbestos packing, union bonnet, malleable iron hand wheel.
- B. GLOBE VALVES: 2" and smaller: Class 150, bronze body, bronze trim, threaded ends, teflon disc, rising stem, non-asbestos packing, union bonnet, malleable iron hand wheel.

PART 3 - EXECUTION

3.1 GENERAL

SECTION 23 10 00
VALVES

- A. Install valves as shown on plans, details and according to the valve manufacturer's installation recommendations. Install valves with stems upright or horizontal.
- B. Install all temperature control valves furnished under Section 15900B - Controls and Instrumentation.

3.2 SHUT-OFF VALVES

- A. Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for servicing.

3.3 THROTTLING VALVES

- A. Install globe or angle valves for throttling service and control device or PRV station bypass.
- B. Install gate valves for throttling in steam systems sizes 8 inches and larger.

3.4 BALL VALVES

- A. Ball valves shall be used for water system shut-off valves.

3.5 BALANCING VALVES

- A. Provide balancing valves for complete balancing of water systems. Furnish calibrated balance valves and flow meters as specified in Section 23 06 30, Piping Specialties, under Flow Meters.

3.6 DRAIN VALVES

- A. Provide drain valves where specified, detailed and at all low points of piping systems for complete drainage of the systems.

END OF SECTION

**SECTION 23 25 00
MECHANICAL INSULATION**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.
- B. Work shall include all labor, equipment, accessories, materials and services required to furnish and install all insulation, fittings and finishes for piping, ducts and related mechanical equipment in the Heating, Ventilating and Air Conditioning Systems.
- C. The following types of insulation are specified in this section:
 - 1. Pipe insulation.
 - 2. Duct insulation.
 - 3. Duct sound lagging treatment.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 09 10 Support and Anchors
 - 2. 23 84 00 Ductwork

1.3 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
 - 1. Owens-Corning
 - 2. Schuller
 - 3. Certainteed
- B. All insulating products delivered to the construction site shall be labeled with the manufacturer's name and description of materials.
- C. All insulation installation methods shall be performed in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions, except as modified in this section of specifications.

1.4 DEFINITIONS

- A. Concealed Ductwork: Concealed areas, where indicated in this section, shall apply to shafts, furred spaces, space above finished ceilings, low tunnels and crawl spaces.
- B. Exposed Ductwork: Exposed ductwork, include mechanical rooms, walk-through tunnels, and similar installations subjecting ductwork insulation to physical damage and tearing.

1.5 SUBMITTALS

**SECTION 23 25 00
MECHANICAL INSULATION**

- A. Submit shop drawings for insulation systems, including a schedule for all insulating materials, including adhesives, fastening methods, fitting materials, installed thickness and intended use of each material.
- B. Submittal shall include catalog sheets indicating density, thermal characteristics, jacket, and installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All products including vapor barriers and adhesives shall conform to NFPA Section 90A. All products except pipe insulation shall possess a flame spread rating of not over 25, without evidence of continued progressive combustion, and a smoke developed rating no higher than 50.

2.2 PIPING INSULATION SCHEDULE

- A. Insulation Thickness Pipe Size Schedule:

| <u>Type of System</u> | <u>Fluid Temp. Range Deg F</u> | <u>*Run-outs Up to 2"</u> | <u>1" and Less</u> | <u>1-1/4" -2"</u> | <u>2-1/2" -4"</u> | <u>5&6 inch</u> | <u>8"& Up</u> |
|-----------------------|--------------------------------|---------------------------|--------------------|-------------------|-------------------|---------------------|-------------------|
| <u>Hot Water:</u> | | | | | | | |
| Low Temp. | 141-200 | 0.5 | 1.0 | 1.0 | -- | -- | -- |
| <u>Steam:</u> | | | | | | | |
| Low Pressure | 200-220 | 1.0 | 1.0 | -- | -- | -- | -- |

*Runouts are extensions to individual terminal units not exceeding 12 ft. in length.

- B. Insulation thickness shown in schedule are based on products having a maximum "k" factor of 0.26 at a mean temperature of 75 degrees F. These thicknesses can be reduced for products having significantly lower "k" values and shall be increased for products having higher "k" values in order to produce equivalent or greater thermal resistance. ("R" value of products equals the thickness of the insulation divided by the "k" factor.)
- C. Insulation Application Schedule:

| <u>Type of System</u> | <u>Fluid Temp. Range (deg. F)</u> | <u>Type of Insulation</u> |
|-----------------------|-----------------------------------|---------------------------|
| <u>Hot Water:</u> | | |
| Low Temp/HWS&R | 141-200 | Glass Fiber |
| <u>Steam:</u> | | |
| Low Pressure | 200-220 | Glass Fiber |

2.3 PIPE INSULATION

SECTION 23 25 00
MECHANICAL INSULATION

- A. Rigid molded glass fiber pipe insulation with ASJ type factory applied jacketing with a density of 3-4 lbs./cubic feet and a "k" factor of 0.25 @ 75 degrees F. mean. (Flame Spread 25, smoke development 50 per ASTM E 84-75, -20 degrees to 500 degrees F. usage.)
1. Jacket shall be glass fiber reinforced foil kraft laminate, factory applied, with white finish. Permeance shall not exceed 0.02 perms. Beach puncture resistance shall be 50 units minimum.
 2. Provide Aluminum or UV-resistant PVC jacket for all exposed exterior piping insulation.
- B. Flexible elastomeric thermal insulation with a "k" factor of 0.26 at 75 degrees F mean density of 5.0 lbs./cu. ft. and a maximum water vapor transmission of 0.17 per inch. Seal joints with manufacturers standard sealant. (Armaflex AP-Flame Spread 25, smoke development 50 per ASTM E 84-75, -40 degrees to 220 degrees F usage.)

2.4 DUCTWORK INSULATION

- A. Material: Flexible Glass Fiber Wrap: Flexible glass fiber insulation shall have a minimum density of 0.75 PCF with thermal conductivity of not more than 0.31 at 75 degrees F mean temperature and suitable for 240 degrees F with FSK aluminum foil reinforced vapor barrier jacket. Material shall meet NFPA 90A and 90B.
1. Jacket shall be glass fiber reinforced foil kraft laminate factory applied with paintable white finish. Permeance shall not exceed 0.04 perms. Beach puncture resistance shall be 15 units minimum.

2.5 DUCTWORK INSULATION SCHEDULE

- A. Supply Air Ducts:
1. Type Insulation: 1-1/2" Flexible Wrap (Concealed).
 2. Exposed ducts in conditioned spaces do not require external insulation (i.e. gym, etc.)

2.6 DUCT WORK SOUND LAGGING TREATMENT

- A. Acoustical duct lagging shall be a 2 lb psf vinyl noise barrier with a reinforced foil facing on one side.
1. Sound Transmission class: 31
 2. Standard Width: 54 inches
 3. Length: As indicated, up to 30 feet long
- B. Accessories for securely mounting the Acoustical pipe and duct lagging:
1. Foil lag tape
 2. Stick pins
 3. Welding pins
 4. Banding
- C. Acoustical Performance:

Sound Transmission Loss: Per ASTM E 90

Octave Band Center Frequency (Hz):

| 125 | 250 | 500 | 1000 | 2000 | 4000 | STC |
|-----|-----|-----|------|------|------|-----|
| 16 | 22 | 26 | 32 | 35 | 40 | 31 |

SECTION 23 25 00
MECHANICAL INSULATION

D. Products:

1. Sound Seal Model # B-20 LAG
2. Approved Equal.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Application of insulation materials to piping, equipment, tanks and ductwork shall be done in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer and required by applicable codes.
- B. All insulation shall be continuous through wall and ceiling openings and sleeves. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. (If necessary, extra fittings and pipe are to be used.).

3.2 PIPING INSTALLATION

- A. All pipe installation shall be installed with joints butted firmly together. All valves and fittings shall be insulated with mitered sections of insulation equal in density and thickness to the adjoining insulation by one of the following methods:
1. Premolded PVC fittings installed in accordance with the manufacturer's instructions.
 2. Jackets on pipe insulation laps are to be vapor sealed using self-sealing lap, lap-seal tape gun or adhesive such as Armstrong 520. All insulation ends are to be tapered and sealed regardless of service.
- B. Provide removable insulation sections to permit easy access where inspection, service and/or repairs are required.
1. Insulation for valves, unions (cold only), strainers, flexible connections and expansion joints shall be removable for inspection and repair.
- C. On all cold piping insulated with vapor barrier covering, use protection shield to over bottom one-half of insulated pipe. Provide half-round, 12" long, hanger block at the bottom half of the pipe in place of the fiberglass pipe insulation. The hanger blocks shall be molded cork or calcium silicate pipe insulation of the same thickness as the adjoining fiberglass pipe insulation. The vapor barrier jacket shall be continuous through the hanger location.
1. Provide removable elastomeric insulation wraps over cold piping unions.
- D. Vapor barrier jackets shall be applied with a continuous, unbroken vapor seal. Pipe hangers on cold lines (dual temperature piping) are to be sized large enough to be installed over the outer surface of the insulation.
- E. On hot piping 2" and smaller, the hanger shall be secured directly to the pipe and the pipe insulation shall surround the hanger. Provide pipe covering protection saddles and hanger blocks at hanger locations on hot piping 4" and larger.

SECTION 23 25 00
MECHANICAL INSULATION

- F. Insulation shall preferably be applied while surfaces are hot. Chilled water lines shall be at room temperatures when insulation is applied.
- G. Omit insulation for the following:
 - 1. Discharges piping from safety and relief valves to outlets.
 - 2. Piping unions on hot only (HWS&R) systems.
 - 3. Provide removable insulation jackets over unions and valves for hot/chilled water systems.
 - 4. Hot water piping inside convector, wall fin radiation and cabinet heater enclosures.
- H. Seal all exposed end sections of pipe covering with a coat of vapor barrier mastic. Childers CP-30 or equal.
- I. No covering shall be applied until after piping is cleaned and tested, inspected and approved.

3.3 DUCTWORK INSULATION AND SOUND TREATMENT INSTALLATION

- A. Insulation shall be installed per manufacturer recommendations with mechanical fasteners. Seal all joints and fasteners with UL labeled vapor proof tape.
- B. Provide finished edges at all access doors and ends.

3.4 INSTALLATION OF EQUIPMENT INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork surfaces prior to insulating, Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Do not insulate over equipment nameplates or ASME stamps. Bevel and seal insulation at these locations.
- E. Do not insulate factory insulated equipment.

3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation installer shall advise Contractor of required protection for insulation work during remainder of construction; period, to avoid damage and deterioration.

END OF SECTION

**SECTION 23 63 00
WATER TREATMENT**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section includes requirements for water treatment related to the following:
1. Closed Loop Treatment System
 2. Pipe Cleaning and Inhibiting Treatment
- B. Specification of an item in this section shall not relieve the HVAC Contractor from providing all items, materials, operations, methods, labor, equipment and incidentals necessary for a complete and functional system.
- C. All services will be performed by a qualified, full-time representative of the water treatment company.
1. Coordinate water treatment with Owner's current water treatment program(Industrial Water Management) for compatible chemicals and treatment methods.
 2. Industrial Water Management: Contact Joe Wenn jwenn@iwmcorporation.com

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
1. 23 06 00 Pipe and Pipe Fittings

1.3 SUBMITTALS

- A. Submit product data, installation and operating instructions.

1.4 SUPERVISION AND INSPECTION

- A. Water treatment manufacturer or his qualified representative to provide supervision and final inspection upon completion of installation and adjustment, shall submit report in writing, certifying the correctness of the installation in compliance with the specifications and proper operation.

PART 2 - PRODUCTS

2.1 CLOSED LOOP TREATMENT SYSTEM

- A. Water treatment consists of initial chemical type treatment to clean piping and prevent rust and scale in final fill treated water.
1. Sequestering agent to reduce deposits and adjust pH.
 2. Corrosion inhibitors.
 3. Conductivity enhances.

SECTION 23 63 00
WATER TREATMENT

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Heating Contractor will provide initial fill treatment to each closed-loop system. After this initial treatment, the Owner shall be responsible for all future service requirements.
- B. Furnish start-up chemical treatment chemicals, procedures and certification after installation is complete.
- C. After start-up treatment, the treatment company shall be responsible for all water treatment service requirements for one year, to include the following treatment services performed by qualified, full time representatives of the treatment company.
 - 1. Initial water analysis and recommendations.
 - 2. Initial equipment clean-up chemicals, procedures and certification after clean-up is complete.
 - 3. Assistance during start-up of the treatment program.
 - 4. Instructions of operating personnel on proper feeding and control techniques.
 - 5. Periodic service and consultation meetings.
 - 6. Any necessary record forms and log sheets.
 - 7. Any required laboratory and technical assistance.

3.2 PIPE CLEANING AND INHIBITING GUIDELINES

- A. Cleaning: Hydronic water piping system shall be cleaned by using a solution consisting of a blend of organic alkaline penetrants, emulsifiers, surfactants and corrosion inhibitors and containing propylene glycol, methyl ether, phosphonates, sodium-meta-silicate-hydrate and sodium hydroxide.
 - 1. The material shall not contain tri-sodium phosphate.
 - 2. The piping system shall be filled, vented and circulated employing the chemical cleaner solution for a period of at least 24 hours or more in accordance with the manufacturer's recommendations and job site chemical tests. Water filters shall be removed from the system for this cleaning. The concentration shall be brought to a level which raises the M Alkalinity to a value of 250 above that for the existing water used for the fill.
 - 3. Chemical tests shall be made to verify these levels and submitted to the A/E. The system should be circulated, drained and flushed to achieve the original M Alkalinity level.
- B. Inhibitor:
 - 1. The inhibitor shall be added to the system after it is acceptably cleaned and flushed and refilled. The inhibitor shall consist of a boron nitrite, benzol thiazol, benzotriazole, mercapto-benzo-thiazole, tolyltriazole silicates and color trace all producing a scale and corrosion inhibitor system. The inhibitor shall be chemically installed to a concentration of 700 to 1000 parts per million and the solution shall be tested to indicate that it falls within this range.
 - 2. Test results shall be submitted to the A/E.
 - 3. The strainer baskets may be remounted before the system is inhibited.

**SECTION 23 63 00
WATER TREATMENT**

C. Supervision:

1. The chemical supplier shall supervise the addition, the testing of the flushing and draining of all chemical scale and inhibitor solutions for all systems. Three copies of the chemical water status shall be submitted to the A/E for final approval.
2. Cleaning, inhibiting and testing of the piping systems shall be carried out in the presence of the owner's representative.

END OF SECTION

SECTION 23 74 00
TERMINAL AIR DISTRIBUTION UNITS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of terminal air distribution unit equipment work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of terminal air distribution unit equipment required for project include the following:
 - 1. VAV Boxes with reheat.
- C. Refer to other Division 15 temperature control system sections for control work required in conjunction with air distribution equipment.

1.2 RELATED DOCUMENTS

- A. Applicable provision of Division 1 governs work under this section.
- B. Specified Elsewhere:
 - 1. 23 05 90 Testing, Adjusting and Balancing
 - 2. 23 06 30 Piping Specialties
 - 3. 23 25 00 Mechanical Insulation
 - 4. 23 90 00 Controls and Instrumentation

1.3 QUALITY ASSURANCE

- A. IBR Compliance: Provide terminal heating units bearing the IBR Hydronics Institute Certified Rating Seal.
- B. AMCA Compliance: Provide air distribution equipment bearing the Air Movement and Control Association, Inc. (AMCA) Certified Rating Seal.
- C. UL Compliance: Provide air distribution equipment electrical components which have been listed and labeled by Underwriter Laboratories (UL).

1.4 SUBMITTALS

- A. Submit shop drawings for all equipment including all data concerning dimensions, air flow capacities, sound ratings, unit pressure drop, finish and appropriate identification.
- B. Submit certified sound data for both casing discharge and radiated sound levels from 125 thru 8000 Hz as tested in accordance with Air Diffusion Council (ADC) Test Standard 1062R4.

PART 2 - PRODUCTS

2.1 VARIABLE AIR VOLUME BOXES

- A. General: Provide single-duct VAV boxes of size and arrangement as indicated on Drawings, and of capacities and having accessories as scheduled.

SECTION 23 74 00
TERMINAL AIR DISTRIBUTION UNITS

- B. Housing: Factory assembled unit with welded 26-gauge galvanized steel casing, acoustically and thermally lined with 1" thick 3 PSF fiberglass with high-density facing. Leakage rate 2% maximum at 0.5 inch W.G. Insulation to be UL listed and meet NFPA 90A requirements.
1. Provide bottom or side access panel for air valve.
 2. Provide bottom or side access panel upstream and downstream of reheat coil. Access panel shall be large enough to allow proper cleaning of reheat coil without dismantling ductwork.
- C. Air Valves: Air flow control device with integral actuator. Electronic volume regulator supplied by Temperature Control Contractor, factory or field installed. Integral flow ring sensor with taps and calibration chart to measure air flow with 10% regardless of inlet connections.
- D. V.A.V. Box Control: DDC/Electronic actuators, sensor wiring and application-specific controller supplied by Temperature Control Contractor, field-installed.
- F. Hot Water Coil: Performance and rated capacities as indicated on schedules on Drawings.
1. Hot water coil with aluminum fins mechanically bonded to 5/8" OD seamless copper tube. Same end connections.
 2. Coil leak tested at 300 PSIG air pressure, under water.
 3. Provide duct extensions for access panel installation upstream of reheat coil to clean coil surface.
- G. Acceptable Manufacturers:
1. Enviro-Tec
 2. Nailor
 3. Carnes
 4. Titus

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which terminal air distribution units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF TERMINAL AIR DISTRIBUTION EQUIPMENT

- A. Install terminal air distribution equipment where indicated, in accordance with equipment manufacturers installation instructions, and with recognized industry practices to ensure that equipment complies with requirements and serves intended purposes.
1. Provided proper service clearance space for controls and damper actuators.
 2. Provide duct access panels upstream and downstream of reheat coils.
- B. Coordinate with other work, including ductwork, piping and control work as necessary to interface installation of terminal air distribution equipment with other work.

3.3 FIELD QUALITY CONTROL

SECTION 23 74 00
TERMINAL AIR DISTRIBUTION UNITS

- A. Upon completion of installation of terminal unit equipment, test equipment to demonstrate compliance with requirements. Where possible, field correct malfunctioning equipment, and then retest to demonstrate compliance. Replace equipment which cannot be satisfactorily corrected.

END OF SECTION

**SECTION 23 84 00
DUCTWORK**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of ductwork requirements is indicated on the Drawings and by requirements of this section.
- B. The ductwork requirements for this project include the following:
 - 1. Low-Pressure Ductwork
 - 2. High-Pressure Ductwork
 - 3. Plenums
 - 4. Flexible Ductwork
 - 5. Acoustic Duct Lining

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 25 00 Mechanical Insulation
 - 2. 23 86 00 Ductwork Accessories

1.3 QUALITY ASSURANCE

- A. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards" first edition 1985 for fabrication and installation of metal and flexible ductwork.
- B. ASHRAE Standards: Comply with ASHRAE Handbook and Product Directory, 1979 Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of ductwork.
- C. NFPA Compliance: Comply with ANSI/NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and ANSI/NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems."
- D. ACIGH Industrial Ventilation 24th Edition 2001.

1.4 SUBMITTALS

- A. Submit product data and specifications for ductwork materials.
- B. Indicate duct fittings, particulars such as gages, sizes, welds, and configuration prior to start of work for low and high-pressure and exhaust ductwork systems.

PART 2 - PRODUCTS

2.1 DUCTWORK MATERIALS

- A. Above ground, general ductwork: Galvanized steel, lock-forming quality, ASTM A527; 1.25 oz. zinc coating each side, mill phosphatized, ASTM A525.

SECTION 23 84 00
DUCTWORK

1. Round – Spiral wound ductwork.
- B. Steel Ducts: Galvanized steel, lock-forming quality, ASTM A527; 1.25 oz. zinc coating each side(G90), mill phosphatized, ASTM A525.
- C. Stainless Steel Ducts: ASTM A167, Type 304.
- D. Flexible Duct:
 1. Spiral wire Reinforced Fabric: Spiral wire reinforced fabric type flexible duct shall be made of a corrosion-resistant reinforcing wire helix bonded to a continuous layer of fabric. Class I Air Duct Material, UL Standard 181.
- E. Insulated Flexible Duct: Insulation shall be cellular glass, 1-1/2" nominal thickness of 1-1/2 pound density per cubic foot. The insulation shall encase the flexible duct and shall be sheathed with vapor barrier having a permeability of not over 2.0 perm. Insulation and vapor barrier shall be factory installed.
- F. Flexible Fiberglass Duct Liner: Flexible coated glass fiber duct liner; ANSI/ASTM C553; 'K' value of 0.26 at 75 degrees F; 1-1/2 lbs./cu. ft. minimum density; coated air side for maximum 4,000 ft./min. air velocity.
 1. Lagging Adhesives: Fire resistive to ASTM E84, NFPA 255.
 2. Impale Anchors: Galvanized steel, 12 gage self-adhesive pad or mechanical fastener type as recommended, insulation manufacturer.
- G. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant gaskets and tapes as compounded and recommended by the manufacturer specifically for sealing joints and seams in ductwork.
- H. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
- I. Drive Screws and Clamps: As recommended by SMACNA.
- J. Factory Made Joints: Ductmate system as manufactured by Ductmate Industries, Inc., Nexus system as manufactured by Exanno, or other approved product may be used.

2.2 DUCTWORK PRESSURE-VELOCITY CLASSIFICATION

- A. General: Construct ductwork in conformance to SMACNA "HVAC Duct Construction Standards" 1st edition 1985.
- B. Low Pressure Ductwork:
 1. Static Pressure Class: +2" W.G.
 2. Maximum Velocity Level: 2500 FPM.
- C. High Pressure Ductwork:
 1. Static Pressure Class: +4" W.G.
 2. Maximum Velocity Level: 4000 FPM.

SECTION 23 84 00
DUCTWORK

2.3 DUCTWORK SEALING CLASSIFICATION

- A. General: Construct ductwork in conformance to SMACNA "HVAC Duct Construction Standards" 1st edition 1985.
- B. Low Pressure Ductwork:
 - 1. Seal Class: B seal transverse joists and longitudinal seams.
- C. High Pressure Ductwork:
 - 1. Seal Class: A seal transverse joints and longitudinal seams and ductwall penetrations.

2.4 FABRICATION

- A. Shop fabricate ductwork in 4, 8, 10, or 12 foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembling and coordinated installation.
- B. All dimensions indicated on drawings are free area ductwork requirements. Increase ductwork dimensions to accommodate ductwork lining requirements.
- C. Accessories:
 - 1. Fabricate ductwork with accessories such as air turns, extractors, and volume dampers, installed during fabrication to greatest extent possible.
 - 2. Fabricate ductwork with duct liner in each section of duct where required.
- D. Variation: No variation of duct configuration or sizes permitted except by written permission.
- E. Directional Change:
 - 1. Construct tees, bends, and elbows with radius minimum 1-1/2 times width of duct on center lines.
 - 2. Where not possible and where rectangular elbows used, provide airfoil type turning vanes.
 - 3. Where acoustical lining is required, provide turning vanes of perforated metal type with fiberglass inside.
- F. Size Change:
 - 1. Increase duct sizes gradually, not exceeding 15 deg. divergence wherever possible.
 - 2. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.
- G. Seams and Joints:
 - 1. Seams and joints fabricated in accordance with SMACNA standards.
 - 2. Rigidly construct metal ducts with joints mechanically tight, substantially airtight, braced and stiffened so not to breathe, rattle, vibrate, or sag.

SECTION 23 84 00
DUCTWORK

2.5 LOW PRESSURE DUCTWORK

- A. Fabricate and support in accordance with SMACNA Low Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on center line. Where not possible and where rectangular elbows are used, provide airfoil turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
 - 1. Where acoustic lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.
- E. Provide easements where low pressure ductwork conflicts with piping and structure. Where easements exceed 10 percent duct area, split into two ducts maintaining original duct area.
- F. Connect flexible ducts to metal ducts with adhesive and draw bands.
- G. Round Duct Take-Offs: Provide conical or bellmouth low-pressure fittings.
- H. Square Duct Take-Offs: Provide 45 degree leading edge at square take-off with 4: minimum depth.

2.6 HIGH PRESSURE DUCTWORK

- A. Fabricate and support in accordance with SMACNA High Pressure Duct Construction Standards and ASHRAE handbooks, except as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows are used, provide airfoil-turning vanes. Where acoustical lining is required, provide turning vanes of perforated metal with glass fiber insulation. Weld in place.
- C. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence.
- D. Fabricate continuously welded medium and high pressure round and oval duct fittings as indicated in SMACNA Standard. Joints shall be minimum 4-inch cemented slip joint, brazed or electric welded. Prime coat welded joints.
- E. Round or flat oval type ducts shall be constructed with lock tight spiral seams, gored elbows with centerline radius of 1-1/2 times the duct diameter and male/female fittings.
- F. Take-Offs: Conical tees, conical 45 degree laterals, conical bellmouth taps and fittings shall be used. Seal all joints airtight with gaskets and mastic sealants.

SECTION 23 84 00
DUCTWORK

- G. Fabricated rectangular ducts shall be constructed with companion angle flanged joints secured to duct walls. Use continuous closed cell gasket at joints with snap-on cleats and corner bolts. Provide 45-degree close openings at takeoffs and corners. Seal all joints air tight with gaskets and mastic sealants.

2.7 DUCTWORK APPLICATION SCHEDULE

| | <u>Air System</u> | <u>Classification</u> | <u>Material</u> |
|----|------------------------------------|-----------------------|-----------------|
| A. | Supply air - AHU's to VAV boxes: | High Press | Steel |
| B. | Return air - to AHU's: | Low Press | Steel |
| C. | Supply air - VAV boxes to outlets: | Low Press | Steel |
| D. | Exhaust air: | Low Press | Steel |
| E. | Transfer air: | Low Press | Steel |

2.8 ACOUSTIC DUCT LINING APPLICATION SCHEDULE

| | <u>Air System</u> | <u>Thickness</u> |
|----|---|------------------|
| A. | Transfer Ducts: | 1" |
| B. | 10 ft down stream of VAV terminal outlets | 1" |
| C. | Return Air Ductwork - Return Fan RF-3 | 1" |

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble and install ductwork in accordance with SMACNA standards, and which will achieve airtight and noiseless systems, capable of performing each indicated service.
1. Align ductwork accurately at connections.
 2. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts straight, plumb and free of sags and vibration.
- B. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.
- C. Metal Duct Support:
1. Support ductwork from building structure as required and, where not otherwise indicated, anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps or special beam clamps.
 2. Support vertical ducts, at 12 foot spacing, by attachment to adjacent vertical structural surfaces or by direct bearing at floor penetrations and similar locations.
 3. Support horizontal ducts located against structural walls and other similar adjacent vertical surfaces, at 8 foot spacing for ducts up to 40 inches horizontal dimension and 4 foot spacing for larger ducts.
 4. Hang horizontal rectangular ducts from overhead structure, at 10 feet spacing for duct widths up to 60 inches and 8 foot spacing for larger ducts.
 5. Arrange hangers, supports and duct rests to permit free, unrestrained and noiseless expansion and contraction of duct.

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DUCTWORK

6. Where duct lining not used, vertical members may be fastened to duct sides with sheet metal screws.
 7. Where duct lining is used, do not puncture sheet metal.
- D. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- F. Slope underground ducts to plenums or low pumpout points at 1:100 feet. Provide access doors for inspection.
- G. Connect terminal units to high-pressure ducts directly with three-foot maximum length of flexible duct. Do not use flexible duct to change direction.
- H. Provide residue traps in kitchen hood exhaust ducts at base of vertical risers with provisions for cleanout.
- I. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- J. Provide sleeved opening where ducts pass through smoke, fire and sound walls.
1. Seal space between duct and sleeve airtight with mineral wool or approved fire stopping material.
 2. Provide duct flange to cover and retain fire-stopping material.
- K. Connections:
1. Connect duct to equipment with flexible fabric, sheet metal clips, screws and washers.
 2. Connect branch take-offs to include prefabricated air scoops formed of same material as associated duct system.
 3. Connect diffusers or plenum boots to low-pressure ducts with 10-foot maximum length of flexible duct, held in place with strap or clamp.
- L. Flexible Ductwork:
1. Do not exceed 6 feet in length in accordance with NFPA 90.
 2. Install flexible ductwork with minimum offsets and trim.
 3. Connect with factory-installed compression coupling each end or provide separate adjustable bond and clamp to secure duct to trunk fitting and to distribution unit fitting.
 4. Where recommended by manufacturer, make connections with mastic duct tape and adjustable clamp.

3.2 ADJUSTING AND CLEANING DUCTWORK

SECTION 23 84 00
DUCTWORK

- A. Clean duct system and force air at high velocity through duct to remove accumulated dust. To obtain sufficient air, clean half the system at a time. Protect equipment, which may be harmed by excessive dirt with temporary filters, or bypass during cleaning.
- B. Clean duct systems with high power vacuum machines. Protect equipment, which may be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

3.3 DUCT LEAKAGE

- A. Inspect all ductwork for leak sources and repair.
- B. Do not insulate ductwork until it has been accepted for duct leakage.
- C. Refer to Section 23 05 90 for Testing, Adjusting, and Balancing requirements of ductwork system.
- D. Low pressure ductwork leakage rate shall not exceed 5%.
- E. High pressure ductwork leakage rate shall not exceed 2%.

END OF SECTION

SECTION 23 86 00
DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of duct accessories work is indicated on drawings and in schedules, and by requirements of this section.
- B. Types of duct accessories required for this project include the following:
 - 1. Dampers:
 - a. Manual dampers
 - b. Control dampers
 - 2. Fire dampers
 - 3. Turning vanes
 - 4. Duct hardware
 - 5. Duct access panels
 - 6. Flexible connections
 - 7. Duct Silencers

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 25 00 Mechanical Insulation
 - 2. 23 84 00 Ductwork
 - 3. 23 90 00 Controls and Instrumentation

1.3 QUALITY ASSURANCE

- A. SMACNA Compliance: Comply with applicable portions of Sheet Metal and Air Conditioning Contractor's National Association SMACNA "HVAC Duct Construction Standards" 1st edition, 1985.
- B. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers Inc. (ASHRAE) recommendations pertaining to construction of duct accessories, except as otherwise indicated.
- C. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers".
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of duct accessories.

PART 2 - PRODUCTS

2.1 DAMPERS

SECTION 23 86 00
DUCTWORK ACCESSORIES

- A. Manual Dampers: Provide dampers of single blade type (up to 6" height) or multiblade type (over 6" height), constructed in accordance with SMACNA Standards. Provide damper operator with locking devices and damper position indicator.
- B. Automatic Control Dampers (ACD): Refer to Division 15900C section "Controls and Instrumentation" for automatic control damper requirements. Furnished by Temperature Controls Contractor.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include, but are not limited to the following:
1. Honeywell.
 2. Vent Products
 3. Ruskin Mfg. Co.

2.2 FIRE DAMPERS

- A. Fire Dampers: Provide 1-1/2 hour, Type 'B' UL listed fire dampers, of sizes indicated, unless indicated otherwise. Construct casing of 16 ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link as required. Provide damper with positive lock in closed position, and with the following additional features:
1. U.L. Listed Fire Rating: 1-1/2 hour
 2. Damper Blade Assembly: Curtain type.
 3. Blade Material: Steel, match casing.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include, but are not limited to the following:
1. Air Balance Inc.
 2. Safe Air Inc.
 3. Ruskin Mfg. Co.

2.3 TURNING VANES

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1.5" wide curved blades set at 1.5" spacing O.C., supported with bars perpendicular to blade set at 2" O.C., and set into side strips suitable for mounting in ductwork. Double wall type turning vanes shall be 2" radius, 2-1/8" spacing O.C.
1. Ducts over 24-inch dimension shall use double-wall airfoil type turning vane.
 2. Ducts with air velocity over 2500 FPM shall use double-wall airfoil type turning vane.
- B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.
1. Provide where acoustic duct liner is required.

2.4 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:

SECTION 23 86 00
DUCTWORK ACCESSORIES

1. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include, but are not limited to the following:

1. Ventfabrics, Inc.
2. Young Regulator Co.

2.5 DUCT ACCESS PANELS

A. General: Provide where indicated, duct access panels of size indicated. Minimum size 12" x 12". Access panels are required at the following equipment, but are not limited to these locations:

1. Upstream and downstream of reheat or duct-mounted coils.
2. Fire Dampers.
3. Backdraft and motorized dampers.
4. Automatic Control Dampers - internally mounted.
5. Louvers.

B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one size hinged, other side with one (1) handle-type latch for doors 1/2" high and smaller, 2 handle-type latched for larger doors.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access door which may be incorporated in the work include, but are not limited to the following:

- 1 Air Balance Inc.
- 2 Duro Dyne Corp.
- 3 Ruskin Mfg. Co.
- 4 Ventfabrics Inc.

2.6 FLEXIBLE CONNECTIONS

A. General: Provide flexible duct connections, wherever ductwork connects to vibration-isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.7 DUCT SILENCERS

A. General Requirements: Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer.

1. Silencer inlet and outlet connection dimensions must be equal to the duct sizes shown on the drawings. Duct transitions at silencers are not permitted unless shown on the contract drawings.

SECTION 23 86 00
DUCTWORK ACCESSORIES

2. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
 3. All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed except as noted in Section G below, to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
 4. All perforated steel shall be adequately stiffened to insure flatness and form. All spot welds shall be painted.
 5. Fire-Performance Characteristics: Silencer assemblies, including acoustic media fill, film liner, sealants, and acoustical spacer, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
 6. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.
- B. Silencers Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel, minimum 22 gauge.
- C. Inner perforated metal liner: ASTM A 653/A 653M, G90 galvanized sheet steel.
1. Silencers: 26 gauge.
 2. Elbow Silencers: 22 gauge.
- E. Principal Sound-Absorbing Mechanism:
1. Dissipative silencers: provide with acoustic media of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin.
 2. Glass fiber density and compression shall be as required to insure conformance with laboratory test data.
 3. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly.
 4. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.
- F. Media Protection:
1. Dissipative silencers: Where indicated on the silencer schedule, media shall be encapsulated in glass fiber cloth to help prevent shedding, erosion and impregnation of the glass fiber.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which duct accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

SECTION 23 86 00
DUCTWORK ACCESSORIES

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA Standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 deg. elbows in supply and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against systems air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork as necessary to interface installation of duct accessories properly with other work.
 - 1. Install control dampers provided by Temperature Control Contractor.
- E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

END OF SECTION

SECTION 23 87 00
AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
- B. Types of outlets and inlets required for project include the following:
 - 1. Ceiling Diffusers
 - 2. Return & Exhaust Registers and Grilles

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 84 00 Ductwork
 - 2. 23 86 00 Ductwork Accessories

1.3 QUALITY CONTROL

- A. Manufacturers: Firms regularly engaged in manufacturer of outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. Acceptable manufacturers are listed as follows:
 - 1. Carnes
 - 2. Titus
 - 3. Metal-Aire
 - 4. Krueger
 - 5. Price.
- B. ARI Standards: Comply with Air Conditioning and Refrigeration Institute (ARI) Standard 650 "Air Outlets and Inlets".
- C. ADC Standards: Comply with Air Diffusion Council standards.
- D. MCA Standards: Comply with Air Moving and Conditioning Association standards.

1.4 SUBMITTALS

- A. Submit shop drawings covering each item together with schedule of outlets and inlets.
- B. Submit manufacturer's air diffusion performance data and installation instructions.

PART 2 - PRODUCTS

2.1 GENERAL

SECTION 23 87 00
AIR OUTLETS AND INLETS

- A. Except as otherwise indicated, provide manufacturers standard outlet and inlet products where shown, of size, shape, capacity and type indicated on schedules, constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide outlet and inlet products that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturers current data and schedule for application.
- C. Ceiling Compatibility: Provide outlet and inlet products with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

2.2 CEILING DIFFUSERS

- A. Ceiling Diffusers: Face panel and blades shall be constructed of galvanized steel with exposed surfaces finished in off-white or as scheduled. Diffuser shall have horizontal directional blades for airflow, round or square neck with opposed blade damper. Adjustable vertical or horizontal hinged blades, where scheduled.
 - 1. Extruded aluminum construction.
- B. Diffuser is designed to mount over T-bar suspended or surface mounted in plaster ceiling systems.

2.3 PERFORATED CEILING GRILLES

- A. Perforated Square: Steel construction, perforated hinged face, T-Bar mounted, white finish with black interior. Square or round neck, as scheduled.

2.4 RETURN AND EXHAUST GRILLES AND REGISTERS

- A. Square and Rectangular: Steel or extruded aluminum construction, 40 degrees fixed deflection, surface-mounted.
 - 1. Opposed blade damper, as scheduled.
 - 2. Finish: White.
 - 3. Reversible bar aluminum bar grilles, as scheduled.
- B. Heavy Duty Aluminum Wall Grille and Register: Heavy duty extruded aluminum construction, 1/8" face bars, 1/3" O.C., 30 degree fixed deflection down, extruded aluminum frame.
 - 1. Opposed blade damper, as scheduled.

2.5 SUPPLY REGISTERS

- A. Square and Rectangular: Aluminum construction, double-deflection, streamlined bars spaced 1/2" O.C., 1 1/4" margin, and gasket seals.
 - 1. Opposed blade damper, as scheduled.

2.6 LINEAR SLOT DIFFUSERS

SECTION 23 87 00
AIR OUTLETS AND INLETS

- A. Insulated Plenum Slot Diffusers: Steel construction, insulated plenum with linear slot diffusers for 1 or 2-way throw at ceiling. T-bar mounted or surface mounted with flanged frame.
1. Opposed blade damper, as scheduled.
 2. Finish: White.
 3. Notched center for 48 inch diffusers, as scheduled.
 4. Provide center T-bar, as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Coordinate with other work, including ceiling layout, ductwork and ductwork accessories, as necessary to interface installation of air diffusers properly with other work.
- B. Install items in accordance with manufacturer's printed instructions.
- C. Paint ductwork visible behind air outlets matt black.
- D. Diffusers:
1. At each duct drop or take-off to individual diffusers, locate extractor or scoop.
 2. Support diffusers adequately for type of ceiling receiving diffusers.
 3. Adjust diffuser air pattern as required to provide draft less uniform air distribution.
- E. Grilles and Registers:
1. Secure overlapping frame of register or grille to screen, flange, or angle of ductwork with countersunk screws.
 2. Locate wall registers and grilles minimum 6 inches below ceiling, unless otherwise indicated.
 3. Locate separate accessible balancing volume damper at each register or grille in addition to control damper integral with register or grille.
 4. Adjust registers and grilles to provide draft less uniform air distribution.
- F. Louvers:
1. Coordinate required wall openings with other trades.
 2. Turn over louver to General Contractor for installation.
 3. Verify proper opening requirement with General Contractor.
 4. Caulking and waterproofing by General Contractor.

3.2 FIELD QUALITY CONTROL

- A. Test and operate installed outlets and inlets to demonstrate compliance with requirements.

END OF SECTION

SECTION 23 89 50
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of variable frequency drive (VFD) equipment work is indicated by the Drawings and schedules, and by requirements of this section.
- B. Types of variable frequency drives required for this project include the following:
 - 1. Air Handling Unit AH-13 Supply Fan(10 HP 480-volt 3-phase).
 - 2. Return Fan RF-3(5 HP 480-volt 3-phase).
- C. Variable Frequency Drives(VFD) shall be provided by the HVAC Contractor.
 - 1. The Variable Frequency Drives shall be mounted and wired by the Electrical Contractor.
 - 2. The HVAC Contractor shall be responsible for providing VFD-compatible HVAC motors, where applicable.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 23 05 00 HVAC General Provisions
 - 2. 23 90 00 Controls and Instrumentation

1.3 QUALITY ASSURANCE

- A. UL and NEMA Compliance: Provide products which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.
 - 1. ANSI/UL Standard 508.
- B. IEEE and ANSI Compliance: VFD shall comply with applicable standards of IEEE, ANSI and NEC.
- C. Power Line Noise: Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. Distortion shall not exceed 5%.
- D. Radiated Noise: VFD shall not emit either conducted or radiated RFI in excess of limitations set forth in the FCC Rules and Regulations, Part 15, Subpart J.
- E. Installation and Start-Up Services: VFD manufacturer shall provide a factory trained engineer to approve the installation; start-up operations, test and adjust for proper operations and instruct Owner's representative in the proper operation and maintenance of the units.
- F. Warranty: Manufacturer shall provide standard 18-month warranty for VFD system parts and labor against defects in workmanship and material.
- G. Acceptable Manufacturers:

SECTION 23 89 50
VARIABLE FREQUENCY DRIVES

1. ABB

1.4 SUBMITTALS

- A. Submit shop drawings for all VFD and associated system components as herein specified including all data concerning dimensions, capacities and performance, wiring diagrams and appropriate identification.
- B. Submit certified efficiency versus load and speed curves for VFD.
- C. Submit certified electrical noise generation data in accordance with IEEE 519 standard. Submit electrical noise attenuation equipment required to meet criteria specified.
- D. Operation and Maintenance Manual.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Furnish complete variable frequency drives as specified herein for the fans and pumps, designated on the drawing schedules to be variable speed. All standard and optional features shall be included within the VFD enclosure, unless otherwise specified. VFD enclosure shall be NEMA 1, freestanding or wall mounted.
- B. The VFD shall convert three-phase, 60-Hz utility power to adjustable-voltage and frequency, three-phase power for stepless motor speed control from 5% to 100% of the motor's 60-Hz speed. Input voltage shall be as specified on the Drawing schedules.
- C. The VFD shall include a converter and an inverter section. the converter section shall convert fixed frequency and voltage AC utility power to DC voltage. All VFDs shall include input line reactors.
- D. The inverter section of the VFD shall invert the DC voltage into a quality output waveform, with adjustable voltage and frequency for stepless motor speed control.
- E. The VFD and options shall be tested to ANSI/UL Standard 508. The Complete system, including all specified options, shall be listed by a nationally recognized testing agency such as UL or BTL.
- F. Power line noise shall be limited to a voltage distortion factor and line notch depth as defined in IEEE Standard 519-1981, Guide for Harmonic Control and Reactive Compensation of Static Power Converters. The total voltage distortion shall not exceed 5%.
- G. The VFD shall not emit radiated RFI in excess of the limitations set forth in the FCC Rules and Regulations, Part 15 for Class A computing devices. The VFD shall carry a FCC compliance label. PWM type drives shall include RFI filters.
- H. The VFD shall not cause objectionable acoustical motor noise. Motor noise as a result of the VFD shall be limited to three dB-over across-the-line operation, measured at three feet from the motors center line.
- I. The VFD's full load AMP rating shall meet or exceed NEC Table 430-150.

SECTION 23 89 50
VARIABLE FREQUENCY DRIVES

- J. Motors and variable frequency drives shall be provided by the drive manufacturer and selected to accommodate additional motor heating when driven by a VFD, while maintaining full nameplate horsepower at specified service factor.
- K. VFD system shall modulate the speed of its respective motor in response to a 0-10 VDC or 4-20 mA control signal provided by the Temperature Control Sub-contractor.
- L. VFD system shall consist of the following components:
 - 1. Variable frequency drive.
 - 2. Input disconnect switch.
 - 3. Electrical noise filter.

2.2 VFD UNIT

- A. General: VFD shall be variable torque, solid state transistorized control with diode bridge rectifier and manual transfer switch. The unit shall be U.L. listed, solid state, micro processor-based with a pulse width modulated (PWM) output wave form (none others are acceptable).
 - 1. The VFD shall employ a full wave bridge rectifier, to prevent line notching, with DC output bus choke, capacitors to minimize the ripple of the rectified voltage to maintain near constant DC voltage. Insulated gate bipolar transistors (IGBT's) shall be employed as the output switching device.
 - 2. VFD shall be factory tested at maximum HP and 40 deg. C for 100 hours.
- B. Performance:
 - 1. Input Voltage: 480 volts, 3-phase, 60 Hertz.
 - 2. Output Voltage: 480 volts, 3-phase, 3 to 60 Hertz.
 - 3. Speed Range: 20:1 maximum.
 - 4. Enclosure: NEMA 1 with lock, wall mount.
 - 5. Minimum Efficiency: 92% @ 50%; 99% @ 100% speed.
 - 6. Power Factor: 0.95 thru speed range.
 - 7. Adjustments: Minimum and maximum speed acceleration-deceleration 30 to 50 seconds.
 - 8. Power Line Noise: Voltage distortion factor of 5% or less and a line notch depth of 25% or less.
- C. Standard Features:
 - 1. Run/stop selector switch, auto/manual/bypass selector switch, fault light, manual speed potentiometer, power on light, ready light.
 - 2. Speed/power/load digital display and selector switch.
 - 3. Automatic under voltage reset with adjustable time delay.
 - 4. 0-10 VDC or 4-20 mA common input signal follower.
 - 5. Motor overload protection.
 - 6. Over temperature protection.
 - 7. Under voltage/over voltage protection.
 - 8. Adjustable current limit.
- D. Special Features:
 - 1. Two N.C. and N.O. auxiliary contacts.

SECTION 23 89 50
VARIABLE FREQUENCY DRIVES

2. Input disconnect switch.
- E. Provided devices to permit field adjustment of minimum and maximum output frequency.
- F. Drives shall be equipped with devices allowing field adjustment of acceleration rate. Capability shall exist to allow motor speed to increase from start to full speed in a field adjustable period of time.
- G. Provide one normally open and one normally closed auxiliary contact in each drive. These contacts shall be activated upon drive failure of any kind, including safety shutdowns. Contacts are intended to be used for remote monitoring of drive operation by the central energy management system.
- H. Field performance testing of adjustable speed drive assemblies to determine compliance with specified performance requirements will be performed at the Owner's discretion. Performance testing may include any specified feature, including operation of protective devices (through simulated fault). The cost of initial testing will be borne by the owner. Should drive be found to be deficient in any performance category, drive manufacturer will be required to make any and all changes necessary to bring units into compliance with performance guidelines as specified. The cost of changes, and the cost of retest, will be borne by mechanical contractor.

PART 3 - EXECUTION

3.1 INSTALLATION OF VFD SYSTEM

- A. Install VFD system in accordance with details, shop drawings and manufacturer's instructions.
- B. VFD system components shall be turned over to the Electrical Trade for mounting and wiring under the supervision of the HVAC Contractor and Temperature Controls Sub-Contractor.
 1. Field electrical wiring of line voltage components between transformer, VFD and motors shall be by the Electrical Trade.
 2. Control wiring (100 volts or less) shall be by the Temperature Control Sub-Contractor.
- C. Start-up, Operation and Maintenance:
 1. Manufacturer shall provide the services of a factory-trained engineer to approve the installation, Start-up, test and adjust units for proper operation, and instruct and train the owner's maintenance personnel in the operation and maintenance of the units. Manufacturer's representative shall demonstrate operational capability of units during instruction and training period.
 2. Upon completion of this service, submit to the Engineer a complete diagnostic report, including start-up and test log, signed by the manufacturer's representative.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Includes:

1. Complete system of Direct Digital Automatic controls.
2. Complete integration into existing Alerton network at City-County Building
3. Electrical actuation and control.
4. Control panels, devices, components, wiring and material.
5. Instructions for users.

1.2 DESCRIPTION OF WORK

A. Extent of controls and instrumentation work is indicated on drawings and schedules and by requirements of this section. The DDC control system shall consist of the following:

1. Direct Digital Control Panels.
2. Standalone Application Specific Controllers (ACSs).
3. Network wiring.

B. Integrate the new DDC control work onto the existing Alerton BACnet network. The existing City-County Building service contract is with Environmental System Inc. Contact Jerry Gitlewski @ 262-832-1308 for Alerton Network information and building automation expansion requirements.

C. Existing Controls Upgrade: The new DDC control system shall replace the existing DDC/pneumatic control system for air handler unit AH-13. The Control Contractor shall replace and convert existing pneumatic valve(steam & chilled water) actuators to electric actuation as part of the new DDC control work.

1. Existing damper actuators serving AH-13 are currently electric actuators(24 VAC Belimo).

D. Provide new DDC VAV and fan coil controllers for new equipment scheduled and incorporate into the new DDC control wiring network.

E. Provide temperature sensor and control relay for new Data Closet 100 exhaust fan EF-3.

F. Instruction of Owner's personnel.

1.3 RELATED WORK

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

B. Specified Elsewhere:

1. 23 05 00 HVAC General Provisions
2. 23 05 90 Testing, Adjusting and Balancing
3. 23 90 10 DDC Point List
4. 23 96 00 Starting of Mechanical Systems
5. Division 26 Electrical

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:

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1. National Electrical Code, NEC
 2. National Electrical Manufacturers Association, NEMA
 3. Underwriter's Laboratories, UL
- B. All equipment provided, including control panels, dampers, valves, controllers, transmitters, sensors and other control devices shall bear the manufacturer's nameplate.
- C. Entire control system including piping and wiring shall be installed by mechanics specifically authorized by the Temperature Control equipment manufacturer for the installation and having acceptable experience installing and servicing similar control equipment.
- D. Acceptable Manufacturers:
1. Alerton Controls - BACnet protocol.
- E. Guarantee: Guarantee the controls and instrumentation to maintain the temperature within one degree of the setpoint and further guarantee all work, materials, equipment, and controls against defects in workmanship and material, and provide service for a period of one (1) year from date of final acceptance.

1.5 SUBMITTALS

- A. Shop Drawings:
1. Schematic control diagrams giving specific data on all settings, ranges, action, adjustments, and normal positions.
 2. Wiring diagrams detailed adequately for field construction and include all related wiring.
 3. Control valve and damper schedules with complete sizing data giving required design flow and temperature or pressure, and any other pertinent data.
 4. Sequence of operation for each system corresponding to control schematics.
 5. Panel drawings including complete internal wiring and piping schematics and complete data on all mounted components.
 6. Damper operator schedule, listing quantity, size of operators and mounting arrangement.
 7. Space thermostat sensor schedule indicating types of covers and adjustment means for each space.
- B. Control Diagrams:
1. Furnish and mount in each equipment room or space prints of schematic control diagrams and corresponding sequences of operation for all systems located therein.
 2. Diagrams and sequences mounted in frames under clear plastic and located in easily visible location or as directed by A/E.
- C. Product Data:
1. Submit published descriptive data on each item of equipment and accessories.
 2. Submit manufacturer's installation instructions.
- D. Report:
1. At completion of work, submit report of check-out of automatic control system.
 2. Report actual setpoints with record drawings.

1.6 CALIBRATION AND ADJUSTMENTS

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- A. After completion of the installation, perform final calibrations and adjustments of the control equipment provided under this contract and supply services incidental to the proper performance of the automatic control system under warranty.
- B. Submit letter to Engineer indicating all controls are calibrated and operating per sequence of control.

1.7 SYSTEM START-UP AND ACCEPTANCE PROCEDURE

- A. Upon completion of the calibration, the Control Contractor shall start up the system and perform all necessary testing and run diagnostic tests to ensure proper operation. Control Contractor shall be responsible for generating all software and entering all database necessary to perform the sequence of control and specified software routines. An acceptance test in the presence of the Owner's representative or engineer shall be performed.

1.8 OWNER TRAINING

- A. Provide sufficient but not less than 2 hours of training to the Owner's representatives, concerning the proper operation and maintenance of all control systems, sensing, monitoring and control equipment. Training sessions shall be conducted during normal business hours after system start-up and acceptance by the Owner.
- B. Submit operating and maintenance manuals to Owner a minimum of five (5) working days prior to training session. Use these manuals as the basis for instruction at all training sessions.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Factory shipping cartons for each piece of equipment.
- B. Factory-applied plastic end caps on each length of pipe and tube.
- C. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tube.
- D. Where possible, store equipment and materials inside and protected from weather.
- E. When necessary to store outside, elevate well above grade and enclose with durable waterproof wrapping.

PART 2 - PRODUCTS

2.1 SYSTEM REQUIREMENTS

- A. Provide complete control systems consisting of thermostats, sensors, control valves, dampers, operators, indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified and in compliance with the sequence of operations described herein.
- B. Provide necessary materials, labor and field work necessary to connect control components factory supplied as part of equipment controlled.

2.2 COORDINATION OF TEMPERATURE CONTROL WORK

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- A. Electric Wiring: All electric wiring in connection with the automatic temperature control system shall be furnished and installed by the Controls Trade, except for equipment starter interlocks, which are the responsibility of the Electrical Trade.
1. All 120 (line) volt or larger electrical service wiring and connections to equipment and motor starters is the responsibility of the Electrical Trade.
 2. All additional line voltage power requirements beyond which is indicated on the Drawings and Specifications for the temperature control system shall be the responsibility of the Controls Trade.
- B. Valves and Piping Wells: Furnish by Controls Trade, installed by HVAC Trade under supervision.
- C. Dampers, Valves, Actuators and related Controlled Devices: Furnished by Controls Trade, installed by HVAC Trade under supervision.

2.3 CONTROL VALVES

- A. Water Valves:
1. Furnish all modulating straight-through water valves with equal-percentage contoured throttling plugs. Furnish all three-way valves with linear throttling plugs such that the total flow through the valve shall remain constant regardless of the valve's position.
 2. Valves 2" and smaller shall be screwed type, forged or cast brass, 125 PSIG rated, stainless steel stems, synthetic elastomeric or teflon packing.
- B. Steam Valves: 2-way globe stainless steel trim with Belimo LF series actuator.

2.4 ELECTRIC CONTROL ACTUATORS

- A. Electronic Actuators shall be sized to operate their appropriate dampers or valves with sufficient reserve power to provide smooth proportional action or two-position action as specified.
1. Modulating Valves: Valve actuators shall accept proportional 0-10 VDC or 0-20 mA signals for modulating action.
 2. Two-Position Valves: May be provided at water valves or air handler unit steam valves.
 3. Three-way Valves: Air handling unit water coils.
- B. Provide positive position sequencing relays for accuracy and non-overlapping operation of two or more actuators where required system design function.
- C. Actuators shall be designed to allow replacement of seal glands without draining the piping system.
- D. Acceptable Manufacturers: Belimo or approved equal.

2.5 NORMAL POSITIONS

- A. Regardless of type of system, each device shall assume specified normal positions on power failure.
- B. Normal positions shall be safe positions and as follows:
1. Outside and Relief/Exhaust Air Dampers: Normally closed.
 2. Return Air Damper: Normally open.
 3. Automatic Control Valves: Normally open - full flow thru heat transfer device.

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4. Terminal Heating Valves: Normally open valve position; spring-return to full flow thru heat transfer device.

2.6 CONTROL DAMPERS

- A. The control trade shall furnish all control dampers as shown on the plans and/or as required to perform the control sequence specified except those furnished with fan equipment.
- B. All modulating dampers shall be sized by the control trade to meet flow requirements of the application in accordance with his recommendation. All two-position dampers to be sized as close as possible to duct size, but in no case is damper size to be less than 90% of duct area.
- C. Unless otherwise indicated, all control dampers shall be opposed blade type. Two position dampers may be parallel blade type.
- D. All dampers shall be factory fabricated and shall be standard products of the control manufacturer.
- E. Damper frames shall not be less than 13 gauge galvanized steel or extruded aluminum of 12 gauge. Blades shall not be less than 16 gauge galvanized steel or 14 gauge aluminum, not over 8 inch width with steel trunnions mounted in a bronze sleeve or ball bearings.
- F. All blade linkage hardware shall have corrosion-resistant finish and be readily accessible for maintenance.

2.7 ELECTRICAL EQUIPMENT REQUIREMENTS

- A. Provide electrical devices and relays that are UL listed and of a type meeting current and voltage characteristics of the project.

2.8 SENSORS/TRANSMITTERS

- A. Temperature Sensors (Room): Use a surface mount zone temperature sensor housed in a durable, ventilated plastic wall-mount enclosure, with broad aluminum faceplate. The sensing element to be a 1,000 ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA accuracy +/- 1/2% span.
1. Adjustable setpoint space thermostats with LED readout and setpoint information consistent with the other thermostats in the City-County Building DDC system.
 2. Unoccupied override button at sensor.
- B. Temperature Sensors (Discharge and Return Duct): Use a surface mount duct temperature sensor housed onto a standard metal handibox. The sensing element to be a 10,000-ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA. House sensor in an 8-1/2" stainless steel probe. Accuracy +/- 1/2% span.
- C. Temperature Sensor (Mixed Air - Averaging): Select an averaging capillary type sensor housed on a standard metal handibox. The capillary type sensor to house no less than five sensing elements, which will return an average of the five or more sensor elements. The sensing elements are to be a 1,000-ohm RTD (nickel or silicon) 0-10 VDC, or 4-20 MA. Accuracy +/- 1/2% span.
- D. Immersion type temperature sensors: Rod and tube type with linear output. Provide separable thermo wells with heat conductive fluid for installation in pipeline. Units shall be factory calibrated.

2.9 DIGITAL PANELS

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- A. General: Digital Panels shall be microprocessor-based, multi-tasking, multi-user, digital control processors.
- B. Memory: Each Digital Panel shall have sufficient memory to support its own operating system and databases including:
 - 1. Control Processes
 - 2. Energy Management Applications
 - 3. Alarm Management
 - 4. Trend Data
 - 5. Maintenance Support Applications
 - 6. Operator I/O
 - 7. Dial-Up Communications
 - 8. Manual Override Monitoring
- C. Expandability: The system shall be modular in nature, and shall permit easy expansion through the addition of field controllers, sensors, and actuators.
- D. Serial Communication Ports: Digital Panels shall provide at least two RS-232C serial data communication ports for simultaneous operation of multiple operator I/O devices such as laptop computers, Personal Computers, and Video Display terminals.
- E. Hardware Override Monitoring: Digital Panels shall monitor the status of all overrides, and include this information in logs and summaries to inform the operator that automatic control has been inhibited.
- F. Integrated On-Line Diagnostics: Each Digital Panel shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all subsidiary equipment. The Digital Panels shall provide both local and remote annunciation of any detected component failures, or repeated failure to establish communication. Indication of the diagnostic results shall be provided at each Digital Panel.
- G. Surge and Transient Protection: Isolation shall be provided at all network terminations, as well as all field point terminations to suppress induced voltage transients consistent with IEEE Standard 587-1980. Isolation levels shall be sufficiently high as to allow all signal wiring to be run in the same conduit as high voltage wiring where acceptable by electrical code.
- H. Powerfail Restart: In the event of the loss of normal power, there shall be an orderly shutdown of the Digital Panels to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data, and battery back-up shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
 - 1. Upon restoration of normal power, the Digital Panels shall automatically resume full operation without manual intervention.

2.10 SYSTEM SOFTWARE FEATURES

- A. General
 - 1. All necessary software to form a complete operating system as described in this specification shall be provided.
 - 2. The software programs specified in this section shall be provided as an integral part of the Digital Panel and shall not be dependent upon any higher level computer for execution.
- B. Graphic Requirements: Provide color graphic backgrounds with operational information interface for the following systems:

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1. Air handling system with AH-13, RF-3 & EF-2
2. Each VAV terminal.
3. Fan Coil S-10.
4. EF-3.
5. Building Floor Plan graphic for temperature sensor informational and terminal unit service designations.

C. Control Software Description:

1. Equipment Cycling Protection: Control software shall include a provision for limiting the number of times each piece of equipment may be cycled within any one-hour period.
2. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
3. Powerfail Motor Restart: Upon the resumption of normal power, the DDC panel shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling, and turn equipment on or off as necessary to resume normal operation.

D. Energy Management Applications: Digital Panels shall have the ability to perform any or all of the following energy management routines:

1. Time of Day Scheduling
2. Calendar Based Scheduling
3. Holiday Scheduling
4. Temporary Schedule Overrides
5. Optimal Start
6. Optimal Stop
7. Demand Limiting
8. Load Rolling
9. Heating/Cooling Interlock
10. Average/High/Low Signal Select and Reset

All programs shall be executed automatically without the need for operator intervention, and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the "Execution" portion of this specification.

E. Programming Capability: Digital Panels shall be able to execute configured processes defined by the user, to automatically perform calculations and control routines.

1. Process Inputs and Variables: It shall be possible to use any of the following in a custom process:
 - a. Any system-measured point data or status
 - b. Any calculated data
 - c. Any results from other processes
 - d. Boolean logic operators (and, or,)
2. Process Triggers: Configured processes may be triggered based on any combination of the following:
 - a. Time of Day
 - b. Calendar Date
 - c. Other Processes
 - d. Events (e.g., point alarms)
3. Data Access: A single process shall be able to incorporate measured or calculated data from any and all other ASCs.

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In addition, a single process shall be able to issue commands to points in any and all other NCUs on ASCs local network.

- F. Alarm Management: Alarm management shall be provided to monitor, buffer, and direct alarm reports to operator devices and memory files. Each Digital Panel shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost. At no time shall the Digital Panel's ability to report alarms be affected by either operator activity at the local I/O device, or communications with other ASCs on the network.
1. Alarm Messages: In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 60-character alarm message to more fully describe the alarm condition or direct operator response.
 2. Each Digital Panel shall be capable of storing a library of at least 100 Alarm Messages. Each message may be assignable to any number of points in the panel.
 3. Auto-Dial Alarm Management: In dial-up applications, only critical alarms shall initiate a call to a remote operator device. In all other cases, call activity shall be minimized by time-stamping and saving reports until an operator scheduled time, a manual request, or until the buffer space is full. The alarm buffer must store a minimum of 50 alarms.
- G. Trend Analysis: A data collection utility shall be provided to automatically sample, store and display system data.
- Measured and calculated analog and binary data shall be assignable to user-definable trends for the purpose of collecting operator-specified performance data over extended periods of time. Sample intervals of 5 seconds to 24 hours, in one-minute or one-hour intervals, shall be provided. Each Digital Panel shall have a dedicated buffer for trend data, and shall be capable of storing 32 trend logs. Each trend log shall have up to 4 points trended at 168 data samples each. data shall be stored at the Digital Panel.
- Trending: The BAS will be capable of trending all data points for 5 years with logging intervals of 15 minutes, and be available to trend all data points with an interval of 5 seconds or less for up to at least two hours. The format of the trending data will be in a format acceptable by MS Excel-2003 or newer.
- The trend data shall be in a table with date and time in the first column(s) and the trending data in consecutive columns. All columns shall have the heading on the first row(s) and the data for that heading in the same column in the following rows. All headings will be explained in detail such that there is no uncertainty as to what was measured and the location of that sensor. All columns headings shall include the units for the trended data.
- The trending data files shall not contain more than 200 columns and 65,000 rows each.
- H. Runtime Totalization: Digital Panels shall automatically accumulate and store runtime hours for binary input and output points as specified in the "Execution" portion of this specification.
1. The Totalization routine shall have a sampling resolution of one minute.
 2. The user shall have the ability to define a warning limit for Runtime Totalization. Unique, user-specified messages shall be generated when the limit is reached.
- I. Event Totalization: Digital Panels shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

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1. The Event Totalization feature shall be able to store the records associated with a minimum of 9,999,999 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

2.11 APPLICATION SPECIFIC CONTROLLERS - HVAC APPLICATIONS

- A. Each Digital Panel shall be able to extend its performance and capacity through the use of standalone Application Specific Controllers (ASCs).
- B. Each ASC shall operate as a standalone controller capable of performing its specific control responsibilities independently of other controllers in the network. Each ASC shall be of microprocessor-based, multi-tasking, real-time digital control processor.
- C. Each ASC shall have sufficient memory to support its own operating system and data bases including:
 1. Control Processes
 2. Energy Management Applications
 3. Operator I/O (Portable Service Terminal)
- D. The operator interface to any ASC point data or programs shall be through the Digital Panel or portable operator's terminal connected to any ASC on the network.
- E. ASCs shall directly support the temporary use of a portable service terminal that can be connected to the ASC via zone temperature or directly at the controller. The capabilities of the portable service terminal shall include, but not be limited to, the following:
 1. Display temperatures
 2. Display status
 3. Display setpoints
 4. Display control parameters
 5. Override binary output control
 6. Override analog setpoints
 7. Modification of gain and offset constants
- F. Powerfail Protection: All system setpoints, proportional bands, control algorithms, and any other programmable parameters shall be stored such that a power failure of any duration does not necessitate reprogramming the ASC.
- G. Application Descriptions:
 1. VAV Terminal Unit Controllers:
 - a. VAV Terminal Unit Controller shall support, but not be limited to, the control of the following configurations of VAV boxes to address current requirements described in the "Execution" portion of this specification, for future expansion.
 - 1.) Single Duct Only (Cooling Only, or Cooling with Reheat)
 - 2.) Supply/Exhaust.
 - b. VAV Terminal Unit Controller shall support the following types of point inputs and outputs:
 - 1.) Proportional Cooling Outputs
 - 2.) Box and Baseboard Heating Outputs: (Proportional or 1 to 3 Stages)
 - 3.) Fan Control Output: (On/Off Logic, or Proportional Series Fan Logic)
 - 4.) Discharge Air Temperature

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- c. VAV Terminal Unit Controllers shall support the following library of control strategies to address the requirements of the sequences described in the “Execution” portion of this specification, and for future expansion:
 - 1.) Daily Schedules
 - 2.) Comfort/Occupancy Mode
 - 3.) Economy Mode
 - Standby Mode
 - Unoccupied
 - Shutdown
 - 4.) Lighting Logic Interlock to Economy Mode
 - 5.) Temporary Override Mode

 - d. Alarm Management: Each VAV Terminal Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.
2. Unitary Controllers:
- a. Unitary Controllers shall support, but not be limited to, the following types of systems to address specific applications described in the “Execution” portion of this specification, and for future expansion:
 - 1.) Fan Coils (Two-Pipe, Four-Pipe)
 - 2.) Generic Point Multiplexing

 - b. Unitary Controllers shall support the following types of point inputs and outputs:
 - 1.) Economizer Switchover Inputs
 - a.) Drybulb
 - b.) Outdoor Air Enthalpy
 - c.) Differential Temperature
 - d.) Binary Input from a separate controller
 - 2.) Economizer Outputs
 - a.) Integrated Analog with minimum position
 - b.) Binary Output to enable self-contained
 - c.) Economizer Actuator
 - 3.) Heating and Cooling Outputs
 - a.) 1 to 3 Stages
 - b.) Analog Output with two-pipe logic
 - c.) Reversing valve logic for Heat Pumps
 - 4.) Fan Output
 - a.) On/Off Logic Control

 - c. Unitary controllers shall support the following library of control strategies to address the requirements of the sequences described in the “Execution” portion of this specification, and for future expansion:
 - 1.) Daily Schedules
 - 2.) Comfort/Occupancy Mode
 - 3.) Economy Mode:
 - Standby Mode/Economizer Available
 - Unoccupied/Economizer Not Available
 - Shutdown
 - 4.) Lighting Logic Interlock to Economy Mode
 - 5.) Temporary Override Mode:
 - Temporary Comfort Mode (Occupancy-Based Control)
 - Boost (Occupant Warmer/Cooler Control)

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- d. Alarm Management: Each VAV Terminal Unit Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

- 3. AHU Controllers:
 - a. AHU Controllers shall support, but not be limited to the following configurations of systems to address current requirements as described in the “Execution” portion of this specification, and for future expansion:
 - 1.) Air Handling Units
 - Mixed Air-Single Path
 - Mixed Air-Dual Path
 - 100% Single Path
 - 100% Dual Path
 - Generic Point Multiplexing

 - b. AHU Controllers shall support all the necessary point inputs and outputs to perform the specified control sequences in a totally standalone fashion.

 - c. AHU controllers shall have a library of control routines and program logic to perform the sequence of operation as specified in the “Execution” portion of this specification.

 - d. Continuous Zone Temperature Histories: Each AHU Controller shall automatically and continuously, maintain a history of the associated zone temperature to allow users to quickly analyze space comfort and equipment performance for the past 24 hours. A minimum of two samples per hour shall be stored.

 - e. Alarm Management: Each AHU Controller shall perform its own limit and status monitoring and analysis to maximize network performance by reducing unnecessary communications.

 - f. Each AHU Controller shall come with a hand-held Zone Terminal permanently mounted at the controller to allow interface with the controller. This device will allow the user to monitor or adjust set points and time scheduling within a specific zone.

2.10 CONTROL SEQUENCE

- A. Systems shall perform in accordance with the following descriptions of the control strategy intent.

- B AIR HANDLER UNITS AH-13 / RF-3
 - 1. System consists of a draw-through single path air handling unit with variable volume supply and return fans, steam water heating, chilled water cooling coil, duct-mounted fresh, return and exhaust air control dampers.
 - a. Retrofit existing normally open two-way steam modulating automatic valve for steam heating coil and three-way modulating automatic valve for the chilled water coil to electric actuation.
 - b. Reuse existing damper operators only for the duct-mounted fresh air, return air and exhaust dampers serving air handling unit.
 - c. Reuse existing sensors to fullest extend possible.

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2. Occupied Mode: Supply fan SF and return fan RF shall run continuously with fresh air, return air and exhaust air dampers indexed to minimum fresh air position. Discharge air controller shall sequence economizer low-limit control, modulate 2-way steam valve on the heating coil and 3-way chilled water valve on cooling coil to maintain discharge air temperature setpoint. Discharge air temperature setpoint shall be reset by the BAS based on the most demanding VAV damper position(call for cooling).
 - a. Reset range: 53 to 60 degrees F.
 - b. Interlock Exhaust Fan EF-2 with Occupied Mode.
3. Unoccupied Mode: Supply and return fans will shutdown with fresh air, return air and exhaust air dampers indexed move to 100% return air position. Valves move to normal position.
4. Morning Warm-Up Mode: On morning warm-up cycle, supply and return fan shall operate continuously with 100% return air. Steam coil and VAV reheat coil valves shall open 100% to supply heat to discharge air until return air temperatures reach a preset warm-up set point temperature.
 - a. Initial Warm-Up Set Point: 68 degrees F.
5. VAV Supply Air Fan SF Capacity Control: Static pressure controller with duct-mounted pressure sensor where shown on the Drawings shall modulate supply air fan volume through VFD motor speed controls to maintain minimum duct static setpoint in supply duct at sensor location.
 - a. Initial Setpoint: 0.75" W.G.(adjustable)
 - b. High limit supply duct static pressure control set at 4.0" W.G. shall shut down supply and return fans and signal alarm with manual reset.
6. VAV Return Fan RF Air Capacity Control: Return fan volume shall modulate with VFD motor speed controls to match supply fan VFD motor speed controls.
7. Economizer Control: A low-limit mixed air dry-bulb controller will sense return air and outside air temperature conditions and modulate mixing box dampers in sequence to maintain optimum temperature mixture for discharge air setpoint conditions.
8. Freeze Control: Low-limit immersion water sensor in the heating coil leaving water stream(HWR) shall upon sensing temperature below 35 degrees: Close fresh air damper, open heating coil valve 100%, shut down supply fan, return fan and move mixed air/relief dampers to 100% return air. Signal local and BAS alarm with manual local reset and remote BAS reset.
9. Smoke Detector: Existing smoke detector in the return air ductwork shall shut down supply fan, open relief damper and return mixing box dampers to 100% return air upon detection of products of combustion. Smoke detector by the Electrical Contractor; associated wiring to the temperature control panel and interlocks shall be provided by this Contractor. Signal local and BAS alarm with manual local reset.

C. VAV TERMINAL UNITS WITH REHEAT

1. The VAV terminal units shall be individually controlled by a DDC VAV controller per VAV terminal unit. VAV box manufacturer shall provide flow ring with VAV box. The DDC controller, damper motor, and differential pressure transducer shall be supplied by the BAS Contractor and furnished to the terminal unit supplier for factory installation.

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2. The room sensor working through the pressure independent DDC controller shall modulate the box damper from minimum damper position and sequence reheat coil valve to maintain discharge air setpoint at 70 deg F heating and 75 deg F cooling with deadband. Discharge air shall be reset by the space sensor to satisfy the space conditions. Upon a further drop in space temperature below space setpoint for heating, controller shall sequence on perimeter radiation, where present.
 - a. Reset range 55 deg F - 100 deg F.
 - b. Provide single minimum air flow through deadband and dual maximum air flow for cooling and heating.
 3. Unoccupied: Provide unoccupied space setpoint for heating and cooling. Air system shall be activated and shall supply heating or cooling to the space to satisfy the unoccupied heating setpoint.
 - a. Local override switch at sensor shall allow override of central air handling unit unoccupied mode to occupied mode.
- D. FAN COIL S-10
1. Fan coil shall be equipped with two-way hot water control valve and return air temperature sensor.
 - a. Occupied Mode: Fan coil supply fan shall run continuous. Upon a call for heating from RA sensor, two-way control valve shall modulate open to satisfy temperature set point.
 - b. Unoccupied Mode: Upon a call for heating from RA sensor, fan shall cycle with two-way control valve 100% open to satisfy space temperature set point.
- E. EXHAUST FAN EF-3
1. Activate exhaust fan EF-3 upon temperature at sensor reaching setpoint.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install all control equipment, wiring and air piping in a neat and workmanlike manner.
- B. All immersion wells, pressure tappings and any associated shut-off valves, flow switches, level switches and other such items furnished by the control manufacturer shall be installed by the mechanical contractor under the coordinating control and supervision of the control contractor.
- C. Install all control devices in an accessible location.
- D. Electrical Wiring: All electrical wiring for the automatic control system, excluding line voltage power to control panels, as indicated on the Drawings, shall be furnished and installed by the Temperature Control Contractor in accordance with this specification section. All the electrical sections of this specification and all applicable electric codes shall apply to the required work.
 1. Sensor and/or control wiring shall be provided with conduit independent of those used for high voltage, switches AC or other signals which may create interference or cause induced

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voltages which promote signal drift or reduced accuracy. Sensor and high voltage wiring may not be run in the same conduit.

3.2 INSTALLATION

- A. Check and verify location of thermostats, room sensors and other exposed control sensors with plans and piping details before installation. Locate thermostats and sensors 60 inches above floor.
1. Isolated from exterior walls as recommended by manufacturer.
 2. Located where not exposed to direct rays of sun, and where not influenced by concealed or adjacent heating, domestic hot water piping or warm air currents.
- B. Valve tops, inserts or bonnets, sensors, thermostats, thermometers, gauges, and damper motors of all types:
1. Provide with access doors and/or access panels, in building construction so that they may be readily removed, replaced and serviced.
 2. Access doors and access panels by HVAC Contractor.
- C. Control Wiring of all Kinds:
1. All control wiring to be labeled at both ends identifying termination and origination point.
 2. In conduit and included with temperature control system.
 3. Concealed low voltage control wiring may be routed as cabling.
 4. Exposed control wiring shall be in EMT conduit.
 5. Conforming to all requirements of Electrical Specifications, Division 16.
- D. Locate controls, relays, instruments, switches, valves, devices and accessories so they are readily accessible for adjustment, service, and replacement or as indicated on the drawings.
- E. Install control valves horizontal with power unit up unless otherwise indicated. Maximum variation from vertical is 45 degrees.
- F. Locate, size and support temperature sensing elements in water streams to properly sense the representative temperature.
1. For controlling, transmitting and indicating elements, sensing device located, sized and of the type to sense the average condition.
 2. Wells shall not obstruct the flow of the fluid being measure.
 3. Pipes 1" and smaller shall be increased at least one pipe size at point of insertion.
- G. Where insulation on piping, ductwork or equipment is punctured or penetrated due to the installation of sensing elements or tubing, reseal the openings air and vapor tight.
- H. Where control devices are to be located on insulated surfaces, provide brackets to clear the finished surface of the insulation avoiding punctures of the vapor seal.
- I. Locate support, enclose and install control devices and equipment so that they will not be subject to:
1. Vibration
 2. Excessive temperatures
 3. Dirt, moisture or other harmful effects.
 4. Conditions beyond their rated limitations.

SECTION 23 90 00
CONTROLS AND INSTRUMENTATION

- J. Conceal all piping except piping in mechanical rooms and other areas where mechanical system piping may be exposed.
- K. Install all exposed piping and conduit parallel to or at right angles to the building structure and support adequately at uniform intervals. Use only tool made bends.
- L. Make tests on piping from time to time during the progress of installation to insure against leaks.

3.3 TESTING, ADJUSTING AND PERFORMANCE DEMONSTRATIONS

- A. All controlling devices which are a part of the automatic temperature control system, shall be tested and adjusted by the Contractor before system is offered for final acceptance.
 - 1. All associated devices, valves, operators and dampers adjusted.
 - 2. All operating and positioning of all dampers verified.
- B. After all calibrations, adjustment and checking have been completed and all systems are operational:
 - 1. Demonstrate to User's representative, the complete and correct functioning of all control systems and equipment.
 - 2. Demonstrations shall consist of operating the controls through their normal full ranges and sequences.
 - 3. Simulate abnormal conditions to demonstrate proper functioning of safety devices.
 - 4. Readjust all settings to their correct design values and after sufficient time, observe ability of controls to establish the desired conditions, noting any abnormal deviations.
 - 5. Make any necessary repairs, replacements or adjustments on all items which fail to perform satisfactorily, all to the satisfaction of the Owner's representative.
- C. Upon completion of the work and testing, but prior to final acceptance:
 - 1. A representative of the control system manufacturer shall spend such length of time as necessary to instruct the Owner's personnel in proper operation, adjustment and maintenance of the control equipment and systems.
 - 2. Instruction shall be performed by competent, trained, full-time employees of the control system manufacturer who have a complete working knowledge of the systems and equipment installed in this job.

END OF SECTION

SECTION 23 90 10
DDC POINT LIST

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Direct Digital Control (DDC) Point List.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Refer to schematic layout of control and HVAC equipment on HVAC drawings.
- C. Specified Elsewhere:
1. 23 90 00 Controls and Instrumentation

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Refer to Section 23 90 00 - Controls and Instrumentation.

PART 3 - EXECUTION

3.1 DDC POINT LIST

- A. Controls systems shall provide the DDC input/output control points and related as scheduled on the attached sheets 23 90 10 - 2 and 3.

END OF SECTION

DDC POINT LIST

| <u>POINT DESCRIPTION</u> | <u>TYPE</u> | <u>OPERATION SCHEDULE</u> | <u>ALARM</u> | <u>HISTORY</u> | <u>FIELD DEVICE</u> |
|--|----------------|---------------------------|--------------|----------------|------------------------|
| AIR HANDLING UNIT AH-13 & RETURN FAN RF-3 | | | | | |
| SF FAN(AH-13) | DIGITAL OUTPUT | START/STOP | -- | RUNTIME | RELAY @ VFD |
| SF FAN(AH-13) | DIGITAL INPUT | STATUS | FLOW FAIL | -- | CURRENT SENSOR |
| SF FAN(AH-13) VFD | ANALOG OUTPUT | FAN SPEED | -- | 15 MIN. | 0-10 VDC SIGNAL |
| RF-3 FAN | DIGITAL OUTPUT | START/STOP | -- | RUNTIME | RELAY @ VFD |
| RF-3 FAN | DIGITAL INPUT | STATUS | FLOW FAIL | -- | CURRENT SENSOR |
| RF-3 VFD | ANALOG OUTPUT | FAN SPEED | -- | 15 MIN. | 0-10 VDC SIGNAL |
| SA DUCT PRESS. | ANALOG INPUT | PRESS. | H/L PRESS. | 30 MIN. | DUCT PRESS. SENSORS(2) |
| SA HL DUCT PRESS. | BINARY INPUT | PRESS. | HIGH PRESS. | | HIGH LIMIT DUCT PRESS. |
| AH-13 FA DPRS | ANALOG OUTPUT | MODULATE | -- | 30 MIN. | DAMPER ACTUATOR |
| AH-13 RA DPRS | ANALOG OUTPUT | MODULATE | -- | 30 MIN. | DAMPER ACTUATOR |
| AH-13 EA DPRS | ANALOG OUTPUT | MODULATE | -- | 30 MIN. | DAMPER ACTUATOR |
| AH-13 FA | ANALOG INPUT | TEMP. | H/L TEMP. | 15 MIN. | SENSOR-DUCT |
| AH-13 RA | ANALOG INPUT | TEMP. | H/L TEMP. | 15 MIN. | SENSOR-DUCT |
| AH-13 MA | ANALOG INPUT | TEMP. | H/L TEMP. | 15 MIN. | SENSOR-AHU |
| AH-13 HC TEMP | ANALOG INPUT | TEMP. | H/L TEMP. | 15 MIN. | SENSOR-AHU HTG COIL |
| AH-13 DA | ANALOG INPUT | TEMP. | H/L TEMP. | 30 MIN. | SENSOR-DUCT |
| AH-13 LL | BINARY INPUT | FREEZESTAT | LOW TEMP. | 30 MIN. | DPST SWITCH |
| AH-13 HTG VALVE | ANALOG OUTPUT | MODULATE | -- | 30 MIN. | 2-WAY VALVE ACTUATOR |
| AH-13 CLG VALVE | ANALOG OUTPUT | MODULATE | -- | 30 MIN. | 3-WAY VALVE ACTUATOR |
| AH-13 RA SMOKE DETECTOR | BINARY INPUT | STATUS | SMOKE | 30 MIN. | AUX. CONTACT @ SD |
| EXHAUST FAN EF-2 | DIGITAL OUTPUT | START/STOP | -- | RUNTIME | RELAY @ UNIT |
| EXHAUST FAN EF-2 | DIGITAL INPUT | STATUS | FLOW FAIL | -- | CURRENT SENSOR |

DDC POINT LIST

| <u>POINT DESCRIPTION</u> | <u>TYPE</u> | <u>OPERATION SCHEDULE</u> | <u>ALARM</u> | <u>HISTORY</u> | <u>FIELD DEVICE</u> |
|---------------------------|----------------|---------------------------|--------------|----------------|--------------------------|
| <u>VAV TERMINAL UNITS</u> | | | | | |
| VAV BOX (TYPICAL EA.) | ANALOG INPUT | TEMP. | H/L TEMP | 15 MIN. | SPACE SENSOR |
| VAV BOX (TYPICAL EA.) | ANALOG OUTPUT | MODULATE | -- | 15 MIN. | AIR VALVE ACTUATOR |
| VAV BOX (TYPICAL EA.) | ANALOG OUTPUT | MODULATE | -- | 15 MIN. | REHEAT HW VALVE ACTUATOR |
| VAV BOX (TYPICAL EA.) | ANALOG INPUT | AIR FLOW | H/L TEMP | 15 MIN. | CFM OF VAV BOX |
| VAV BOX (TYPICAL EA.) | ANALOG INPUT | TEMP. | H/L TEMP | 15 MIN. | ENTERING SA |
| VAV BOX (TYPICAL EA.) | ANALOG INPUT | TEMP. | H/L TEMP | 15 MIN. | LEAVING SA |
| <u>FAN COIL UNIT S-10</u> | | | | | |
| RETURN AIR SENSOR | ANALOG INPUT | TEMP. | H/L TEMP | 15 MIN. | DUCT TEMP SENSOR |
| HTG COIL | DIGITAL OUTPUT | OPEN/CLOSE | -- | 15 MIN. | 2-WAY CONTROL VALVE |
| FAN COIL HEATER | DIGITAL OUTPUT | START/STOP | -- | 15 MIN. | FAN RELAY TYP |
| <u>EXHAUST FAN EF-3</u> | | | | | |
| SPACE SENSOR | ANALOG INPUT | TEMP. | H/L TEMP | 15 MIN. | SPACE SENSOR |
| EXHAUST FAN | DIGITAL OUTPUT | START/STOP | -- | 15 MIN. | FAN RELAY TYP |

END OF SECTION

SECTION 23 96 00
STARTING OF MECHANICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Contractor:

1. Provide material and labor required for start up of all equipment and systems installed under general contract.
2. Coordinate start-up work with pipe cleaning, pipe system leak tests, and initial system fill and venting.
3. Provide all information and assistance required for cooperation with testing, adjusting and balancing services.
4. Contractor shall coordinate start-up of mechanical equipment with manufacturer's representative to be present for supervision and certification of correct operating procedures.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

- | | | |
|----|----------|----------------------------------|
| 1. | 23 05 90 | Testing, Adjusting and Balancing |
| 2. | 23 06 00 | Pipe and Pipe Fittings |
| 3. | 23 63 00 | Water Treatment |
| 4. | 23 74 00 | Terminal Air Distribution Units |
| 5. | 23 89 50 | Variable Frequency Drives |
| 6. | 23 90 00 | Controls and Instrumentation |

1.3 START-UP PROCEDURES

A. Bearings:

1. Inspect for cleanliness, clean and remove foreign materials.
2. Verify alignment.
3. Replace defective bearing and those which run rough or noisy.
4. Lubricate as necessary in accordance with manufacturer's recommendations.

B. Motors:

1. Check each motor for amperage comparison to nameplate value.
2. Correct conditions, which produce excessive current flow, which exist due to equipment malfunction.

C. Drives:

1. Adjust tension in V-belt drives, and adjust vari-pitch sheaves and drives for proper equipment speed.
2. Adjust drives for alignment of sheaves and V-belts.
3. Clean and remove foreign materials before starting operation.

D. Pumps:

SECTION 23 96 00
STARTING OF MECHANICAL SYSTEMS

1. Check mechanical seals for cleanliness and adjustment before running pump.
2. Inspect shaft sleeves for scoring.
3. Inspect mechanical faces, chambers and seal rings; replace if defective.
4. Verify that piping system is free of dirt and scale before circulating liquid through pump.
5. Clean suction strainers.

E. Control Valves:

1. Inspect hand and automatic control valves, clean bonnets and stems.
2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
3. Replace packing on any valve, which continues to leak.
4. Remove and repair bonnets, which leak.
5. Coat packing gland threads and valve stems with surface preparation after cleaning.
6. Verify that control valve seats are free from foreign materials and are properly positioned for intended service.

F. Water Systems:

1. Tighten flanges after system has been placed in operation. Replace flange gaskets, which show signs of leakage after tightening.
2. Inspect screwed joints for leakage. Promptly remake each joint, which appears to be faulty; do not wait for rust to form.
3. After water system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems to assure being free of foreign materials.
4. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.
5. Inspect each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.
6. Inspect each pressure gauge and thermometer for calibration. Replace items defaced, broken or read incorrectly.
7. Repair damaged insulation.

G. Air Systems:

1. Set and calibrate draft gages of air filters and other equipment.
2. Replace filter media with new clean units.
3. Inspect fan wheels for clearance and balance. Provide factory-authorized personnel for adjustment when needed.
4. Check each electrical control circuit to assure that operation complies with specifications and requirements to provide desired performance.

H. Adjustments:

1. Provide such periodic continuing adjustment services as necessary to insure proper functioning of mechanical systems after occupancy of the Project, and for a period of one year after Date of Substantial Completion.
2. Note: Adjustment services are not maintenance services.

PART 2 - PRODUCTS

SECTION 23 96 00
STARTING OF MECHANICAL SYSTEMS

--- NOT USED ---

PART 3 - EXECUTIONS

--- NOT USED ---

END OF SECTION

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Applicable provisions of Division 1 shall govern Work under this Section.
- B. Furnish all labor, materials, equipment and accessories required to complete all electrical work as shown on the Drawings and specified herein, and shall include, but is not necessarily limited to:

26 05 00 Electrical General Provisions
26 10 00 Electrical Demolition and Alterations
26 11 00 Raceways and Boxes
26 12 00 Low Voltage Conductors and Cables
26 14 00 Wiring Devices
26 16 20 Panelboards
26 18 50 Equipment Connections
26 19 00 Supporting Devices
26 45 00 Grounding and Bonding
26 51 00 Interior Building Lighting
26 51 10 Lighting Control Systems
Division 27 Communications
Division 28 Electronic Safety and Security

C. Work Included in Division 26:

1. General: The mention hereinafter of article, operation, material, equipment or method requires that the E.C. shall provide such article of quality noted, in the quantity required, shall perform each operation, and use such method, material or equipment prescribed, all in complete accordance with the conditions stated. The E.C. shall provide all materials, labor, tools, equipment and transportation as necessary to complete the project in conformity with the drawings, the specifications, and other Contract Documents. In general, this work includes everything essential for a complete electrical system in operating order as shown or implied on the drawings or hereinafter specified.
2. All work shall be in accordance with all Local & State Inspection Authorities having jurisdiction together with the recommendations of the manufacturer whose equipment is to be supplied and connected by the E.C. All materials shall bear a UL label where a UL Standard and/or test exists.
3. Before submitting his bid, each bidder shall examine the drawings relating to this work and shall become fully informed as to the extent and character of the work required and its relation to other work in the building. No consideration will be granted for any alleged misunderstanding of materials to be furnished or work to be done, it being understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein or indicated on the accompanying drawings.
4. The E.C., in conjunction with the Engineer's representative, shall establish exact location of all materials and equipment to be installed in consideration of construction features, equipment of other trades and requirements and purpose of equipment installed by the E.C.

D. Summary of Electrical Work:

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ELECTRICAL GENERAL PROVISIONS

1. Drawings and Specifications: Electrical drawings are schematic. Minor relocations of these items may be made by the Engineer prior to rough in at no expense to the Owner.
2. Any conflict between the drawings and specifications shall be brought to the attention of the Engineer.
3. Note that the electrical drawings are only a portion of the complete set of plans. The complete set of plans shall be used to define the electrical work.
4. The complete specifications will be utilized to define the electrical work.
5. General Outline: The facilities and systems of the electrical work can be described (but not by way of limitation) as follows:
 - a. Demolish and remove electrical equipment, light fixtures, raceways and conductors.
 - b. Remove and replace panelboard.
 - c. Provide new lighting, electrical devices and distribution.
 - d. Provide Communications cabling and raceways.
 - e. Extend existing fire alarm system to remodeled space.
 - f. Support security system installation with raceways required.

E. Coordination of Electrical Work:

1. General: The Contractor shall confer with the other trades and the Engineer so that all concerned will be thoroughly familiar with the specific items and areas of the coordination.
2. Conflicts of any type shall be immediately reported to the Engineer.
3. The Contractor shall furnish and be responsible for the proper installation of all reinforcement required for wall or ceiling attached equipment.
4. Arrange electrical work in a neat, well organized manner with conduit and similar services running parallel with primary lines of the building construction.
5. Locate operating and control equipment properly to provide easy access, and arrange entire electrical work with adequate access for operation and maintenance.
6. All conduit shall be concealed except in mechanical and electrical rooms.

1.2 RELATED DOCUMENTS

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

1.3 DEFINITIONS

- A. Provide: Furnish and install, complete and ready for service.
- B. Exposed: Exposed to view in any room, corridor or stairway.
- C. E.C.: Electrical Contractor.
- D. Architect: Dimension IV Madison
- E. The Engineer: HEIN Engineering Group.
- F. The Owner: City of Madison
- G. A/E: Architect/Engineer.

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

- H. ANSI: American National Standards Institute
- I. NEC: National Electric Code
- J. NEMA: National Electric Manufacturers Association
- K. NFPA: National Fire Protection Association
- L. UL: Underwriters Laboratories, Inc.

1.4 PERMITS AND LICENSES

- A. Prepare and submit to all authorities having jurisdiction, for their approval, all applications and working drawings required by them. Secure and pay for all licenses and permits required.

1.5 QUALITY ASSURANCE, STANDARDS AND SYMBOLS

- A. General: Specifically, for the electrical work (in addition to standards specified in individual work section), the following standards are imposed, as applicable to the work in each instance:
 - 1. Standards for Materials and Workmanship: All materials shall conform to the standard of the UL in every case where the UL has established a standard of such materials. In addition, these materials shall bear the UL label to show their conformance. Materials not covered by UL standards shall be processed, supplied or manufactured to NEMA, IEEE, or other accepted industry standards for these materials and shall also be labeled or properly identified as being in conformance with the appropriate standards. Substitute standards for those listed are not acceptable. Materials and equipment shall be protected during delivery and handling to prevent damage; and shall be stored in a clean dry area to prevent contamination. Damaged materials shall not be used.
 - 2. All materials and work shall conform to the applicable portions of the latest issues of the following standards:
 - a. UL
 - b. NEMA
 - c. NEC
 - d. NECA
 - e. ANSI
 - f. IEEE
 - g. ASTM
 - h. NFPA
 - i. IPCEA
 - j. FM
 - k. ETL
 - 3. All work shall be installed in accordance with National and State laws, ordinances and regulations. Comply with all applicable OSHA regulations.
 - a. IBC
 - b. IECC
 - 4. All materials shall have a UL label where a UL Standard and/or test exists.

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ELECTRICAL GENERAL PROVISIONS

5. All work shall be executed in a neat and workmanlike manner by workers thoroughly qualified in the trade of duties they are to perform. A rough or unworkmanlike installation will be cause for removal and replacement of said installation.

B. Substitution of Materials:

1. All requests for substitution shall be in writing and shall include sufficient product information to permit the Architect/Engineer to evaluate the request.
2. The Architect/Engineer specifically reserves the right to reject or approve any and all substitute materials or equipment in order to insure compliance with the minimum standards of quality established for the project herein specified, and also to insure that any substitute materials or equipment maintains the trends of style and appearances established for this project.
3. When an item is approved as an equal, either by specification or by approved substitution, this item shall give the same end results, to the Architect/Engineer's satisfaction, as the item it has replaced from the specification. Any modification, additional fittings or change to the approved item or to concomitant items to accomplish these results shall be at the expense of the Contractor.
4. The Contractor shall choose from the listed manufacturers for specific items or a substitute manufacturer if approved, but once a manufacturer has been chosen all similar items shall be by the same manufacturer.

1.6 JOB CONDITIONS

A. Job Site:

1. The Contractor shall be familiar with conditions which will affect his work, and locations where the work will be performed and other pertinent factors.
2. The Contractor shall furnish all labor and materials to complete each installation ready for use.
3. No additional allowances will be granted because the Contractor's knowledge of job site conditions was incomplete.

B. Products, Electrical Work:

1. Product Listing: Prepare the product listing for electrical work. Include listing of each significant item of equipment and material used in the work; and indicate the generic name, product name, manufacturer, model number, related specification number(s).
 - a. Submit list to the Architect/Engineer for approval.
2. Compatibility: Provide products which are compatible with other products of the electrical work, and with other work requiring interface with the electrical work, including electrical connections and control devices. For exposed electrical work, coordinate colors and finishes with the other work.

1.7 WORK SEQUENCE

- A. The Contractor shall review the work sequence and determine if any dates of completion can not be met for his work. Any conflicts with completion dates shall be brought to the Engineer's attention prior to submitting a bid. No time extensions will be granted after contracts are awarded unless permitted in other parts of these specifications.

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

1.8 DIMENSIONS AND DEFINITE LOCATIONS

- A. The drawings depicting electrical work are diagrammatic and depict, in their approximate location, symbols representing electrical equipment. The exact location shall be established in the field in accordance with instructions from the Architect.
- B. Unless specifically stated to the contrary, no measurement of an electric drawing by scale shall be used as a dimension to work by. Dimensions noted on the electric drawings are subject, in each case, to measurements of adjacent or previously completed work and all such measurements necessary shall be taken before undertaking any work dependent upon time.

1.9 DRAWINGS

- A. The E.C. shall prepare, at his expense, complete field installation drawings necessary for the proper installation of his work. These drawings shall be submitted to the Engineer when requested for review and such copies of same as are necessary shall be provided for others as directed.
- B. The E.C. shall keep a detailed record, up-to-date, of the manner and location in which all installations are actually made, properly indexing each feeder, pull box and protective device.
- C. As Built Drawings: See General Requirements - Division 1.
- D. In the event of a conflict between the drawings and specifications the E.C. shall base his bid on the greater quantity, cost or quality of the item in question, unless such conflict is resolved by addenda.

1.10 MATERIALS AND EQUIPMENT

- A. Provide all new materials and equipment to form a complete installation, unless otherwise specified.
- B. All equipment supplied shall be based on materials and equipment of manufacturers specified. No substitutions will be allowed except as provided in Instructions to Bidders.
- C. All items specified shall be the latest type or model produced by the manufacturer specified. If descriptive specification or model number is obsolete, substitute current product.

1.11 FLOOR, WALL AND CEILING OPENINGS

- A. Pipe sleeves must be set for all pipes passing through new masonry construction. Coordinate with G.C. as to size and location of openings.
- B. Coordinate the location of sleeves, openings, chases, furred spaces, etc., with the other Contractors. Provide all sleeves, hangers and inserts that are to be built into the structure during the progress of construction.
- C. Pipe sleeves shall be Schedule 40 galvanized steel pipe and shall extend completely through the construction.
- D. Sleeves for pipe 4" and smaller shall be at least two pipe sizes larger than the pipe passing through.

SECTION 26 05 00
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- E. Sleeves shall extend 3/8" above the finished floor. In mechanical rooms and other areas where water may accumulate, sleeves shall extend 2" above the finished floor.
- F. Pack annular space between sleeves and insulation or pipe with fiberglass. Where penetrations occur through mechanical rooms or fire rated walls, floors, fill with Dow-Corning 3-6548 Silicone RTV Foam.

1.12 SHOP DRAWINGS

- A. Submit to Engineer for review, in accordance with Division 1, shop drawings and/or equipment brochures for the following:
 - 1. Raceways and Boxes.
 - 2. Panelboards.
 - 3. Disconnects and Starters.
 - 4. Low Voltage Conductors and Cables.
 - 5. Wiring Devices.
 - 6. Light Fixtures.
 - 7. Lighting Controls.
- B. Submit in advance of construction requirements and as to cause no delay in the E.C.'s work and to allow the Engineer reasonable time to review them to make necessary corrections.
- C. All data submitted for Engineer's review shall be numbered consecutively, shall be noted to correlate with the electrical drawings and shall bear the name and location of the project, the name of the E.C., the date of submittal, the date of the drawings and the date of each correction and revision. If more than one type of lighting fixture (or other materials) are on submitted sheet, the one specified shall be conspicuously checked with red pencil by the E.C.

1.13 DELIVERY STORAGE AND HANDLING

- A. All materials shall be suitably stored and protected prior to installation and all work shall be protected after installation, during construction and all work prior to acceptance.
- B. The E.C. shall furnish and remove upon completion of the project, all scaffolding, rigging, hoisting and services necessary for delivery, erection and installation of all equipment and apparatus required to be installed by the E.C.

1.14 MAINTENANCE MANUALS

- A. The E.C. shall assemble and submit to the Architect for subsequent submission to the Architect/Engineer, in accordance with Division 1, complete sets of a Manual of Operation and Maintenance for each of the separate systems furnished as a part of the electrical subcontractor.
- B. Each manual shall consist of an approved loose-leaf type bound volume instructing the Architect/Engineer's personnel in the use, operation and maintenance of the system in question. The manual shall cover all phases of operation of the equipment and it shall be illustrated with photographs, drawings, wiring diagrams, etc., as required to accurately and adequately describe the operation, construction and adjustable features of the complete system and each component part. The manual shall be complete with an equipment parts listing to facilitate the ordering of spare and replacement parts.

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

- C. Each manual shall contain two sets of final shop drawings depicting equipment as installed.
 - 1. Equipment Parts Lists: Include a complete list of all equipment furnished for project, with a tabulation of descriptive data of all the equipment replacement parts proposed for each type of equipment or system. Properly identify each part of part number and manufacturer.

1.15 CLEANING AND PAINTING

- A. All rubbish resulting from this work shall be removed and disposed of on a daily basis and in such manner as to be acceptable to the Architect.
- B. The E.C. shall clean all exposed ironwork, interior and exterior of panels and pull boxes, etc., and remove all rubbish and debris resulting from the work.
- C. Where painted surfaces of equipment have been abused, removed, or rusted during construction, the E.C. shall paint same to match original factory or surrounding finish.

1.16 TESTS AND ACCEPTANCE

- A. The operation of the equipment and electrical installations done does not constitute an acceptance of the work by the Architect/Engineer. The final acceptance is to be made after the E.C. has adjusted his equipment and demonstrated that it fulfills the requirements of the drawings and the specifications.
- B. After the work is completed and prior to acceptance, the E.C. shall conduct the following tests, tabulate data, date, sign and submit to the Engineer: clamp ammeter test on each feeder conductor with all utilization equipment energized. The load current in each phase conductor of the feeder of the portion thereof supplying the panel shall not differ from the average connected load currents in the several conductors by more than 10%. If the load current does differ by more than 10%, the E.C. shall change phase loading to same or receive written approval from the Engineer that this is not required due to the nature of the load.
- C. At the time of connection, or energizing, check all motors for proper rotation, conferring with contractor furnishing equipment, if necessary, to determine proper direction.
- D. Upon completion of the installation, the E.C. shall furnish certificates of approval from all authorities having jurisdiction. He shall demonstrate that all work is complete and in perfect operating condition, with raceway and conduit system properly grounded, all wiring free from grounds, shorts, and that the entire installation is free from any physical defects. In the presence of the Engineer and the Architect/Engineer, the E.C. shall demonstrate the proper operation of all miscellaneous systems.
- E. All materials and workmanship is subject to inspection, examination and tests by the Architect/Engineer at any time.

1.17 EXTRA STOCK/SPARE PARTS

- A. None anticipated for electrical work.

1.18 DEFECTS

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

- A. Should it be found by the Engineer that the fixtures, equipment or any portion thereof furnished and installed under this subcontract fail to comply with the specifications and drawings, with respect or regard to the quality, amount of value of material, appliances or labor used in the work, it shall be rejected and replaced by the E.C. and all work disturbed by changed necessitated in consequence of said defects or imperfections shall be made good at the E.C.'s expenses.

1.19 WARRANTY

- A. The Contractor shall warranty: All materials furnished to be perfect in every respect; and, if not, replace same immediately. Replace any material or part showing defects within a minimum of one year of acceptance, or within warranty period of the item if greater than one year. This one-year warranty period shall be binding even though it may exceed the product warranty period normally furnished by some manufacturers. Repair or replacement shall bear an additional 12 months warranty as called for, dated from final acceptance of the repairs or replacement. The apparatus to be installed in strict accordance with these specifications and the various codes covering this work. Neither the final acceptance nor any provisions in the Contract Documents shall relieve this Contractor of the responsibility for negligence, faulty materials or workmanship within the extent and period provided by this contract.

1.20 IDENTIFICATION

- A. General:
1. Materials and equipment shall be clearly identified as listed below.
 2. Locate identification conspicuously.
 3. Terminology to be approved by Architect.
 4. See plans for any additional items to be identified.
 5. Loads such as motors shall be described by function rather than by the system of arbitrary number as shown on electrical plans.
 6. Use abbreviations sparingly.
- B. All panels and cabinets shall be stenciled with 2" letters indicating usage, plan designation and voltage. In Equipment and Mechanical Rooms this identification may be on the exterior of unit; in other areas identification shall be inside door or cover.
- C. Junction and pull boxes shall be stenciled utilizing a coded identification system. The following junction and pull boxes shall be identified using a coded system. Coding shall be submitted to Engineer for approval.
1. Light and Power - 120/208V.
 2. Motors - 277/480 V.
 3. Fire Alarm.
- D. On all 3-phase systems, each phase shall be identified at all terminals using code markers.
- E. Laminated Bakelite Plates: Engraved plastic nameplate shall be securely fastened to the following equipment. Size 1" x 4" with 3/8" high letters unless space available dictates differently.

SECTION 26 05 00
ELECTRICAL GENERAL PROVISIONS

1. Each section of main distribution switchboards and panelboards. Mount one next to each protection device to identify load served by each circuit breaker.
 2. Each contractor, time switch, metering cabinet, starter, motor disconnect switch. In Equipment and Mechanical Rooms this identification may be on the exterior of unit, in other areas identification shall be inside door or cover.
 3. Each feeder at all accessible locations, i.e., panels, junction boxes, pull boxes, etc. (strap plate to feeder conductors in junction boxes or pull boxes).
 4. Each end of empty conduit runs to indicate the intended use of the conduit and the location of opposite end. Use room numbers that are permanently assigned.
- F. Typewritten Directory: Each panelboard shall be provided with a typewritten directory in a steel frame with plastic cover contained on the inside of panel door. These directories shall indicate load served and rooms served by each protective device in the respective panel.
- G. Conductor Identification:
1. Identify each conductor at each conductor or splice point with permanently attached wrap around adhesive markers as manufactured by Brady Company.
 2. This identification shall include branch circuit number, control circuit number, or any other appropriate number or lettering that will expedite future tracing and "trouble shooting".
 3. All wire shall be color-coded per the NEC. In addition, color-coding shall be used to identify phases, neutral, ground and voltages. Coding shall be:

120/208V - Phase A - Black
 - Phase B - Red
 - Phase C - Blue
 - Neutral - White
 - Ground - Green

277/480V - Phase A - Yellow
 - Phase B - Brown
 - Phase C - Orange
 - Neutral - Gray
 - Ground - Green with two yellow stripes

1.21 ACCESS PANEL

- A. Access panels required by code or otherwise to electrical equipment shall be provided by Electrical Contractor. Access panels shall be in accordance with Division 1 complete with master cylinder lock.

PART 2 - PRODUCTS

--- Not Used ---

PART 3 - EXECUTION

--- Not Used ---

END OF SECTION

SECTION 26 10 00
ELECTRICAL DEMOLITION AND ALTERATIONS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

- A. Applicable requirements of Division 1 shall govern work in this section.

1.2 JOB CONDITIONS

- A. The Electrical Contractor shall work with CCB Maintenance Staff to coordinate the disconnection of any electrical services within the building. It is the responsibility of the demolition contractor for demolition of any interior electrical equipment. The Electrical Contractor shall verify for demolition contractor that all electrical equipment is de-energized prior to demolition.
- B. Prior to demolition or alteration of structures, the following shall be accomplished:
1. Owner release of such structure.
 2. Disconnection of electrical power to equipment and circuits removed or affected by demolition work.
 3. trical services rerouted or shut off outside area of demolition.
 4. Coordinate sequencing with Owner and other Contractors.
 5. Survey and record condition of existing facilities to remain in place that may be affected by demolition operations. After demolition operations are completed, survey conditions again and restore existing facilities to their predemolition condition.
- C. Remove all and any unused materials not complying or reused with new electrical plan.
- D. Contractor shall dispose of all obsolete material.
- E. Contractor shall notify the Engineer of any existing code violations observed during the course of performing his work. The Engineer will decide if corrective action needs to be taken. Corrective actions that change the scope of the work will be considered a change order and will be processed accordingly.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 ELECTRIC SERVICE

- A. De-energize existing electric service serving remodeled as required to install new equipment with proper notice to General Contractor and Owner prior to starting shutdown.
1. Refer to Division 1 for further requirements regarding continuation of existing services.

SECTION 26 10 00
ELECTRICAL DEMOLITION AND ALTERATIONS

3.2 REMOVAL

- A. Remove or relocate conduit, wire, boxes, and fixtures.
- B. Remove electrical equipment released from service as a result of construction or as indicated on drawings.
- C. Do not reuse removed electrical equipment, unless specifically called out in the drawing documents.
- D. Where existing equipment is being removed, removal shall include all equipment associated with the device. Associated equipment shall include but not be limited to coverplates, backboxes, conduit, fittings, de-energized conductors, etc. When boxes are removed from existing walls which will remain, it shall be the Electrical Contractor's responsibility to fill in openings and sand as required flush with adjacent surfaces. The General Contractor shall be responsible for final finish work unless specifically indicated otherwise on the plans.

3.3 DISPOSAL

- A. Dispose of equipment that is removed unless specifically indicated on the drawings.
- B. Raceway, conductors, boxes, cabinets and supporting devices shall become the property of the Contractor and shall be removed from the site and disposed of by the Contractor.
- C. The Contractor shall tour demolition areas with the Owner to determine the status of all other equipment to be removed during demolition. All equipment that is to be salvaged for reuse by the Owner shall be removed by the Contractor and transported to an owner designated storage area on the site. The Owner shall be responsible for removal of salvaged equipment from the storage area.

3.4 ASBESTOS REMOVAL

- A. Any work involved with asbestos removal, disposal or abatement shall not be considered as part of this project. All work in this regard shall be the responsibility of the Owner. If this Contractor shall discover the presence of any asbestos material he shall cease work immediately and notify Owner and Engineer of condition.

END OF SECTION

**SECTION 26 11 00
RACEWAY AND BOXES**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide complete raceway system as specified for power, standby and emergency power systems.
 - 1. Conduit, box and raceway systems.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 26 05 00 Electrical General Requirements
 - 2. 26 12 00 Low Voltage Conductors and Cables
 - 3. 26 19 00 Supporting Devices
 - 4. 26 45 00 Grounding and Bonding

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. National Electrical Code, NEC: Comply with NEC/NFPA No. 71 as applicable to construction and installation of electrical conduit.
 - 2. National Electrical Manufacturer's Association, NEMA: Comply with applicable portions of NEMA standards pertaining to non-metallic duct and fittings for underground installation.
 - 3. Underwriters Laboratories: Provide electrical conduit listed and labeled by UL.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Provide color-coded end-cap thread protectors on exposed threads of threaded metal conduit.
- B. Storage:
 - 1. Store pipe and tubing inside and protect from weather.
 - 2. When necessary to store outdoors, elevate well above grade and enclose with durable, watertight wrapping.
- C. Handle conduit and tubing carefully to prevent bending and end damage and to avoid scarring the finish.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Conduit:
 - 1. Allied Tube and Conduit Corporation.

**SECTION 26 11 00
RACEWAY AND BOXES**

2. Wheatland Tube Company.
3. Steelduct Conduit Products.

B. Couplings:

1. Appleton Electric Company.
2. Crouse-Hinds Company.
3. Killark Electric Manufacturing Company.

C. Flexible Conduit:

1. Anaconda Metal Hose.
2. I.B.C. Corporation.
3. Electri-Flex Company.

D. Boxes:

1. Appleton Electric Company.
2. Crouse-Hinds Company.
3. General Electric Company.
4. Killark Electric Manufacturing Company.
6. Lew Electric Fitting Company.
7. O.Z./Gedney Company.
8. Raco, Inc.
9. Square D Company.
10. Steel City Division.
11. Thomas and Betts Company, Inc.
12. Wiremold/Walker.

2.2 CONDUIT MATERIAL

A. RIGID METAL CONDUIT AND FITTINGS

1. Conduit: Heavy wall, galvanized steel, schedule 40, threaded.
2. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

B. INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

1. Conduit: Galvanized steel, threaded.
2. Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

C. ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

1. Conduit: Steel, galvanized tubing.
2. Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.
Conduit Bodies: All steel threaded conduit bodies.

D. FLEXIBLE METAL CONDUIT AND FITTINGS

1. Conduit: steel, galvanized, spiral strip.
2. Fittings and Conduit Bodies: All steel, galvanized, or malleable iron.

E. LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

1. Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

**SECTION 26 11 00
RACEWAY AND BOXES**

2. Fittings and Conduit Bodies: ANSI/NEMA FB 1, compression type. There shall be a metallic cover/insert on the end of the conduit inside the connector housing to seal the cut conduit end.

F. CONDUIT

1. Rigid Threaded: Steel, ANSI C80.1
2. Electrical Metallic Tubing: ANSI C80.3
3. Rigid Nonmetallic Tubing: Schedule 40 PVC; NEMA TC-2 & WC-1094

2.3 BOXES MATERIAL

A. OUTLET BOXES

1. Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.
2. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.
3. Concrete Ceiling Boxes: Concrete type.
4. Cast Boxes: Cast ferroalloy, or aluminum type deep type, gasketed cover, threaded hubs.
5. Boxes:
 - a. Metallic hot-dipped galvanized, 1.25 oz. per square foot or cadmium plated.
 - b. Non-metallic, PVC thermoplastic or thermoset polyester.
6. Interior Boxes:
 - a. Pressed sheet steel, blanked for conduit.
 - b. Provide attached lugs for locating.
7. Exterior Boxes: Cast aluminum, deep type, corrosion proof fasteners, water tight, gasketed with threaded hubs.
8. For Ceiling: 4-inch octagon boxes for 1 fixture, including fixture studs and maximum 2 connecting conduits.
9. For Flush Mounting in Walls:
 - a. Boxes with matching plaster cover for single or two gang outlets.
 - b. Two-gang box or larger or deep masonry box for conductors, conductor joints, conduit terminations and wiring devices.
10. Surface Mounted: 4 inches square.

B. PULL AND JUNCTION BOXES

Pull boxes and junction boxes shall be minimum 4 inch square by 2-1/8th inches deep for use with 1 inch conduit and smaller. On conduit systems using 1-1/4 inch conduit or larger, pull and junction boxes shall be sized per NEC but not less than 4-11/16 inch square.

1. Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.
2. Sheet Metal Boxes Larger Than 12 Inches (300 mm) in any dimension shall have a hinged cover or a chain installed between box and cover.
3. Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
4. Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.
5. Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.
6. Wireways shall not be used in lieu of junction boxes.

SECTION 26 11 00
RACEWAY AND BOXES

7. Pull Boxes and Junction Boxes: NEC metal construction with screw or hinged cover.
- C. CONDUIT BODIES:
1. Galvanized or aluminum cast-metal of type, shape and size to fit each respective location.
 2. Constructed with threaded conduit ends, removable cover and corrosion-resistant screws.
- D. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS: Provide corrosion-resistance punched-steel box knockout closures, conduit locknuts and malleable iron conduit bushing, type and size to suit respective use.
- E. POWER POLES: Steel dual channel raceways with knockouts for voice/data devices on the communication channel and receptacles devices on the power channel. A full compliment of fittings for the Power Pole shall be available including, but not limited to, entrance end fitting for top of the electrical channel, ceiling trim plate, pole-mounting bracket.
1. Power poles shall be equal to Legrand Wiremold 25DTP series.
 2. Field measure required heights prior to ordering.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION

- A. Wiring: All wiring shall be installed in raceways as herein specified. All raceway runs shown on the drawings are diagrammatic; exact locations shall be determined in the field.
1. Conceal all conduit in finished areas.
 2. Concealed raceways shall be installed in the walls, above ceilings, below floors or in furred out spaces so as to be completely concealed from view by occupants during their normal activities in use of the space.
 3. Exposed raceways shall be run in straight lines at right angles or parallel with walls, beams and columns.
 4. Provide raceways as required by the access control equipment controls for door operating and monitoring.
- B. Raceway Installation: All raceways, which are not buried or embedded in concrete shall be supported by straps, suitable clamps or hangers to provide a rigid installation. Perforated strap or wire hangers will not be acceptable. In no case shall raceways be supported or fastened to other pipe. No raceway smaller than 1/2" shall be used, except that light fixture switch legs may be 3/8".
1. Bends: Not more than three 90 degree bends will be allowed in one raceway run. Where more bends are necessary, a conduit or pull box shall be installed. All bends in 1" and smaller conduit or electrical metallic tubing shall be made with proper bender. All other bends shall be machine made.
 2. Joints: Joints in rigid metal shall be threaded type made up watertight with white lead or compound applied to male threads only and all field joints shall be cut square, reamed smooth and properly threaded to receive couplings. Electrical metallic tubing

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RACEWAY AND BOXES

systems shall utilize watertight compression type fittings throughout. No indenter type fittings or running threads will be permitted.

3. Locknuts: Double locknuts shall be provided on all conduit terminations with the exception of conduits terminating in threaded hubs and couplings. Locknuts shall be of a type that have sharp beveled teeth that dig into the metal when tightened and will not loosen through vibration.
 4. Bushing: Bushing shall be provided on all conduits with the exception of conduits terminating in hubs and couplings. Insulating bushings consisting of insulating inserts in metal housing shall be provided on all installations. Insulating bushings shall be grounding type where required by the National Electrical Code.
 5. Heating Ducts and Pipes: Care shall be used to avoid proximity to heating duct and hot water lines. Where such crossings are unavoidable, raceway shall clear covering or line by at least 6".
- C. Utilize rigid steel conduit or rigid nonmetallic conduit where exposed to moisture, buried in earth or in concrete.
- D. Utilize electrical metallic tubing(EMT) or intermediate metal conduit in other above-grade locations.
- E. For underground conduit: use PVC-coated rigid conduit or rigid non-metallic conduit.
- F. Connections:
1. Motors and equipment: Minimum 1/2" size; PVC jacketed flexible conduit and liquid-tight connectors.
 2. Flexible conduit sufficient length to avoid vibration transmission.
 3. Use 3/8" flexible conduit only for light fixture whips(72" max.)and control wiring.
 4. Coordinate service conduit connections with location of service transformers.
- G. Install conduit and tubing products as indicated, in accordance with manufacturers written instructions and applicable requirements of NEC and NEMA Standard and Installation.
- H. Install conduit concealed in all areas excluding mechanical, electrical and other unfinished rooms, connections to motors and connections to surface cabinets.
- I. Coordinate installation of conduit in masonry work.
- J. Do not install conduit larger than 1" in concrete slabs.
- K. Install conduit free from dents and bruises.
- L. Plug conduit end to prevent entry of dirt or moisture.
- M. Clean out conduit before installation of conductor.
- N. Alter conduit routing to avoid structural obstructions, minimizing cross-overs.
- O. Seal conduit with oakum or fiberglass where conduits leave heated area and enter unheated area.

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RACEWAY AND BOXES

- P. Roof Penetrations: Provide flashing and pitchpockets making watertight joints where conduits pass through roof or waterproofing membrane.
- Q. Building Expansion Joints:
1. Install UL listed expansion fittings complete with grounding jumpers where conduits cross building expansion joints.
 2. Provide bends or offsets in conduits adjacent to building expansion joints where conduit is installed above suspended ceiling.
- R. Route all exposed conduits parallel or perpendicular to building lines.
- S. Allow minimum 6" clearance at flues, steam pipes and heat source.
- T Underground Conduit: Direct burial minimum.
1. Support multiple runs vertically and horizontally with plastic spacers 8' on center.
 2. Slope conduit to drainage point.
 3. Adjust final layout to coordinate with existing utilities.
 4. Trench and backfill as detailed on drawings.
 5. Encase conduit with 3" concrete cover under driveways.
- U. Cap all spare conduits.
- V. Provide all empty raceways with a heavy duty nylon cord, full length of raceway. Tag cord for identification.
- W. Maintain safe clearances from hazardous adjacent equipment, hot water piping, flues, high temperature piping, ductwork, etc.

3.2 CONDUIT INSTALLATION SCHEDULE

- A. Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).
- B. Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).
- C. Wet Interior Locations: Rigid steel conduit. Schedule 40 PVC conduit.
- D. Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- E. Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.
- F. Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.
- G. Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

**SECTION 26 11 00
RACEWAY AND BOXES**

- F. In areas where the walls cannot be fished, the station cable serving these outlets shall be covered with raceways. No exposed wire shall be permitted within offices, laboratories, and conference rooms or like facilities.
- G. The non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.
- H. The raceway shall originate from a surface mounted box mounted adjacent to and at the same height as existing electrical boxes in the room, be attached to the wall and terminate above the ceiling.
- I. All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.
- J. The raceway and all systems devices shall be UL listed and exhibit nonflammable self extinguishing characteristics, tested to specifications of UL94V-0.
- K. The raceway and all systems devices shall adhere to the EIA/TIA Category 5e bend radius standard.

3.3 BOX INSTALLATION

- A. Pull Boxes and Junction Boxes: Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms or storage areas.
- B. Outlet Boxes:
 - 1. Mount outlet boxes flush in area other than mechanical rooms, electrical rooms and above removable ceilings.
 - 2. Adjust position of outlets in finished masonry walls to suit masonry course lines.
 - 3. Do not install boxes back-to-back in same wall.
 - 4. Masonry Walls:
 - a. Coordinate cutting of masonry walls to achieve neat openings for boxes.
 - b. Locate boxes in masonry walls so that only corner need be cut from masonry walls.
 - 5. Do not use sectional or handy boxes unless specifically requested.
 - 6. For boxes mounted in exterior walls, make sure that there is insulation behind outlet boxes.
 - 7. For outlets mounted above counters, benches or splashbacks, coordinate locations and mounting heights with built-in units.
 - 8. Adjust outlet mounting height to agree with required location for equipment served.
- C. Boxes supplied by others: Verify exact mounting location and type of mounting.
- D. Provide knockout closures to cap unused knockout holes where blanks have been removed.
- E. Support all boxes independently of conduit.

3.4 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
 - 1. Electrical box locations shown on Contract Drawings are approximate unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

**SECTION 26 11 00
RACEWAY AND BOXES**

2. No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.
 3. Boxes shall not be fastened to the metal roof deck.
- B. It shall be the Contractor's responsibility to study drawings pertaining to other trades, to discuss location of outlets with workmen installing other piping and equipment and to fit all electrical outlets to job conditions.
1. If any question arise over the location of an outlet, the Contractor shall refer the matter to the Architect/Engineer and install outlet as instructed by the Architect/Engineer.
 2. The proper location of each outlet is considered a part of this contract and no additional compensation will be paid to the Contractor for moving outlets which were improperly located.
- C. Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 12 inch by 12 inch access doors.
- D. Locate and install to maintain headroom and to present a neat appearance.
- E. Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

3.5 PULL AND JUNCTION BOX INSTALLATION

- A. Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.
- B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 26 12 00
LOW VOLTAGE CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 WORK INCLUDES

- A. Provide all wires and cables required for a complete electrical system.

1.2 RELATED WORK

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
1. 26 11 00 Raceways and Boxes

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to construction and installation of electrical cable, wire and connectors.
 2. Underwriter Laboratories, UL: Electrical cable, wire and connectors listed and labeled by UL.
- B. References: National Electrical Manufacturers Association/Insulated Power Cable Engineer's Association, NEMA/IPCEA.

1.4 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Provide factory-wrapped waterproof flexible barrier material for covering wire and cable on wood reels, where applicable; and weather-resistant fiberboard containers for factory-packaging of cable, wire and connections to protect against physical damage in transit.
- B. Store cable, wire and connectors in factory-installed coverings in clean, dry indoor space which provides protection against weather.
- C. Do not install damaged cable, wire and connectors; remove from project site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

SECTION 26 12 00
LOW VOLTAGE CONDUCTORS AND CABLES

A. Wire and Cable:

1. Anaconda Wire and Cable Company.
2. Collyer Insulated Wire Company, Division.
3. Electrical Cable Division.
4. General Cable Corporation.
5. General Electric Company.
6. Phelps Dodge Cable and Wire Company.

B. Connectors:

1. AMP, Inc.
2. Burndy Corporation.
3. General Electric Company.
4. Ideal Industries, Inc.
5. 3M Company.
6. O.Z./Gedney Company.
7. Thomas and Betts Company.
8. Buchanon.

2.2 MATERIALS

A. Wire and Cable:

1. 98% conductivity copper.
2. 600 volt insulation.
3. Branch circuit wiring #10 and smaller shall be solid or stranded THWN or THHN. Sizes #8 and larger stranded type THWN or THHN. Stranded wire shall be used for all motor connections regardless of size. Lighting fixture wiring shall be 90 deg C THHN.
4. Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods.
5. Conductors smaller than No. 12 AWG gauge not permitted except for alarm and signal circuits which may be #14 AWG minimum.
6. Color code and identify all wiring as specified in Section 16050.

B. Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits. Type XHHW-2 insulation for feeders with aluminum conductors.

C. Exterior Wiring: Comply with NEC for wet location wiring.

D. Wiring for systems other than power:

1. Conform to system manufacturer standards as to size, type and coding, subject to specified minimums.
2. Size conduit as required by system manufacturer, but no smaller than shown.
3. Provide copper XHHW for exterior services.

E. Armored Cable (AC) or Metal-Clad Cable (MC):

1. Limit AC and MC usage to concealed only locations, branch-circuit wiring after the first junction box from the panelboards; where approved by NEC, state and local electrical inspecting authorities.

SECTION 26 12 00
LOW VOLTAGE CONDUCTORS AND CABLES

2. Not allowed for Panelboard feeders or service conduit.
3. Provide and install per NEC Articles 333 and 334 with grounding conductor.

2.3 WIRING CONNECTORS

- A. Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.
- B. Spring Wire Connectors: Solderless spring type pressure connector with insulating covers or copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.
- C. All wire connectors used in underground or exterior pull boxes shall be gel filled twist connectors or a connector designed for damp and wet locations.
- D. Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.
- E. Split Bolt Connectors: Not acceptable.
- F. Compression (crimp) Connectors: Long barrel; seamless, tin-plated electrolytic copper tubing; internally beveled barrel ends. Connector shall be clearly marked with the wire size and type and proper number and location of crimps.
- G. Splices: Splices and taps for No. 10 or smaller shall be with twist-on insulated connectors. Splices in wire No. 8 and larger shall be made with split-bolt or compression connectors equal to Burndy Hydent requiring a tool and die application. Tape all non-insulated compression connectors to achieve full 600V insulation.

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS

- A. All wire and cable shall be installed in conduit, unless specified
- B. Do not use wire smaller than 12 AWG for power and lighting circuits.
- C. Conductors size indicated on drawings indicates ampacity requirements using copper conductors and type THHN insulation unless otherwise noted.
 1. Provide XHHW for exterior services.
- D. All conductors shall be sized to prevent excessive voltage drop at rated circuit ampacity. As a minimum use 10 AWG conductor for 20 ampere, 120 volt branch circuit home runs longer than 100 feet (30 m), and for 20 ampere, 277 volt branch circuit home runs longer than 200 feet (61 m).

3.2 INSTALLATION

- A. Make conductor length for parallel feeders identical.
- B. Lace or clip groups of feeder conductors at new panel board.
- C. Install wire and cable in NEC Code conforming raceway.
- D. Pulling:

SECTION 26 12 00
LOW VOLTAGE CONDUCTORS AND CABLES

1. Use wire pulling lubricant for pulling No. 4 AWG and larger wire. Use special care to avoid overstraining of conductors.
 2. Pull conductors together where more than one is being installed in raceway.
 3. Do not use pulling means, including fish tape, cable or rope which can damage raceway.
 4. All raceways shall be thoroughly swabbed out with a dry swab to remove moisture and debris before conductors are drawn into place. All ends of raceways shall be tightly plugged with tapered plugs or capped bushings until the conduits are pulled to prevent water and debris from entering conduits. All conduits stubbed up through floors shall be capped and aligned during construction by the use of spacers and caps.
- E. Install wire in conduit runs after concrete and masonry work is complete, conduit shall be clean and dry.
- F. Splicing:
1. Splice only in accessible junction boxes.
 2. Install splices and taps which have equivalent or better mechanical strength and insulation as conductor.
 3. Use splice and tap connectors which are compatible with conductor material.
 4. No. 10 and smaller joints: Utilize connectors as hereinbefore specified with PVC or nylon covers.
 5. No. 8 and larger joints: Clean and join with tool and die compression type fitting.

3.3 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use Listed wire pulling lubricant for pulling 4 AWG and larger wires and for other conditions when necessary.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. Place all conductors of a given circuit (this includes phase wires, neutral (if any), and ground conductor) in the same raceway. If parallel phase and/or neutral wires are used, then place an equal number of phase and neutral conductors in same raceway or cable.

3.4 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice only in accessible junction boxes.
- B. Wire splices and taps shall be made firm, and adequate to carry the full current rating of the respective wire without soldering and without perceptible temperature rise.
- C. Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.
- D. Use mechanical or compression connectors for wire splices and taps, 8 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- E. Thoroughly clean wires before installing lugs and connectors.
- F. At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

END OF SECTION

**SECTION 26 14 00
WIRING DEVICES**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Furnish and install all devices such as switches, receptacles, plates, etc., as shown on the drawings.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 26 11 00 Raceways and Boxes
 - 2. 26 18 50 Equipment Connections
 - 3. 26 45 00 Grounding and Bonding

1.3 SUBMITTALS

- A. Submit products and technical data per Division 1 and Section 26 0500.
- B. Wiring Device and plate color to be selected by Architect.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

- A. Wall Switches for Lighting Circuits and Motor Loads Under 1/2 HP: Heavy duty use toggle switch, rated 20 amperes and 120/277 volts AC. Switches shall be UL20 Listed and meet Federal Specification WS-896. All switches shall be heavy duty Specification Grade with separate green ground screw.
- B. All switches shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG. Switches shall be Leviton model 1221-S, Hubbell model CS1221, Pass & Seymour model CSB20, Cooper model CSB120, or approved equal.
- C. Handle: made of nylon or high impact resistant material.
- D. Dimming Switches: Combination slider with toggle switch at bottom and LED indicator light. Dimmer switch shall be compatible with the type of LED lighting system under control as recommended by light fixture/driver manufacturer.
 - 1. 0-10 VDC Dimmer: Synergy ISD BC 120/277 IV(ivory) or approved equal.
 - 2. Electronic Low-voltage Dimmer: Synergy ISD 400 ELV 120 IV(ivory) or approved equal.

2.2 RECEPTACLES

SECTION 26 14 00
WIRING DEVICES

- A. Convenience and Straight-blade Receptacles: NEMA Type 5-15R or 5-20R, nylon impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596.
- B. All duplex receptacles shall be heavy duty Specification Grade, 15 or 20-amp rated, as scheduled or shown on drawings. All receptacles shall be back and side wired, screw clamp type, suitable for solid or stranded wire up to #10 AWG, with a separate green ground screw. Receptacles shall be Leviton model 5362-S, Hubbell model CR5362, Pass & Seymour model CRB5362, Pass & Seymour model PT5362 with 90° connector, Cooper model 5362C, or approved equal.
 - 1. Provide tamperproof receptacles where required by local code.
- C. Generally, all receptacles shall be duplex convenience type unless otherwise noted.
- D. Receptacles installed in damp or wet locations shall be UL listed weather resistant.
- E. All receptacles installed in outdoor locations, in garages, within 6 feet of the outside edge of sinks, and in other damp or wet locations shall be GFCI type.
- F. GFCI Receptacles: Duplex convenience receptacle, Specification Grade, with integral ground fault current interrupter meeting the requirements of UL standard 943 Class A and UL standard 498. GFCI receptacles shall be Leviton model 8899, Hubbell model GRF5352, Pass & Seymour model 2095 or approved equal.
- G. All receptacles on emergency circuits shall have a red face.
- H. All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.
- I. Locking-Blade Receptacles: As indicated on drawings.

2.3 DEVICE PLATES AND BOX COVERS

- A. Receptacle Cover Plate: Specification Grade 302/304 smooth stainless steel or nylon construction.
 - 1. Plate color to be selected by Architect.
- B. Weatherproof Cover Plate: Gasketed metal with hinged device covers.
- C. Surface Cover Plate: Raised galvanized steel.
- D. Receptacles installed in damp or wet locations shall be UL listed weather resistant.
 - 1. Provide as required for each outlet, single or multiple gang.
 - 2. Provide blank covers on all empty boxes or outlets.
 - 3. Galvanized steel box covers shall be used in unfinished areas. Cover shall be 1/2" raised with no sharp edges.
 - 4. Provide single gang, die-cast, weather-resistant covers equal to Leviton #6196-V on receptacles in damp areas and exterior for in-use per NEC.

**SECTION 26 14 00
WIRING DEVICES**

- E. Any device switches or receptacles necessary for completion of the work, but not called for in the Contract Documents shall be furnished and installed by the Contractor as needed at no additional cost to the Owner. Such devices shall meet the intended standards described in this Section.

PART 3 - EXECUTION

3.1 GENERAL

- A. Receptacles above counters shall be mounted vertically 6" above counter or high enough to miss backsplash if provided.
- B. Receptacles required for equipment shall be located within 2 feet of that equipment if possible.
 - 1. Receptacles for refrigerators, freezers and vending machines shall be mounted at 36" AFF.
 - 2. Verify final mounting height required for electric water cooler with Plumbing Contractor.
- C. Verify all device locations with General Contractor before rough in.

3.2 WIRING DEVICE INSTALLATION

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Install convenience receptacles 18 inches above floor, grounding pole on bottom.
- C. Install box for information outlet 18 inches above finished floor. Install box for telephone jack for wall telephone 54 inches above finished floor.
- D. Install specific-use receptacles at heights shown on Contract Drawings.
- E. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- F. Install device plates on switch, receptacle, and blank outlets in finished areas.
- G. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.
- H. Install devices and wall plates flush and level.
- I. Receptacles shall have a bonding conductor from grounding terminal to the metal conduit system. Self-grounding receptacles using mounting screws as bonding means are not approved.

END OF SECTION

**SECTION 26 16 20
PANELBOARDS**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Branch Circuit Panelboards.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

1. 26 05 00 Electrical General Provisions
2. 26 45 00 Grounding and Bonding

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code, NEC: Comply with NEC/NFPA No. 70/ANSI C1, as applicable to installation of cabinets, cutout boxes and panelboards.
2. Underwriters Laboratories, UL:
 - a. Comply with specified UL publications pertaining to panelboards, enclosures and panelboard accessories.
 - b. Units listed and labeled by UL.

1.4 REFERENCES

A. National Electrical Manufacturers Association, NEMA:

1. PB.1: Panelboards.
2. PB.1.1: Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

1.5 SUBMITTALS

- A. Submit in accordance with Division 1 and Section 16050.

B. Shop Drawings: Submit dimensioned drawings of installed panelboards and enclosures.

1. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Store panelboards and enclosure indoors. Protect from weather.

- B. When necessary to store outdoors, elevate well above grade and enclose with durable waterproof wrapping.

**SECTION 26 16 20
PANELBOARDS**

- C. Handle panelboards and enclosures carefully to prevent breakage, denting and scarring of finish.

1.7 SPARE PARTS

- A. Keys: Furnish 2 keys for each panelboard to Owner.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Panelboards shall be constructed in accordance with latest NEMA, UL and NEC requirements and shall bear UL label.
- B. Panelboard cabinets including boxes and fronts, shall be code gauge galvanized steel. Panel cover shall be finished in manufacturer's standard color. Main lugs shall be top or bottom mounted to coordinate with incoming feeder entrance location.
- C. Provide isolated ground bus, where indicated, in addition to normal ground bus. Label isolated ground bus appropriately.
- D. All panelboards shall be from one manufacturer.

2.2 ACCEPTABLE MANUFACTURERS

- A. Panelboards:
 - 1. Square D Company.
 - 2. Cutler-Hammer.

2.3 PANELBOARD RATINGS

- A. UL listed short circuit rating (integral equipment rating):
 - 1. 208Y/120V Branch Circuit Panels: 10,000 RMS symmetrical amperes minimum or as indicated on panel schedule equivalent to Square D Type NQOD.

2.4 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.
- B. Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches deep; 20 inches wide with 5" minimum gutter space top and bottom. Constructed of galvanized code gauge steel. Panel enclosure (back box) shall be of non-stamped type (without KO's) to avoid concentric break out problem.
- C. Cabinet front cover and cabinet shall be Type 4X, 304 stainless steel in wet and damp locations including kitchen, food service and therapeutic/pool applications.
- D. Provide flush and surface cabinet fronts as scheduled with concealed trim clamps, concealed hinge and flush cylinder lock all keyed alike. Front cover shall be hinged to allow access to wiring gutters without removal of panel trim. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.
- E. Provide metal directory holders with clear plastic covers.

**SECTION 26 16 20
PANELBOARDS**

- F. Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings.
 - 1. Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9.
 - 2. Incoming conductors shall terminate at lug landing pads rated for the panelboard.
 - 3. Provide compression type lugs to accommodate the conductor shown on drawings.
- G. Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/ coordination study provided by the Electrical Contractor.
- H. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers. Provide UL Class A ground fault interrupter circuit breakers where shown on Drawings. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.
 - 1. Do not use tandem circuit breakers.
 - 2. Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.
- I. All of the panelboards provided under this section shall be by the same manufacturer.
- J. All sub-feed panelboards installed side by side shall utilize same enclosure height.

PART 3 - EXECUTION

3.1 GENERAL

- A. Refer to NEMA PB.1.
- B. Coordinate installation of panelboards and enclosures with cable and raceway installation work.
- C. Provide mounting brackets, busbar drillings and filler pieces for unused spaces.
- D. Anchor enclosures firmly to walls and structural surfaces, insuring that they are permanently and mechanically secure.
- E. Provide electrical connections within enclosures.
- F. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit.
- G. Install panelboards so that no cracks or gaps exist between breakers, breaker cover, panelboard cover and wall (where flush).
- H. All wires shall be neatly installed inside the panelboard box.
- I. Unused spaces shall be filled with metal filler designed for the purpose by the manufacturer.
- J. Stub four(4) empty 3/4" conduits into accessible ceiling space for future wiring requirements.

3.2 INSPECTION

- A. Examine area to receive panelboard to assure adequate clearance for panelboard installation.

SECTION 26 16 20
PANELBOARDS

- B. Start work only after unsatisfactory conditions are corrected.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation," and in accordance with recognized industry practices.
- B. Flush mount, surface mount, as specified on drawings and schedules.
- C. Support panel cabinets independently to structure with no weight bearing on conduits.
- D. Install recessed panelboards to allow cover to be drawn tight against wall to provide neat appearance.
- E. Install panelboards so top breaker is not higher than 6 ft.-7 in. above floor.
- F. Adjacent panel cabinets shall be of same size and mounted in horizontal alignment.
- G. Install in each panelboard a typewritten directory accurately indicating rooms and/or equipment being served.
- H. Attach nameplates. Nameplates for panels in public areas shall be attached to the inside face of the cover. Nameplates for panels in equipment rooms and other non- public areas shall be attached to the outside face of the cover.
- I. EC shall coordinate depth of recess-mounted panels with G.C. and wall construction to ensure panel is fully contained within wall cavity.
- J. Recess-mounted panels shall be provided with three 3/4" conduits stubbed into adjacent ceiling space for future circuits.

3.4 FIELD QUALITY CONTROL

- A. Balance load among feeder conductors.
- B. Unbalance shall not exceed + 7-1/2% of computed average load per phase.
- C. Energize each circuit and check for complete and correct function.

3.5 ADJUSTMENT AND CLEANING

- A. Adjust doors and operating mechanisms for free mechanical movement.
- B. Tighten lugs and bus connections.
- C. Clean interior of panelboard.
- D. Sand, prime and paint scratched or marred surfaces to match original finish. If other than factory standard color is indicated on Architectural plans, G.C. shall be responsible for painting panel enclosure and/or cover.

**SECTION 26 16 20
PANELBOARDS**

- E. EC shall install temporary panel covers as necessary during construction to reduce the construction debris within panels.

END OF SECTION

**SECTION 26 18 50
EQUIPMENT CONNECTIONS**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Power and selected control wiring for all equipment including, but not limited to:
 - 1. HVAC motors and control panels.
 - 2. Plumbing motors and control panels.
- B. Coordinate all equipment requirements with the various contractors and the Owner. Review the complete set of drawings and specifications to determine the extent of wiring, starters, devices, etc., required.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. Div. 22 Plumbing
 - 2. Div. 23 HVAC
 - 2. 26 05 00 Basic Materials and Methods
 - 3. 26 11 00 Raceways and Boxes
 - 4. 26 12 00 Low Voltage Conductors and Cables
 - 5. 26 15 10 Motors and Motor Wiring
 - 6. 26 15 50 Motor Starters
 - 7. 26 17 00 Motor and Circuit Disconnects

PART 2 - PRODUCTS

- 2.1 SEE 1.2 ABOVE AND DRAWINGS.**

PART 3 - EXECUTION

3.1 HVAC AND PLUMBING CONNECTIONS

- A. Provide all power wiring including all circuitry carrying electrical energy from panelboard or other source through starters and disconnects to motors or to packaged control panels.
 - 1. Packaged control panels may include disconnects and starters and overcurrent protection. Provide all wiring between packaged control panels and motors.
 - 2. Include starters disconnects and overload protection if not included in packaged control panels.
- B. Provide 120 volts circuits to each temperature control panel as indicated on the Drawings.
 - 1. Line voltage wiring requirements for temperature control beyond the requirements shown on the drawings and schedules shall be the responsibility of the Temperature Control Contractor to retain the electrical trade and pay for such work.

SECTION 26 18 50
EQUIPMENT CONNECTIONS

- C. Unless otherwise specified, all electrical motors and control devices such as aquastats, float and pressure fan powered VAV boxes, switches, electropneumatic switches, solenoid valves and damper motors requiring mechanical connections shall be furnished and installed and wired for low-voltage connections (less than 100volts) by the Contractor supplying the devices or the Temperature Control Contractor, as specified elsewhere.
- D. Each motor terminal box shall be connected with a maximum 36" piece of flexible conduit to a fixed junction box. A green wire run through the flexible conduit shall interconnect the motor frame and the rigid conduit system. Use Liquid tight flexible metal conduit for all motor connections.
- E. Check for proper rotation of each motor.

END OF SECTION

**SECTION 26 19 00
SUPPORTING DEVICES**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Conduit and equipment supports.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

1. 26 11 00 Raceways and Boxes

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to supports.
2. Underwriters Laboratories, UL: Supports listed and labeled by UL.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.
- B. Hardware: Corrosion resistant.
- C. Minimum sized threaded rod for supports shall be 3/8" for trapezes and single conduits 1-1/4" and larger, and 1/4" for single conduits 1" and smaller.
- D. Conduit clamps, straps, supports, etc., shall be steel or malleable iron. One-hole straps shall be heavy duty type. All straps shall have steel or malleable backing plates when rigid steel conduit is installed on the interior or exterior surface of any exterior building wall.

2.2 CONDUIT SUPPORTS

A. Material:

1. Single Runs:
- a. Galvanized two-hole conduit straps or ring-bolt type hangers with specialty spring clips.
- b. *Do not use plumber's perforated straps.*
2. Multiple Runs: Conduit rack with 25% spare capacity.
3. Vertical Runs: Channel support with conduit fittings.
- a. 25-ft intervals.

B. Anchor Methods:

1. Hollow Masonry: Toggle bolts or spike type expansion anchors.
2. Solid Masonry: Lead expansion anchors or preset inserts.

SECTION 26 19 00
SUPPORTING DEVICES

3. Metal Surfaces: Machine screws, bolts or welded studs.
 4. Wood Surfaces: Wood screws.
 5. Concrete Surfaces: Self-drilling anchors or power driven studs.
- C. Light Fixtures:
1. Provide grid troffer clips in accordance with NEC 410-16.
- D. Mounting Racks and Supports:
1. Provide rack and supports of galvanized or painted steel channel sections with bolted or welded fittings.
 2. Provide exterior treated 3/4" plywood mounting surface with gray paint finish on both sides and edges.

PART 3 - EXECUTION

3.1 GENERAL

- A. Maintain headroom, neat mechanical appearance and to support equipment loads.
- B. Suspend, support from and attach only to the structural elements at intervals required by code, with threaded rod, channels, "stand-off" and other clips and NECA approved devices.
- C. To the fullest extent possible, group several conduits together and run parallel, supporting with rod and channel.

3.2 INSTALLATION

- A. Fasten hanger rods, conduit clamps, outlet, junction and pull boxes to building structure using pre-cast insert system, preset inserts, beam clamps, expansion anchors, or spring steel clips (interior metal stud walls only).
 1. Do not use "stand-off" clips for attachment to walls and partitions.
 2. Install raceways tight to walls.
- B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs and wood screws in wood construction. If nail-in anchors are used, they must be removable type anchors.
- C. Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.
- D. Fabricate supports from galvanized structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.
- E. In wet locations, mechanical rooms and electrical rooms install free-standing electrical equipment on 3.5 inch (89 mm) concrete pads.
- F. Install surface-mounted cabinets and panelboards with minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or 3/4" painted, fire-retardant plywood is acceptable).

SECTION 26 19 00
SUPPORTING DEVICES

- G. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.
- H. Furnish and install all supports as required to fasten all electrical components required for the project, including free standing supports required for those items remotely mounted from the building structure, catwalks, walkways etc.

END OF SECTION

SECTION 26 45 00
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide and install materials for a complete grounding system integral with the power distribution in accordance with the National Electrical Code.
- B. Distribution grounding system.
- C. Equipment grounding system.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 26 11 00 Raceways and Boxes
 - 2. 26 12 00 Low Voltage Conductors and Cables

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 2. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to materials and installation of electrical grounding systems and associated equipment and wiring.
 - 3. Underwriters Laboratories:
 - a. Comply with UL Standards pertaining to electrical grounding and bonding.
 - b. UL 467: Grounding and Bonding Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Materials used for grounding conductors shall be as called for in National Electrical Code Article #250-81.
- B. Ground Fittings:
 - 1. OZ Company:
 - a. Type BF
 - b. Type OG
 - c. Type LG
 - d. Type MG

2.2 MECHANICAL CONNECTORS

SECTION 26 45 00
GROUNDING AND BONDING

- A. The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolt type.
- B. Split bolt connector types are NOT allowed. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.
- C. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

2.3 COMPRESSION CONNECTORS

- A. The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.
- B. The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.
- C. The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.
- D. The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.
- E. Each connector shall be factory filled with an oxide-inhibiting compound.

2.4 WIRE

- A. Material: Stranded copper (aluminum not permitted).
- B. Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

PART 3 - EXECUTION

2.1 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.
- D. Attach grounds permanently before permanent building service is energized.

2.2 LESS THAN 600 VOLT SYSTEM GROUNDING

- A. Bond together system neutrals, service equipment enclosures, exposed non-current carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- B. Equipment Grounding Conductor: Provide separate, insulated equipment grounding conductor within each raceway. Terminate each end on suitable lug, bus, enclosure or bushing. Provide a ground wire from each device to the respective enclosure.

3.3 INSTALLATION

SECTION 26 45 00
GROUNDING AND BONDING

- A. Electrical service, electrical equipment enclosures and associated metallic raceway system shall be permanently grounded and bonded together by a grounding electrode conductor as per NEC requirements with a ground clamp to a 1-1/4 inch or larger cold water metallic pipe on street side of water meter and ground rod electrodes.
1. Provide water meter shunt; cable to pipe connections copper cable shunt.
- B. Bond main switches, ground rods, foundation reinforcement rebar and water service entrance together with ground electrodes sized per code.
1. Ground connection surfaces shall be clean.
 2. Bond structural steel frame to grounding electrode conductor.
- C. Damp Locations: All convenience outlets, switches, fixtures, boxes and plates in damp locations or outdoors shall be fully grounded by a separate green grounding conductor.
- D. Panelboard Grounding: Install grounding conductor from main service to each panelboard and ground bar as indicated on Drawings:
1. Provide separate circuit grounding conductors to dedicated ground circuits, surge suppression receptacles (computers), and GFI receptacles.
- E. Bonding Jumpers:
1. Maintain ground continuity by separate insulated green ground wire in fixture cords, flexible connections or similar location where raceway system is interrupted.
 2. Light Fixtures: Provide separate green wire grounded from fixture housing to nearest conduit system box, where flexible conduit is used.
 3. Receptacles: Provide green wire bonding jumper from all new receptacles to metal back box.
- F. Motors: Provide insulated grounding conductor from motor connection to distribution panel grounding bus for all motors.
1. Where motors are connected to conduit systems with flexible conduit section, install greenfield grounding conductor in flexible conduit section.
- G. Equipment Grounding Conductors: Provide separate, insulated grounding conductor within each feeder raceway.
1. Ground cable tray at intervals not exceeding 100 feet.
- H. Device Boxes: Provide new green wire ground from panel ground bar to all new devices located in the raceway systems.
1. Provide dedicated ground wire to GFI and surge suppression receptacles.

END OF SECTION

**SECTION 26 51 00
INTERIOR BUILDING LIGHTING**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Provide and install lighting fixtures, supports and accessories for mounting condition encountered.

1.2 RELATED DOCUMENTS

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

B. Specified Elsewhere:

- | | | |
|----|----------|-----------------------------------|
| 1. | 26 11 00 | Raceways and Boxes |
| 2. | 26 12 00 | Low Voltage Conductors and Cables |
| 3. | 26 51 10 | Lighting Control Systems |

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Certified Ballasts Manufacturers Association, CBM: Ballast labeled by CBM.
2. National Electrical Code, NEC: Comply with NEC/NFPA No. 70, as applicable to installation and construction of interior lighting fixtures.
3. Life Safety Code: Comply with NFPA 101 as applicable to exit signs.
4. Underwriter's Laboratories, UL:
 - a. Interior lighting fixtures listed and labeled by UL.
 - b. UL 57: Electric lighting fixtures.

1.4 REFERENCES

A. Standards:

1. American National Standards Institute, ANSI: Comply with applicable ANSI standards pertaining to lamp materials and lighting ballasts.

B. Manufacturers:

1. National Electrical Manufacturer's Association, NEMA: Comply with applicable portions of NEMA standards pertaining to lighting equipment.

1.5 SUBMITTALS

- A. Submit in accordance with Division 1 and Section 16050.

1. Shop Drawings: Submit shop drawings for luminaires indicating pertinent physical characteristics and photometric data.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Acceptance: Deliver interior lighting fixtures individually wrapped in factory fabricated fiberboard type containers.

SECTION 26 51 00
INTERIOR BUILDING LIGHTING

B. Storage:

1. Store interior lighting fixtures in clean, dry space.
2. Store in original cartons and protect from dirt, physical damage, weather and construction traffic.

C. Handling:

1. Handle interior lighting fixtures carefully to prevent breakage, denting and scoring fixture finish.
2. Do not install damaged lighting fixtures.
3. Replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Refer to fixture schedule. Engineer has final decision on whether submitted fixture is equal.
- B. Other fixture manufacturers who consider their products equal to those specified are required to request approval for bidding as base bid in accord with Instructions to Bidders section.
- C. Approval of products will be considered subject to the following:
 1. Equal manufacturers are required to nominally meet specifications of specified fixtures and lenses in regard to ceiling opening size and shape, housing, and trim/door appearance and construction, general overall appearance, efficiency, thickness, brightness control and lamp hiding characteristics.
 2. Provide equivalent performance to specified fixtures considering application in the environment and intended usage by the Owner.
 3. Manufacturers shall submit complete fixture and lens data for evaluation and shall be prepared to submit sample fixtures and/or lenses. Samples shall be submitted only at the request of the Engineer.

2.2 GENERAL

- A. Subject to compliance with requirements, fixtures that may be incorporated into the work include the products specified in the Lighting Fixture Schedule on the drawings, and the equals listed in the accompanying notes.
- B. The basic catalog number only is indicated in the Lighting Fixture Schedule. The EC shall furnish complete lighting fixtures in quantities, and/or row lengths as shown on the plans, including plaster frames, ends, or caps, couplings, connectors, suspension assemblies, mounting brackets and all auxiliary accessories as required.
- C. Refer to Schedule for description of fixture nomenclature and associated ceiling type and suspension system.

2.3 LUMINAIRES

SECTION 26 51 00
INTERIOR BUILDING LIGHTING

A. Housings:

1. Shall be free from burrs, sharp corners and edges.
2. Shall be steel, unless noted otherwise, formed and supported to prevent warping and sagging.
3. Provide spring loaded latches for all troffers.
4. Provide UL approved earthquake clips for all troffers.
5. Provide locking sockets for fluorescent lamps.

B. Mounting Accessories:

1. Recessed fixtures:
 - a. Provide trim type and accessories required for installation in ceiling types specified and/or shown on the reflected ceiling plan.
 - b. Fixtures mounted in sloped ceilings shall be provided with sloped ceiling adapters and appropriate trim rings and other accessories as required.
2. Surface-mounted fixtures:
 - a. Provide ceiling spacers as required for fixtures not labeled as suitable for direct mounting to a low density ceiling.
3. Suspended fixtures:
 - a. Provide swivel canopy to accommodate any sloped ceilings shown on the plans.
 - b. Provide pendant or cable length required to suspend luminaires at indicated height.
 - c. Swivel hangers in mechanical equipment areas shall be shock- absorbing type.

C. Finishes:

1. Painted finishes:
 - a. Shall be polyester powder painted enamel finish.
2. Polished, brushed, other metal finishes:
 - a. Shall be finished with clear coat to inhibit finish deterioration and corrosion.
3. All finish types and colors shall be verified with the architect prior to ordering.

D. Louvers, Reflectors, Lenses:

1. All louvers and reflectors shall be semi-specular, low iridescent, clear alzak, unless noted otherwise.
2. Provide reflector channels to separate all lamp sections.
3. All acrylic lenses shall be pattern 12 prismatic, overall 0.125" minimum thickness.

2.4 LED LIGHTING

- A. The manufacturer of the LED lighting fixture shall utilize high-brightness LEDs and high-efficiency electronic LED drivers, dimmed or no dimmed as required.
- B. The LED fixture shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the fixture is to be installed.
- C. Light output of the LED system shall be the absolute photometry following IESNA LM-79 and IESNA LM-80 requirements and guidelines.

SECTION 26 51 00
INTERIOR BUILDING LIGHTING

- D. Minimum power factor of 0.90.
- E. LED lighting fixture shall be mercury-free, lead-free and RoHS compliant.
- F. The LED lighting fixture shall maintain 70% lumen output for a minimum of 50,000 hours.
- G. All components of the LED lighting fixture shall be replaceable.
- H. The LED lighting fixture shall carry a limited 3-year warranty minimum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

- 1. It shall be the Contractor's responsibility to determine mounting requirements and verify ceiling types and to coordinate locations of lighting with other contractors to assure that installation will not interfere with other equipment.
- 2. Anchor surface mounted fixtures on walls or ceilings in a manner to prevent rotation and light leakage. Do not use plastic, composition or wood type anchors.
- 3. Provide pendant mounted fixtures with self aligning stem hangers and rigid steel conduit stems, cut and threaded to fit required length. One stem must serve as wireway.
- 4. Mount suspended fixtures at heights indicated on the drawings. If height is not indicated, mount as high as possible, but not above lowest point of mechanical equipment.
- 5. Support all suspended fixtures from structural building components. Unless directed otherwise, do not suspend from other suspended equipment.
- 6. Support system capable of supporting 300% fixture and lamp weight.

B. Recessed Luminaires:

- 1. Install recessed luminaire to permit removal from below for access to outlet or prewired fixture box.
- 2. Connect recessed luminaire to boxes with flexible conduit and fixture wire.
- 3. Suspended ceiling with exposed tee bar grid system. Support from ceiling tee bar grid structure and with bolts, screws, rivets or approved ceiling framing member clips.

C. Lay-In Luminaires:

- 1. Install with plastic protection over louver.
- 2. Remove plastic protection after final clean up.
- 3. Fixtures used for temporary lighting shall have louver removed and safely stored.
- 4. Any contact with louver shall be made utilizing clean gloves to prevent fingerprints on specular finish.

3.2 FIELD QUALITY CONTROL

- A. At time of substantial completion, replace lamps in fixtures, which are observed to be noticeably dimmed after Contractor's use and testing as judged by Architect-Engineer.

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INTERIOR BUILDING LIGHTING

- B. Prior to final acceptance replace all cracked or broken lenses, dented, scratched or otherwise damaged fixtures at no cost to the Owner.

3.3 ADJUST AND CLEAN

- A. Align luminaires and clean diffusers prior to final acceptance.
- B. Provide lamps, as scheduled, for each luminaire.

3.4 SCHEDULES

- A. Lighting Fixture Schedule on Drawings.

END OF SECTION

SECTION 26 51 10
LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish all labor, equipment, materials, and performing all operations in connection with the installation of the Lighting Control System as shown on the drawings, as hereinafter specified, and as directed by the Engineer. The intent of this specification is to provide for furnishing, installing, testing and placing in operation, the necessary equipment for switching and control of lighting systems.
- B. Extent of lighting control system work is indicated by drawings and by the requirements of this section. Types of lighting control equipment and wiring specified in this section includes the following:
 - 1. Occupancy sensor controls.
- C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways, electrical boxes and fittings, and routers or other network components required for installation of control equipment, which are not work of this section.

1.2 LIGHTING CONTROL SYSTEM OPERATION

- A. It shall be the contractor's responsibility to make all proper adjustments to assure owner's satisfaction with the lighting control system.
- B. Factory Startup: It shall be the manufacturer's responsibility to verify all proper adjustments and train owner's personnel to ensure owner's satisfaction with the occupancy system. This service is provided at an additional cost.

1.3 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 26 05 00 Basic Materials and Methods
 - 2. 26 11 00 Raceways and Boxes
 - 3. 26 19 00 Supporting Devices
 - 4. 26 51 00 Interior Building Lighting

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Local and state building codes.
 - 2. All requirements of the local authority having jurisdiction.
 - 3. Underwriter's Laboratories: The system and all components shall be listed by Underwriters Laboratories, Inc. for use in fire protective signaling systems under the following standards as applicable.
- B. Codes and Standards:

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LIGHTING CONTROL SYSTEMS

1. Network - ANSI 875.1, ARCNET®
 2. Protocol - ASHRAE 135 – 1995, BACnet®
 3. IEEE Std 2000.1-1998
 4. UL 916 Energy Management Equipment
 5. California Energy Commission
- C. Independent Testing Laboratory - The control panels shall be tested and listed under the UL 916 Energy Management Equipment standards.
- D. System Checkout and training - A factory trained technician or other factory-authorized personnel shall functionally test the system and verify performance after contractor installation. Factory authorized personnel shall conduct a training session to train the building operations personnel on the set-up, programming, operation and maintenance of the lighting control systems.

1.5 SUBMITTALS

- A. Submit in accordance with Section 23 05 00.
- B. Submit complete documentation showing the type, size, rating, style, catalog number, manufacturer's names, photos and or catalog data sheets for all items to ensure compliance with these specifications.
- C. Prior to fabrication manufacture shall submit the following materials for approval:
1. Manufacturer's published catalog data sheets for all equipment and components of the lighting control system.
 2. Shop Drawings - Submit drawings of lighting control system and accessories including, but not necessarily limited to, the central programming system, intelligent relay/dimmer panels, network wiring, switch inputs, analog inputs and modem location. As a minimum, the shop drawings shall include the following:
 - One-line schematic diagram with wire type details
 - Network wiring details
 - Lighting control panel load schedules
 - Input and output wiring details
 - Programming worksheets for system configurations
- D. Submit point list for owner to complete custom label requirements.
- E. All references to manufacturer's or supplier's model numbers and other pertinent information herein is intended to establish minimum standards for performance, function and quality. Equivalent equipment (compatible UL listed) from other manufacturers may be substituted for that specified providing the submittal is performed as specified above.

1.6 DELIVER, STORAGE AND HANDLING

- A. Deliver equipment individually wrapped in factory fabricated fiberboard type containers.
- B. Store equipment in clean, dry space.

**SECTION 26 51 10
LIGHTING CONTROL SYSTEMS**

- C. Protect from dirt, fumes, water and physical damage.
- D. Do not install damaged equipment, remove from site.

1.7 FIELD PROGRAMMING

- A. The system shall be programmable, configurable and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory ICs. All standard control panel keyboard or through the use of the optional CRT-1 keyboard. All programs shall be stored in non-volatile memory.
- B. The programming function shall be entered with a special password that may be selected when the system is installed. The password may be changed in the field to a new value at any time by entering the old password and requesting a password change. In the event that the programmer may enter a password and then lose or forget it, the system shall be designed such that the password may be determined by special procedures available through the system manufacturer.

PART 2 - PRODUCTS

2.1 OCCUPANCY SENSOR CONTROLS

- A. Occupancy Sensors shall be equal to Sensor Switch Watt Stopper, Hubbell/Unenco, Novitas, or approved equal.
 - 1. Line voltage occupancy sensors may be used in lieu of low-voltage sensors where approved by the Engineer for areas with inaccessible power pack locations.
- B. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.
- C. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180° coverage capability.
- D. Wall switch products shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush current, and increases sensor's longevity.
- E. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.
- F. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON.
- G. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.
- H. Passive infrared sensors shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion.

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LIGHTING CONTROL SYSTEMS

- I. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.
- J. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.
- K. Where specified, passive infrared and dual technology sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.
- L. Dual technology sensors shall be corner mounted to avoid detection outside the controlled area when doors are left open.
- M. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.
- N. Ultrasonic sensors shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.
- O. Ultrasonic operating frequency shall be crystal controlled at 25 kHz within $\pm 0.005\%$ tolerance, 32 kHz within $\pm 0.002\%$ tolerance, or 40 kHz $\pm 0.002\%$ tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.
- P. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.
- Q. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.
- R. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
- S. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.
- T. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
- U. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
- V. All sensors shall have UL rated, 94V-0 plastic enclosures.

2.2 OCCUPANCY SENSOR CIRCUIT CONTROL HARDWARE

**SECTION 26 51 10
LIGHTING CONTROL SYSTEMS**

- A. Control Units - For ease of mounting, installation and future service, control unit(s) shall be able to externally mount through a 1/2" knock-out on a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Control unit shall provide power to a minimum of two (2) sensors.
- B. Relay Contacts shall have ratings of:
 - 13A - 120 VAC Tungsten
 - 20A - 120 VAC Ballast
 - 20A - 277 VAC Ballast
- C. Control wiring between sensors and controls units shall be Class II , 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
- D. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

2.3 WIRE AND CABLE

- A. All low voltage cable and wire shall be supplied and installed in accordance with the National Electrical Code and other provisions of Division 26
- B. Cable and wire selected for each application shall be in strict accordance with the original equipment manufacturers recommendations.
- C. All cables and wires shall be permanently tagged at both ends for ease in maintenance.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION AND DOCUMENTATION

- A. Installation - The control system shall be installed and connected as shown on the plans and as directed by the manufacturer. The contractor shall complete all electrical connections to all control circuits, network terminations, RS-232 connections, sensors and override wiring.
- B. Documentation - The contractor shall provide accurate "as built" drawings to the owner indicating the correct and latest program in each controller. The "as-built drawings" shall clearly indicate the lighting control panel identification, the load controlled by each relay, and the device connected to each input.
- C. Operation and Service Manuals – Provide operation and service manuals for all system components as indicated in the General Provisions.

3.2 PRODUCT SUPPORT AND SERVICE

- A. System Start-up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:

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1. The control system has been fully installed in accordance with manufacturer's installation instructions.
 2. Low voltage wiring for overrides and sensors is completed.
 3. Accurate "as-built" load schedules have been prepared for each lighting control panel.
 4. Proper notification of the impending start-up has been provided to the owner's representative.
- B. **Factory Support:** Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll-free number for technical support.

3.3 OCCUPANCY SENSOR CONTROL INSTALLATION

- A. It shall be the contractor's responsibility to locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.
- B. It is the contractor's responsibility to arrange a pre-installation meeting with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.
- C. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

3.3 WARRANTY

- A. Manufacturer shall provide a one (1) year limited warranty on the lighting control system and software. A ten (10) year limited warranty shall be provided on the lighting control relays.

3.4 TESTS AND REPORTS

- A. Final Acceptance: The system will be accepted only after a satisfactory test of the entire system has been accomplished by a factory-trained distributor in the presence of the Owner's Representative.
- B. On-Site Services: Contractor shall provide the on-site services of an authorized technical representative of the manufacturer, to supervise all connections and fully test all devices and components of the system as installed. Owner's representative shall be instructed in the proper use and testing of the system.

3.5 BASIC OPERATOR TRAINING

SECTION 26 51 10
LIGHTING CONTROL SYSTEMS

- A. Installation Contractor and equipment vendor shall provide all training materials, testing equipment, and demonstration aids required to provide operator, supervision, and maintenance personnel training. At completion of the training period, all training brochures, bulletins, manuals, handbooks, and diagnostic guidelines shall remain with the Owner.

END OF SECTION

SECTION 27 05 00
COMMUNICATIONS RACEWAY SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish and install backboxes, conduit, sleeves and raceway raceway system for communications (voice/data) system cabling as described herein and indicated on the drawings.
- B. Furnish and install backboxes, junction boxes, conduit and raceway system for future telecommunication systems as indicated on the Drawings.
- C. Provide telephone service raceway and termination backboards as indicated on the drawings.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
 - 1. 26 11 00 Raceways and Boxes

PART 2 - PRODUCTS

2.1 COMMUNICATIONS RACEWAYS

- A. Communication Outlets: Telecommunication(voice/data) outlets shall be a 4" square box, 2-1/2" depth, with plaster ring for a single device. Stub 3/4" EMT conduit to above accessible ceiling with insulated bushing termination. Refer to the drawings for locations required.
 - 1. In hard ceiling areas, provide 3/4" EMT stub with bushing at back box and cable concealed to main distribution wiring closet.
 - 2. Provide EMT sleeves with bushing at both ends for penetration of masonry walls, floors and ceilings. Provide UL fire stopping at rated penetrations.
- B. Sleeves: Provide EMT conduit sleeves through walls between rooms with insulated bushing at both ends.

PART 3 - EXECUTION

3.1 COMMUNICATION RACEWAY INSTALLATION

- A. The E.C. shall install all required backboxes, conduits, sleeves and conduit fittings for the complete communication raceway system.
 - 1. All empty conduits shall be provided pull wire by E.C.
 - 2. Coordinate all work above the accessible ceilings with other trades.
 - 3. Seal all openings for sleeves between rooms for soundproofing.
- B. The E.C. shall coordinate installation with local Telephone Utility and Owner for new telephone service to the building.

END OF SECTION

COMMUNICATIONS RACEWAY SYSTEMS

**SECTION 28 31 00
FIRE ALARM SYSTEM**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Furnish all labor, equipment, materials, and performing all operations in connection with the installation of the Fire Alarm System as shown on the drawings, as hereinafter specified, and as directed by the Engineer.
1. Expand the existing Simplex addressable multiplexing fire alarm system with new addressable devices.
 2. The Contractor shall visit and inspect existing facility to determine extent of fire alarm work and to meet requirements of this specification and existing conditions.
- B. The Fire Alarm System shall consist of all necessary software, field wiring and equipment to perform all fire alarm, detection, and annunciation operations.
1. Annunciation per NFPA 72 and ADA.
- C. Fire Alarm Equipment shall Include:
1. Existing fire-alarm control panel.
 2. New notification appliances.
 3. Existing NAC power panels
 4. Existing digital alarm communicator transmitter.
- D. The Fire Alarm Sub-contractor shall be responsible for advising the Engineer ten(10) days prior to the bidding date of any omissions required to meet the local, state and federal requirements for the fire alarm installation. After this date, the additional requirements for a complete installation of the fire alarm system shall become the responsibility of the Fire Alarm Sub-contractor.
- E. The Fire Alarm Sub-contractor shall provide final fire alarm design responsibility for the project and submit all plans, plan approval fees, calculations and related to the City of Madison Fire Department to provide required approvals necessary to obtain facility occupancy for the Owner.

1.2 RELATED DOCUMENTS

- A. Applicable provisions of Division 1 shall govern work under this section.
- B. Specified Elsewhere:
1. 26 00 00 Electrical Systems

1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. National Electric Code, Article 760.
 2. National Fire Protection Standards:
 - a. NFPA 71: Central Station Signaling Systems - Protected Premises Unit.

SECTION 28 31 00
FIRE ALARM SYSTEM

- b. NFPA 72A: Local Protective Signaling Systems.
 - c. NFPA 72D: Protective Signaling Systems - Protected Premises Unit.
 - d. NFPA 72E: Automatic Fire Detectors.
 3. Local and state building codes.
 4. IBC.
 6. All requirements of the local authority having jurisdiction.
 7. Underwriter's Laboratories: The system and all components shall be listed by Underwriters Laboratories, Inc. for use in fire protective signaling systems under the following standards as applicable.
 - a. UL 864: Control Units for Fire Protective Signaling Systems.
 - b. UL 464: Audible Signaling Appliances.
 - c. UL 1638: Visual Signaling Appliances.
 - d. UL 1481: Power Supplies for Fire Protective Signaling Systems.
- B. The equipment and installation supervision furnished under this specification is to be provided by a manufacturer (independent dealers and/or distributors will NOT be considered) who has been engaged in production of this type (software driven) of equipment for at least five (5) years, and has a fully-equipped service organization within one hundred (100) miles of the installation.
1. All control equipment must have transient protection devices to comply with UL864 requirements.
- C. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- D. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA70, by a qualified testing agency, and marked for intended location and application.

1.4 SUBMITTALS

- A. Submit in accordance with Division 1 and specified herein.
- B. Submit complete documentation showing the type, size, rating, style, catalog number, manufacturer's names, photos and or catalog data sheets for all items to ensure compliance with these specifications.
- C. Submit complete point to point wiring diagrams.
- D. All references to manufacturer's or supplier's model numbers and other pertinent information herein is intended to establish minimum standards for performance, function and quality. Equivalent equipment (compatible UL listed) from other manufacturers may be substituted for that specified providing the submittal is performed as specified above.
- E. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 1. Include voltage drop calculations for notification appliance circuits.

**SECTION 28 31 00
FIRE ALARM SYSTEM**

2. Include battery-size calculations.
3. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
4. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
5. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

1.5 WARRANTY AGREEMENT

- A. The contractor shall warranty all materials, installation and workmanship for three (3) years from date of acceptance, unless otherwise specified. A copy of the manufacturers' warranty shall be provided with closeout documentation and included with the operation and installation manuals.
- B. Technical Support: Beginning with Substantial Completion, provide software support for three (3) years, shall be included in this project.

1.6 DELIVER, STORAGE AND HANDLING

- A. Deliver equipment individually wrapped in factory fabricated fiberboard type containers.
- B. Store equipment in clean, dry space.
- C. Protect from dirt, fumes, water and physical damage.
- D. Do not install damaged equipment, remove from site.

1.7 GENERAL

- A. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition.
- B. The system shall use closed loop initiating device circuits with individual zone supervision, individual notification appliance circuit supervision, incoming and standby power supervision. Include a control panel, manual pull stations, automatic fire detectors, all wiring, connections to devices, outlet boxes, junction boxes, and all other necessary material for a complete operating system.

1.8 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Sprinkler system flow detection.

SECTION 28 31 00
FIRE ALARM SYSTEM

- B. Fire-alarm signal shall initiate the following actions:
1. Activate the audio (speakers) and visual notification appliances.
 2. Identify alarm at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Record events in the system memory.
 8. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Retain only those devices and actions in subparagraphs below that are applicable to Project.
 2. Coordinate with requirements in other Sections that specify listed devices and systems.
 3. Open circuits, shorts, and grounds in designated circuits.
 4. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 5. Loss of primary power at fire-alarm control unit.
 6. Ground or a single break in fire-alarm control unit internal circuits.
 7. Abnormal ac voltage at fire-alarm control unit.
 8. Break in standby battery circuitry.
 9. Failure of battery charging.
 10. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators. Record the event on system printer.
- F. General – Audio: Upon alarm activation of any area smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:
1. The internal audible device shall sound at the control panel or command center.
 2. The LCD Display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location and time/date.
 3. All system activity/events shall be documented on the system printer.
 4. Any remote or local annunciator LCD/LED's associated with the alarm zone shall be illuminated.
 5. The following audio messages and actions shall occur simultaneously: An evacuation message shall be sounded for general alarm throughout the building. Owner to select tone and message for review by Dubuque Fire Marshall.
 6. Activate all visual strobes throughout the building. The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the "Alarm Silence" is pressed.

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7. Provide selective paging to each individual floor (zone). In addition to the message/channels detailed above, a dedicated page channel shall be capable of simultaneously providing live voice instructions without interrupting any of the messages listed above shall be provided.
8. Transmit signal to the central station.
9. Activate automatic smoke control sequences.
10. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.
11. All electrically locked stairwell/exit doors shall unlock throughout the building.
12. All self-closing fire/smoke doors held open shall be released.

1.09 SUPERVISION

- A. Each independently supervised circuit shall include a discrete panel readout to indicate disarrangement conditions per circuit.

1.10 POWER REQUIREMENTS

- A. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of twenty-four (24)] hours with 10 minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
 1. All circuits requiring system operating power shall be 24VDC and shall be individually fused at the control panel.

1.11 MULTIPLE ADDRESSABLE PERIPHERAL NETWORK

- A. Communication with addressable devices: The system must provide communication with all initiating and control devices individually. All of these devices are to be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
 1. Alarm
 2. Trouble
 3. Open
 4. Short
 5. Ground
 6. Device Fail/or Incorrect Device
- B. All addressable devices are to have the capability of being disabled or enabled individually.
- C. Up to 127 addressable devices may be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices are unacceptable.
- F. Format: The communication format must be a poll/response protocol to allow t-tapping of the wire to addressable devices and be completely digital. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission protocol. Systems that do not utilize full

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digital transmission protocol (i.e. that may use time pulse width methods to transmit data etc.) will not be acceptable since they are considered unreliable and prone to errors.

- G. Identification of Addressable Devices: Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable due to the potential of vibration and poor contact.
- H. Wiring Type, Distances, Survivability and Configurations: Wiring types will be approved by the equipment manufacturer. Existing wiring will be utilized in retrofit applications. The system must allow up to 2,500 feet wire length to the furthest addressable device. Class A (Style 6 Signaling Line Circuit as defined by NFPA-72) communications will be provided where shown on the drawings. Wire will be so routed to maintain sufficient distance between the forward and return loop as called for by the Authority Having Jurisdiction (AHJ). To minimize wire routing and to facilitate future additions, t-tapping of the communications channel will be supported except where Class A wiring is required.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Simplex.
- B. Compatible Simplex fire alarm appliances.

2.2 INTELLIGENT ANALOG SYSTEM SMOKE DETECTORS

- A. General Requirements for Intelligent Analog Detectors:
 - 1. Integral Microprocessor: All decision are made at the detector determining if the device is in the alarm or trouble condition.
 - 2. Non-Volatile Memory: Permanently stores serial number, and type of device.
 - 1. Automatically updates historic information including hours of operation, maintenance date, number of alarms and troubles, time of last alarm and analog signal patterns for each sensing element just before last alarm.
 - 4. Electronic Addressing: Permanently stores programmable system address. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable.
 - 5. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision of the device physical location and the device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.
 - 6. Sensitivity Range: Each analog addressable smoke detector's sensitivity shall be capable of being programmed individually as: most sensitive, more sensitive, normal, less sensitive or least sensitive. It shall be possible to automatically change the sensitivity of individual analog/addressable detectors for the day and night periods. It shall be possible to program control panel activity to each level.
 - 7. Pre-Alarm: Detector stores 20 pre-alarm sensitivity values to alert local personnel prior to the sensor reaching full evacuation sensitivity. Sensitivity values can be set in 5% increments.

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8. Environmental Compensation: The detector's sensing element reference point shall automatically adjust, compensating for background environmental conditions such as dust, temperature, and pressure. Periodically, the sensing element real-time analog value shall be compared against its reference value. The detector shall provide a maintenance alert signal when the detector reaches 75% (Dirty) to 99% (More Dirty) compensation has been used. The detector shall provide a dirty fault signal when 100% or greater compensation has been used.
 9. Twin Status LEDs: Flashing Green LED shows normal; flashing RED shows alarm state; steady RED and steady GREEN show alarm state in stand-alone mode, visible from any direction.
 10. UL Sensitivity Testing: The detector shall utilize a supervised microprocessor that is capable of monitoring the sensitivity of the detector. If the detector sensitivity shifts outside of the UL limits, a trouble signal is sent to the panel.
 11. Device Replacement: The system shall allow for changing of detector types for service replacement purposes without the need to reprogram the system. The replacement detector type shall automatically continue to operate with the same programmed sensitivity levels and functions as the detector it replaced. System shall display an off-normal condition until the proper detector type has been installed or change in the application program profile has been made.
- B. Intelligent 4D Multi-sensor Detector (Photo/Ion/Thermal and Time):
1. Provide intelligent analog addressable 4D multi-sensor smoke detectors at the locations shown on the drawings. The 4D Intelligent detector gathers analog information from each of its three fire sensing elements and converts it into digital signals. The detectors on-board microprocessor measures and analyzes these signals separately with respect to a fourth element – Time. It compares the information to historical readings, time patterns and known fire characteristics to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.
 2. Separately mounted combinations of photoelectric detectors, ionization detectors and heat detectors in the same location, clustered at the manufacturer's listed spacing is an acceptable alternative.
- C. Intelligent 3D Multi-sensor Detector (Photo/Thermal and Time):
1. Provide intelligent analog addressable 3D multi-sensor smoke detectors at the locations shown on the drawings. The 3D Intelligent detector gathers analog information from each of its two fire sensing elements and converts it into digital signals. The detectors on-board microprocessor measures and analyzes these signals separately with respect to a third element – Time. It compares the information to historical readings, time patterns and known fire characteristics to make an alarm decision. Digital filters remove signal patterns that are not typical of fires.
- D. Intelligent Photoelectric Detector:
1. Provide intelligent analog addressable photoelectric smoke detectors at the locations shown on the drawings.
- E. Intelligent 135 Degree Fixed Temperature / Rate of Rise Heat Detector:
1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors at the locations shown on the drawings.

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2. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm.
3. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable.
4. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute.
5. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

B. Fixed Temperature Heat Detector:

1. Provide intelligent fixed temperature heat detectors at the locations shown on the drawings.
2. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data.
3. Systems using central intelligence for alarm decisions shall not be acceptable.
4. The heat detector shall have a nominal alarm point rating of 135°F (57°C).
5. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

C. Detector Base Types

1. Provide standard detector mounting bases suitable for mounting on 1-gang, or 4inch octagon box and 4 inch square box. The base shall, contain no electronics and support all series detector types. Bases with electronics or dip-switches are not acceptable.
2. Provide relay detector mounting bases suitable for mounting on 1-gang, or 4” octagon box and 4” square box. The relay base shall support all Signature Series detector types and have the following minimum requirements:
 - a. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.
 - b. The position of the contact shall be supervised.
 - c. The relay shall automatically de-energize when a detector is removed.
 - d. The operation of the relay base shall be controlled by its respective detector processor or under program control as required by the application. Detector relays not capable of operational programming independent of the detector shall not be considered equal. Form “C” Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for “pilot duty”.
 - e. Removal of the respective detector shall not affect communications with other detectors.
3. Provide audible detector mounting bases suitable for mounting on 4” x 4” octagonal concrete ring (mud box) and 4” square x 2-1/8” (54 mm) deep box.
 - a. The base shall support all Signature Series detector types and be capable of single or group operation. The audible base shall emit a temporal alarm tone and be selectable for low or high output.

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- b. The operation of the audible base shall be controlled by its respective detector processor or under program control as required by the application. Detector audible base not capable of operational programming independent of the detector shall not be considered equal.
 - c. The audible bases shall be UL268 and UL464 Listed, and provide a reverberant room sound output per UL464 of 81 dBA at 10ft (3m). and an average anechoic sound output of 90 dBA at 10 ft. (3m).
- D. Intelligent Duct Smoke Detector – Photoelectric:
- 1. Provide intelligent photoelectric duct smoke detector at the locations shown on the drawings.
 - a. One form C auxiliary alarm relay rated at 2amps @ 30Vdc.
 - b. The operating range shall be 100ft/min to 4,000ft/min air velocity and temperature range of -20 to 158F.
 - c. Sample tube can be installed with or without the cover plate and be rotated in 45- degree increments to ensure proper alignment with duct airflow.
 - d. Local magnet-activated test switch.
 - 2. Provide remote test station with Alarm LED and Key Switch.
 - 3. Relay Fan Shutdown: Rated to interrupt fan motor control circuit. Furnish and install separate device for each motor start. Connect to motor start as required for fan shutdown during alarm condition.

2.3 INTELLIGENT MODULES

- A. It shall be possible to address each intelligent module without the use of DIP or rotary switches. Devices using switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller.
- 1. Integral Microprocessor: All decisions are made at the module determining if the device is alarm or trouble condition.
 - 2. Non-Volatile Memory: Permanently stores serial number, and type of device. Automatically updates historic information including hours of operation, number of alarms and troubles, time of last alarm.
 - 3. Automatic Device Mapping: Each detector transmits wiring information regarding its location with respect to other devices on the circuit, creating an As-Built wiring diagram. This will also provide enhanced supervision of the device physical location. The device message shall reside with the location and not the device address. Devices installed in the wrong location will always report the correct message of the physical location.
 - 4. Twin Status LEDs: The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status.
 - 5. Input and output circuit wiring shall be supervised for open and ground faults.
 - 6. Two styles of modules shall be available; those designed for gang box mounting, and where multiple modules are required in a single location, plug in modules shall be provided with a Universal Input/Output motherboard.
- B. Intelligent Input Module. The Input Module shall provide one or two supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The

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module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers. The single input module shall support the following circuit types:

1. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
 2. Normally-Open Alarm Delayed Latching (Water flow Switches)
 3. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
 4. Normally-Open Active Latching (Supervisory, Tamper Switches)
- C. Intelligent Relay Module. Provide addressable control relay circuit modules shall provide one (1) form C dry relay contacts rated at 24Vdc @ 2 amps (pilot duty) to control external appliances or equipment. The position of the relay contact shall be confirmed by the system firmware. The module shall be suitable for mounting on North American 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers.
- D. NAC Control Module: Provide intelligent NAC control module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation. The gang box -mounted version shall be suitable for mounting in North American 2 ½” (64mm) deep 2-gang boxes and 1 ½” (38mm) deep 4” square boxes with 2-gang covers, or European 100mm square boxes. The plug-In version shall plug into a universal multi-module motherboard. The NAC control module shall support the following operations:
1. 24volt NAC circuit
 2. Audio notification circuit 25v or 70v
 3. Telephone Power Selector with Ring Tone (Firefighter’s Telephone)
 4. Visual Synchronized Output to Genesis appliances or to NAC Power Supply.
- E. FA Elevator Interface Cabinet
1. Provide red metal cabinet enclosure with word FIRE in white letters on the cover. Inside will be four intelligent relays (Primary Recall, Alternate Recall, Fire Hat and Shunt Trip), one monitor input (Shunt Trip AC Power Supervision) and 120vac relay (Shunt Trip AC Power Supv).
 2. Label all the relays and input modules for the function.

2.4 NOTIFICATION APPLIANCES

- A. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers’ instructions.
- B. Any appliances, which do not meet the above requirements, and are submitted, for use must show written proof of they're compatibility for the purpose intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended. All appliances shall be UL listed Fire Protective Service. and shall be UL 1971.
- C. Notification Appliances – Visual:

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1. Provide wall or ceiling mounted white strobes with in-out screw terminals shall be provided for wiring. Strobes shall provide a smooth light distribution pattern field selectable candela 15 cd, 30 cd, 75 cd, and 110 cd flash output rating.
2. The strobe (15, 30, 75, 110) candela rating shall be view from the side window to verify the setting.
3. All strobes shall be synchronization to within 10 milliseconds for an indefinite period shall not require the use of separately installed remote synch modules.
4. The strobes shall mount to one-gang electrical box. The device shall have plastic protective cover for during installation.
5. The actual candela setting on the visual shall be marked on the appliance.

D. Notification Appliance – Horn:

1. Provide low profile wall mount horns at the locations shown on the drawings. The horn shall provide an 95 dBA sound output at 10 ft. when measured in reverberation room per UL-464. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring. The horn shall mount in a 1-gang box.
2. The device shall have plastic protective cover for during installation.

E. Notification Appliance – Horn/Strobe:

1. Provide low profile wall mount horn/strobes at the locations shown on the drawings. The horn/strobe shall provide an audible output of 95 dBA at 10 ft. when measured in reverberation room per UL-464. Strobes shall provide synchronized flash outputs.
2. The strobe output shall be determined as required by its specific location and application from a family of 15cd, 30cd, 60cd, 75cd & 110cd devices. The horn shall have a selectable steady or synchronized temporal output. In and out screw terminals shall be provided for wiring.
3. Low profile horn/strobes shall mount to one-gang box.
4. The device shall have plastic protective cover for during installation.

F. Notification Appliance – Harsh Environment Temporal Horn/Strobes:

1. Provide red electronic horn/strobes at the locations shown on the drawings. Horns shall be temporal output. At the high output setting, the horn shall provide a 85 dBA continuous sound output or a 95 dBA temporal sound output, when measured in reverberation room per UL-464. Strobes shall provide 15 cd, 75 cd, 110 cd synchronized flash outputs without the use of separate “synchronizing” modules. The strobe shall have lens markings oriented for wall or ceiling mounting.
2. In - Out screw terminals shall be provided for wiring. Horns shall mount to a North American 4” electrical boxes (2-1/8” deep) or to a 2-gang (2-3/4” deep) electric box. Weatherproof wall boxes shall be provided for outdoor applications.
3. Provide GE-EST model 757 series.

G. Notification Appliance –Speakers:

1. Provide 4" white speakers at the locations shown on the drawings.
2. Speakers shall have a 4" mylar cone, paper cones are not acceptable.
3. The rear of the speakers shall be completely sealed protecting the cone during and after installation.
4. In and out screw terminals shall be provided for wiring.

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5. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 25V or 70V systems.
6. At the 2 watt setting, the speaker shall provide a 90 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480.

H. Notification Appliance –Speakers/Strobes:

1. Provide 4" white speakers/strobes at the locations shown on the drawings.
2. Speakers shall have a 4" mylar cone, paper cones are not acceptable.
3. The rear of the speakers shall be completely sealed protecting the cone during and after installation.
4. In and out screw terminals shall be provided for wiring. Speakers shall provide 1/4w, 1/2w, 1w, and 2w power taps for use with 25V or 70V systems.
5. At the 2 watt setting, the speaker shall provide a 87 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480.
6. Strobes shall provide synchronized flash. Strobe output shall be determined as required by its specific location and application from a family of 15/75cd, 30cd, 60, 75 & 110cd devices.

2.5 GUARDS FOR PHYSICAL PROTECTION

- A. Provide welded mesh of size and shape for the manual pull stations, smoke detectors, notification appliances at location noted on the drawings.

2.6 INSPECTION BAR CODES

- A. Inspection bar codes shall be installed on all initiating devices, annunciators, control panels and power supplies.
- B. Inspection bar codes used by the system must utilize Code 3 of 9 or other approved format, and contain a minimum of eight (8) digits that comprise a unique serial identifier within the Web-based Reporting System. There shall be no duplication of serial numbers. Serial number shall be printed below the bar code for identification purposes.
- C. Inspection bar codes shall be limited in size to no more than 2" (5cm) in width, and 3/8" (2 cm), in height and shall include a Mylar[®] or other protective coating to protect the bar code from fading due to sunlight or exposure.
- D. Inspection bar codes shall be installed on each device in such a manner as to require that scanning of the bar code take place no further than 12" from the device during inspection.

2.7 WIRE AND CABLE

- A. Signaling Line Circuits – Network Data: Twisted pair, not less than No. 18Awg or as recommended by the manufacturer.
- B. Signaling Line Circuits – Intelligent Loop: Twisted pair, not less than No. 18Awg or as recommended by the manufacturer.

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1. Circuit Integrity Cable: Provide as required to meet NFPA or Local Code requirements.
 2. CI Cable shall meet article 760, power limited fire alarm service.
- C. Notification Appliance Circuits –
1. Audio and Visual. 12 AWG THHN or FPLP or as recommended by the manufacturer.
- D. All low voltage cable and wire shall be supplied and installed in accordance with the National Electrical Code and other provisions of Division 16000.
- E. Cable and wire selected for each application shall be in strict accordance with the original equipment manufacturers recommendations.
- F. All cables and wires shall be permanently tagged at both ends for ease in maintenance.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Notification Appliance Devices: Install between 80 and 96 inches on the wall.

3.2 CABLE WIRING

- A. Cable shall be the type listed for the use as specified under NEC Article 760-30 (bell wire, intercom, or telephone wire are not approved).
 1. All cable shall be installed as per NEC Article 760.
 2. Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control Panel.
 3. Cable for conventional initiating devices shall be looped by zone. Cable shall be installed from the Monitor Module to the first device, then to each succeeding device within each zone loop. An end-of-line resistor device shall be installed at or after the last device on the circuit.
 4. Cable for conventional indicating devices (audible or visual) shall be looped as stated above from the Control Module. An end-of-line resistor device shall be installed at or after the last device on the circuit. Wire may be 16 through 12 AWG.
 5. Cable for SLC loops shall be 18 to 12 AWG twisted pair with a shield jacket. Shield continuity must be maintained and connected to earth ground only at the control panel. Intelligent detector wiring must not be routed adjacent to, or in the same conduit with Audio/Visual power wiring, 120/240 VAC power wiring or other high current circuits.
 6. T-Taps or branch circuit connections are allowed for all Style 4 intelligent loop circuits.
 7. Cable for RS-232c devices (CRT, Printer) shall be dual pair twisted-shielded.
 8. Power wiring shall be 12 AWG.

3.3 DEVICE BOX MOUNTING

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- A. Device Box Mounting: Unless otherwise noted on the drawings, plans, specification or by the Engineer; the recommended mounting heights, type of boxes required and other specific requirements are as follows:
1. Signaling Device(s): Standard semi-flush horns, bells and chimes require a 4 inch square, 2-1/8 inch deep, device box with a 2-gang ring (1/2" minimum depth). Install 6" below finished ceiling or 120" maximum height.
 2. Where new devices are mounted at existing locations, provide painted back-up plates to provide a finished appearance.

3.4 FIELD QUALITY CONTROL

- A. All intelligent analog addressable devices shall be tested for current address, sensitivity, and user defined message.
- B. All wiring shall be tested for continuity, shorts, and grounds before the system is activated.
- C. All test equipment, instruments, tools and labor required to conduct the tests shall be made available by the installing contractor.
- D. The system including all its sequence of operations shall be demonstrated to the Owner, his representative, and the local fire inspector. In the event the system does not operate properly, the test shall be terminated. Corrections shall be made and the testing procedure shall be repeated until it is acceptable to the Owner, his representatives and the fire inspector.
- E. At the final test and inspection, a factory trained representative of the system manufacturer shall demonstrate that the system functions properly in accordance with these specifications. The representative shall provide technical supervision, and participate during all of the testing for the system.
- F. All fire alarm testing shall be in accordance with National Fire Alarm Code, NFPA 72 - 1999, Chapter 7.
- G. A letter from the Contractor certifying that the system is installed entirely in accordance with the system manufacturer's recommendations and within the limitations of the required listings and approvals, that all system hardware and software has been visually inspected and functionally tested by a manufacturer's certified representative, and that the system is in proper working order.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 16 Section "Electrical Identification."
- B. Install framed instructions in a location visible from fire-alarm control unit.
- C. All initiating devices shall have bar code label installed visibly on the device. This bar code shall be used for digital inspection of the fire alarm system using Building Reports.Com.

3.6 GROUNDING

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- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Architect, Engineer and authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

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- H. Annual Test and Inspection: During the warranty period, each year test fire-alarm system complying with visual and testing inspection requirements in NFPA72. Use forms developed for initial tests and inspections.
- I. Detector Sensitivity Testing: During the warranty period, each year the contractor is to perform detector sensitivity testing and provide report to the Owner. Unless, the system is UL Listed to perform automatic sensitivity testing without any manual intervention and should detector fall outside of sensitivity window, the system will automatically indicated a devices trouble. A copy of UL letter is to be provided as proof of system operation

3.8 DEMONSTRATION

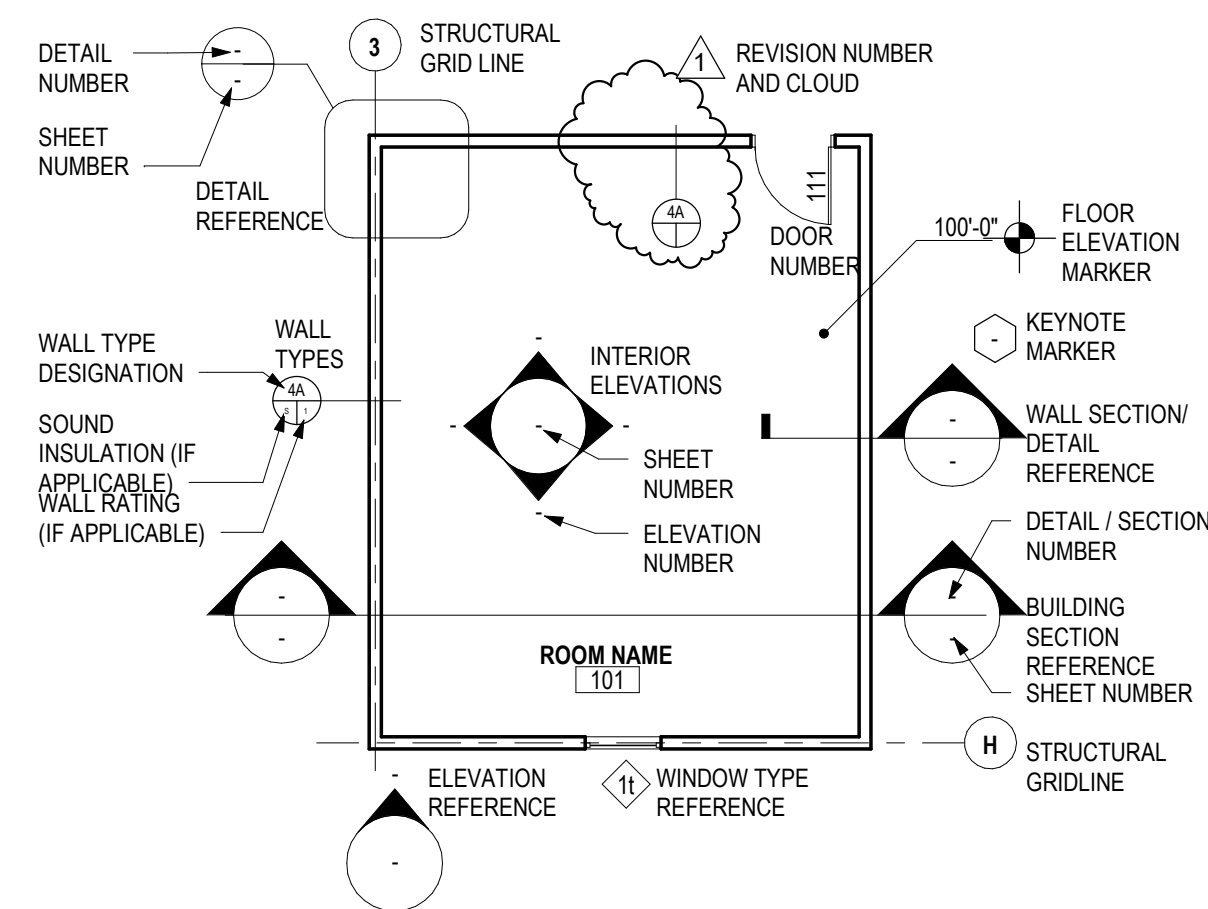
- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

CCB PRINTING SERVICES

210 MARTIN LUTHER KING, JR. BLVD.,
MADISON, WI 53703

| ARCHITECTURAL ABBREVIATIONS LEGEND | | |
|--|--|--|
| + - AND | FIN - FINISH | PREFAB - PREFABRICATED |
| @ - AT | FLR - FLOOR | PERIM - PERIMETER |
| AB - ANCHOR BOLT | FND - FOUNDATION | PC - PLUMBING CONTRACTOR |
| AFF - ABOVE FINISH FLOOR | FOM - FACE OF MASONRY | P/C - PRECAST / PRESTRESSED |
| ALT - ALTERNATE | FOS - FACE OF STUD | P/T - POST TENSIONED |
| ALUM - ALUMINUM | FTG - FOOTING | PT - PRESSURE TREATED |
| ARCH - ARCHITECT / ARCHITECTURAL | FUT - FUTURE | |
| | FV - FIELD VERIFY | |
| BRD - BOARD | | R - RADIUS |
| BLK - BLOCK (CMU) | GA - GAUGE | RD - ROOF DRAIN |
| BOT - BOTTOM | GALV - GALVANIZED | REINF - REINFORCING |
| | GB - GRAB BAR | REQD - REQUIRED |
| | GC - GENERAL CONTRACTOR | RM - ROOM |
| | GYP - GYPSUM | |
| CB - CATCH BASIN | | SCHED - SCHEDULE |
| CIP - CAST-IN-PLACE | HC - HVAC CONTRACTOR | SHT - SHEET |
| CJ - CONSTRUCTION JOINT | HM - HOLLOW METAL | SIM - SIMILAR |
| CL - CENTERLINE | HORIZ - HORIZONTAL | SOG - SLAB ON GRADE |
| CLG - CEILING | HT - HEIGHT | SPEC - SPECIFICATION |
| CLJ - CONTROL JOINT | HVAC - HEATING, VENTILATION & AIR CONDITIONING | SQ - SQUARE |
| CLR - CLEAR DISTANCE | HR - HOUR | SS - STAINLESS STEEL |
| CMU - CONCRETE MASONRY UNIT | ID - INSIDE DIAMETER | STL - STEEL |
| CO - CASED OPENING | IF - INSIDE FACE | STR - STRUCTURAL |
| COL - COLUMN | INSUL - INSULATION | THK - THICKNESS |
| CONC - CONCRETE | INT - INTERIOR | TOL - TOP OF LEDGE ELEVATION |
| CONT - CONTINUOUS | JBE - JOIST BEARING ELEVATION | TOP - TOP OF PIER ELEVATION |
| CU - CUBIC | JT - JOINT | TP - TOILET PAPER DISPENSER |
| | | TS - (SEE HIGH STRENGTH STEEL DESIGNATION) |
| DBL - DOUBLE | L - STEEL ANGLE DESIGNATION | TYP - TYPICAL |
| DF - DRINKING FOUNTAIN | LAM - LAMINATE | TOW - TOP OF WALL ELEVATION |
| DIM - DIAMETER | LVL - LAMINATED VENEER LUMBER | UL - UNDERWRITERS LAB |
| DN - DOWN | | UNO - UNLESS NOTED OTHERWISE |
| DS - DOWN SPOUT | | |
| DTL - DETAIL | | VB - VAPOR BARRIER |
| DWG - DRAWING | | VERT - VERTICAL |
| | | VIF - VERIFY IN FIELD |
| EA - EACH | MAX - MAXIMUM | |
| EC - ELECTRICAL CONTRACTOR | MBW - MASONRY BEARING WALL | W - WIDTH |
| EIFS - EXTERIOR INSULATION FINISH SYSTEM | MFG - MANUFACTURER | WI - WITH |
| EL - ELEVATION | MIN - MINIMUM | W/O - WITHOUT |
| ELEV - ELEVATOR | MO - MASONRY OPENING | WC - WATER CLOSET |
| ENG - ENGINEER | MTL - METAL | WD - WOOD |
| EQ - EQUAL | | WRB - WEATHER RESISTANT BARRIER |
| EXIST - EXISTING | NIC - NOT IN CONTRACT | WWF - WELDED WIRE FABRIC |
| EXP - EXPANSION | NOM - NOMINAL | |
| EXT - EXTERIOR | NTS - NOT TO SCALE | |
| | NO - NUMBER | |
| FD - FLOOR DRAIN | OC - ON CENTER | |
| FND - FOUNDATION | OD - OUTSIDE DIAMETER | |
| FE - FIRE EXTINGUISHER | O.F. - OUTSIDE FACE | |
| FEC - FIRE EXTINGUISHER CABINET | OH - OVERHEAD | |
| FF - FINISH FLOOR | OPCI - OWNER PROVIDED, CONTRACTOR INSTALLED | |
| | OPOI - OWNER PROVIDED, OWNER INSTALLED | |
| | OPNG - OPENING | |
| | OPP - OPPOSITE | |



CODE INFORMATION SUMMARY:

APPLICABLE CODE
WISCONSIN COMMERCIAL BUILDING CODE REFERENCING 2015 INTERNATIONAL CODES

CONSTRUCTION TYPE
TYPE IIA

OCCUPANCY
B - BUSINESS

FIRE SPRINKLER
BUILDING IS FULLY SPRINKLERED
NFPA 13 - ENTIRE BUILDING

FIRE RESISTANCE RATING BUILDING ELEMENTS
STRUCTURAL FRAME (COLUMNS & BEAMS) = 1 HOUR
BEARING WALLS (EXTERIOR AND INTERIOR) = 1 HOUR
NON-BEARING WALLS (EXTERIOR) =
1 HOUR < 30' TO PROPERTY LINE
NO RATING > 30' TO PROPERTY LINE
FLOOR = 1 HOUR
ROOF = 1 HOUR

REQUIRED FIRE BARRIER/PARTITION FIRE RESISTANT RATINGS:
CORRIDOR WALLS: 0 HOUR
SHAFTS: 2 HOURS
STAIR ENCLOSURE: 2 HOURS

SEE CODE COMPLIANCE PLANS FOR MORE INFORMATION

ARCHITECTURE : Dimension IV - Madison Design Group
6515 Grand Teton Plaza, Suite 120, Madison, WI 53719
p: 608.829.4444 www.dimensionivmadison.com

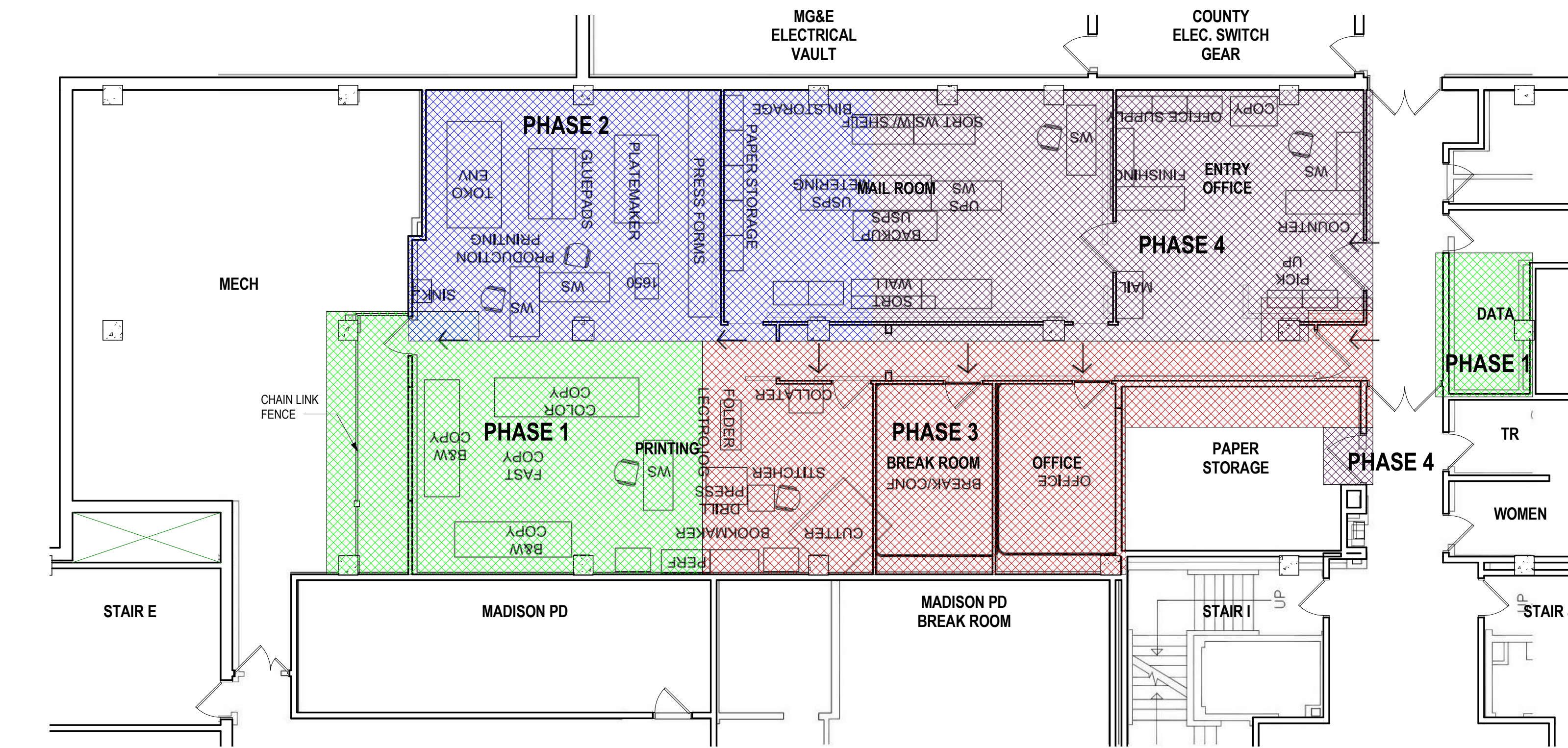
MEP ENGINEERING: HEIN Engineering Group
17 Applegate Court, Suite 200, Madison, WI 53713
p: 608.288.9260 web site

LIST OF DRAWINGS

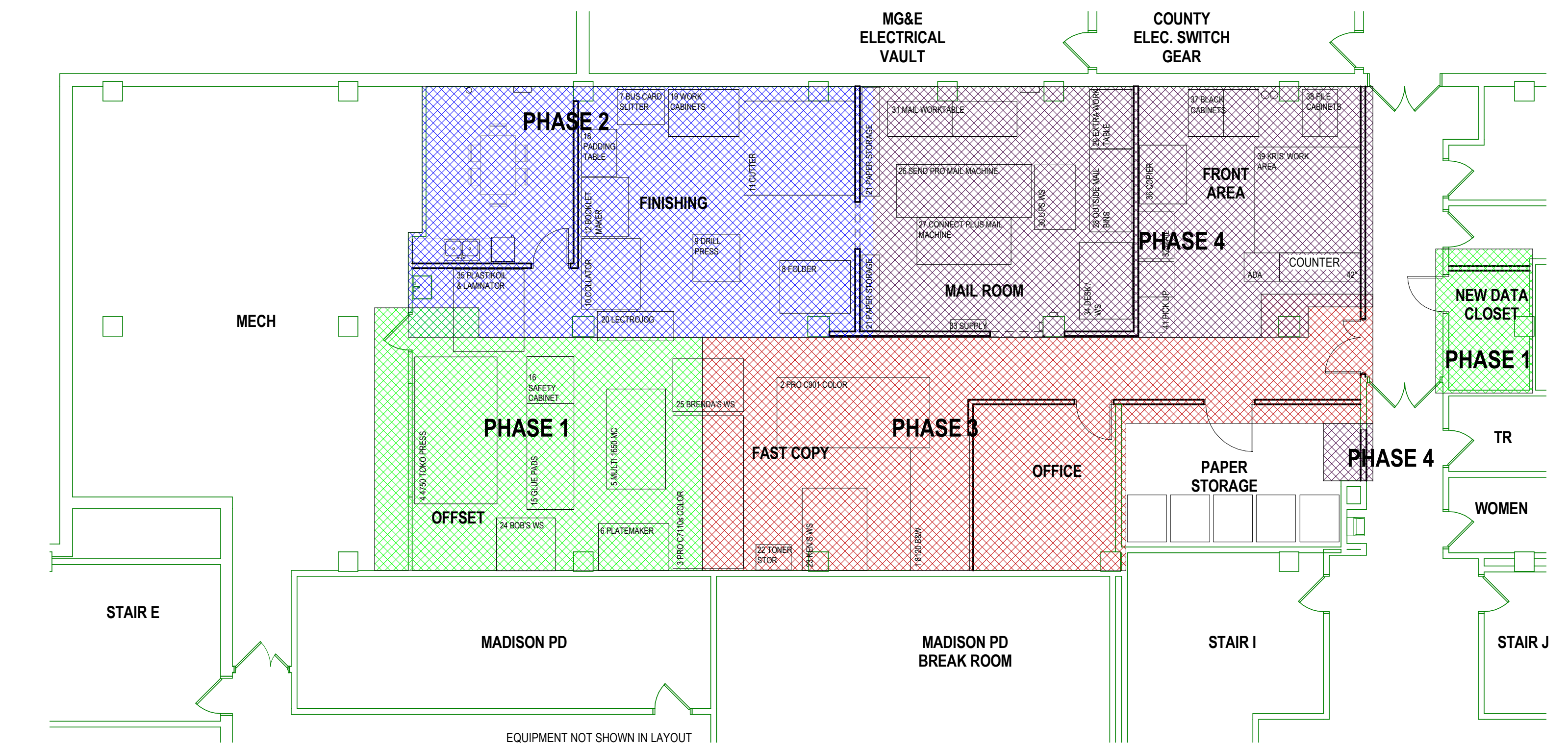
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| GENERAL | |
| G0.1 | COVER SHEET |
| G0.2 | PHASING PLAN |
| G1.0 | CODE COMPLIANCE PLAN |
| ARCHITECTURAL | |
| D1.0 | DEMOLITION PLAN |
| A1.0 | FLOOR PLAN |
| A4.0 | REFLECTED CEILING PLAN |
| A6.1 | DOOR SCHEDULES, DOOR TYPES, DOOR & FRAME ELEVATIONS |
| PLUMBING | |
| P1.0 | PLUMBING PLANS, SCHEDULES & RISERS |
| FIRE PROTECTION | |
| FP1.0 | FIRE PROTECTION PLANS |
| HVAC | |
| DH1.0 | HVAC DEMOLITION PLAN |
| H1.0 | HVAC DUCTWORK PLAN |
| H1.1 | HVAC PIPING PLAN |
| H2.0 | HVAC DETAILS & SCHEDULES |
| H2.1 | HVAC DETAILS |
| ELECTRICAL | |
| DE1.0 | ELECTRICAL DEMOLITION PLAN |
| E1.0 | ELECTRICAL LIGHTING PLAN |
| E1.1 | ELECTRICAL POWER/LV PLAN |
| E2.0 | ELECTRICAL SCHEDULES |
| E2.1 | ELECTRICAL DETAILS |

RFB No. 318037

CONSTRUCTION DOCUMENTS

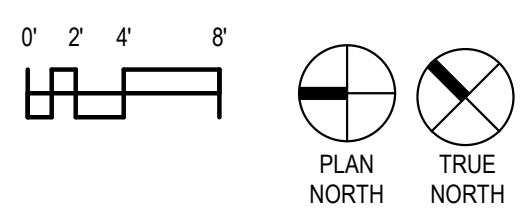


2 PRINTING SUITE - EXISTING LAYOUT
1/8" = 1'-0"



1 PRINTING SUITE - NEW LAYOUT
1/8" = 1'-0"

EQUIPMENT NOT SHOWN IN LAYOUT
13 STITCHER
14 PRESS FORMS
40 WALK-UP WORK AREA BY KRIS



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PROJECT # 18031

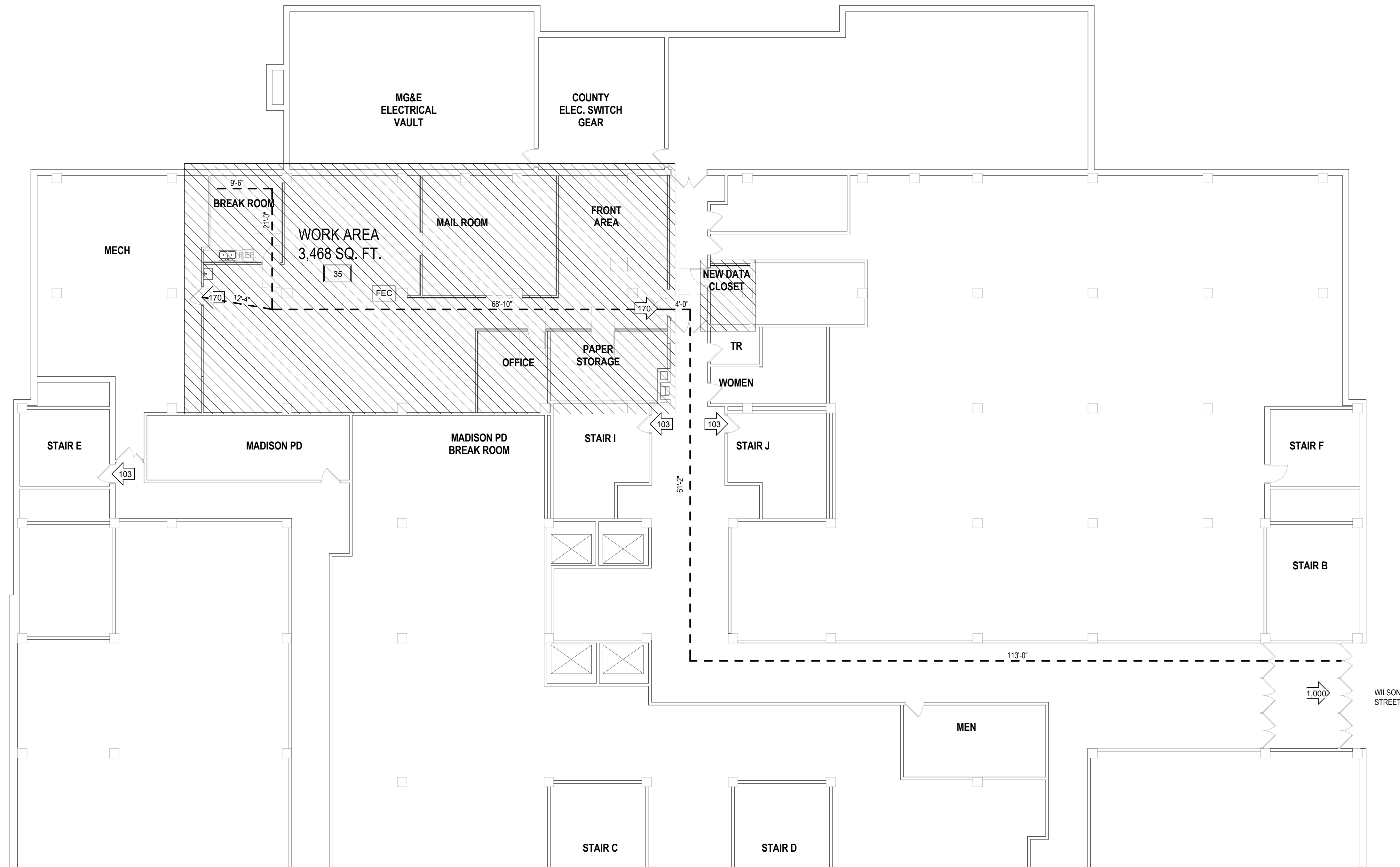
PHASING PLAN

CODE COMPLIANCE GENERAL NOTES

- A. ALL FIRE EXTINGUISHER CABINETS SHALL BE IN APPROVED LOCATIONS WITH A MAXIMUM TRAVEL DISTANCE TO EXTINGUISHER TO BE 75 FEET PER I.F.C.
- B. COMMON PATH OF EGRESS TRAVEL SHALL NOT EXCEED 100' PER TABLE 1006.2.1.
- C. EXIT ACCESS TRAVEL DISTANCE IS 300' WITH SPRINKLERS PER TABLE 1017.2.
- D. FIRE WALLS, FIRE BARRIERS, FIRE PARTITIONS, SMOKE BARRIERS AND SMOKE PARTITIONS OR ANY OTHER WALL REQUIRED TO HAVE PROTECTED OPENINGS OR PENETRATIONS SHALL BE EFFECTIVELY AND PERMANENTLY IDENTIFIED IN THE FIELD WITH SIGNS OR STENCILING PER IBC 703.6

CODE COMPLIANCE SYMBOLS LEGEND

- FEC INDICATES FIRE EXTINGUISHER CABINET LOCATION
- XXX INDICATES OCCUPANCY CAPACITY
- INDICATES ADA ACCESSIBLE ROUTE
- XXX INDICATES EXIT AND EXIT CAPACITY
- · — INDICATES 1 HOUR FIRE RATED WALL (SEC 709)



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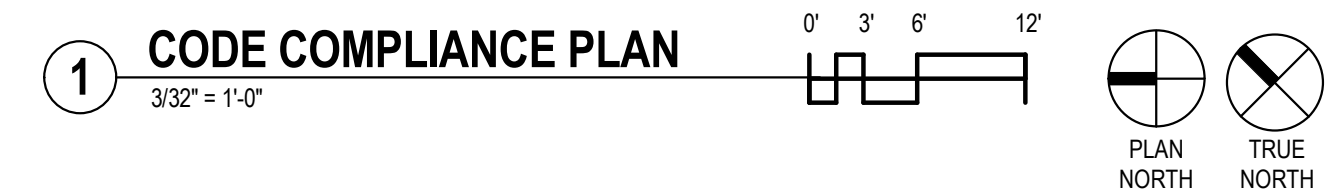
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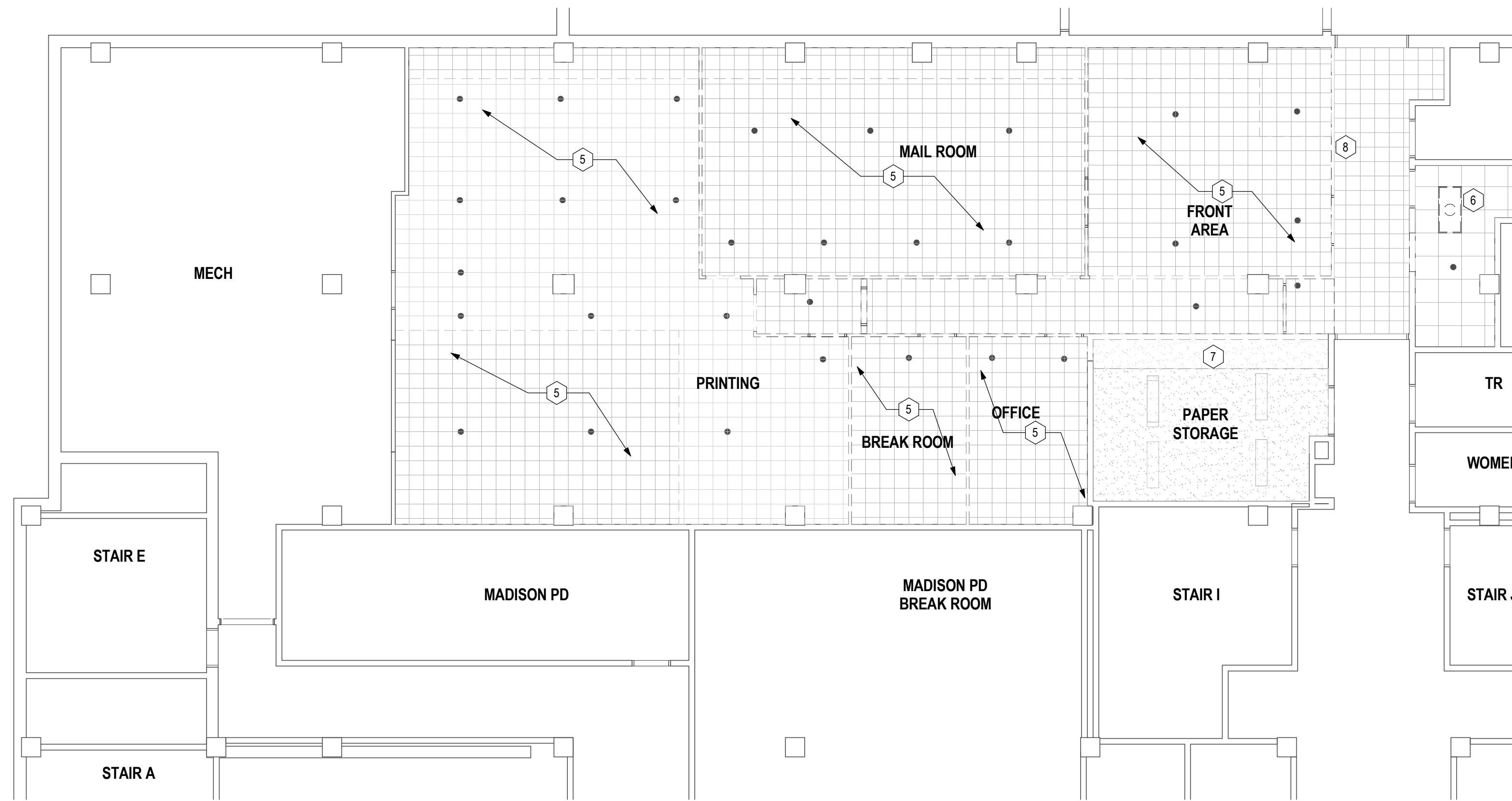
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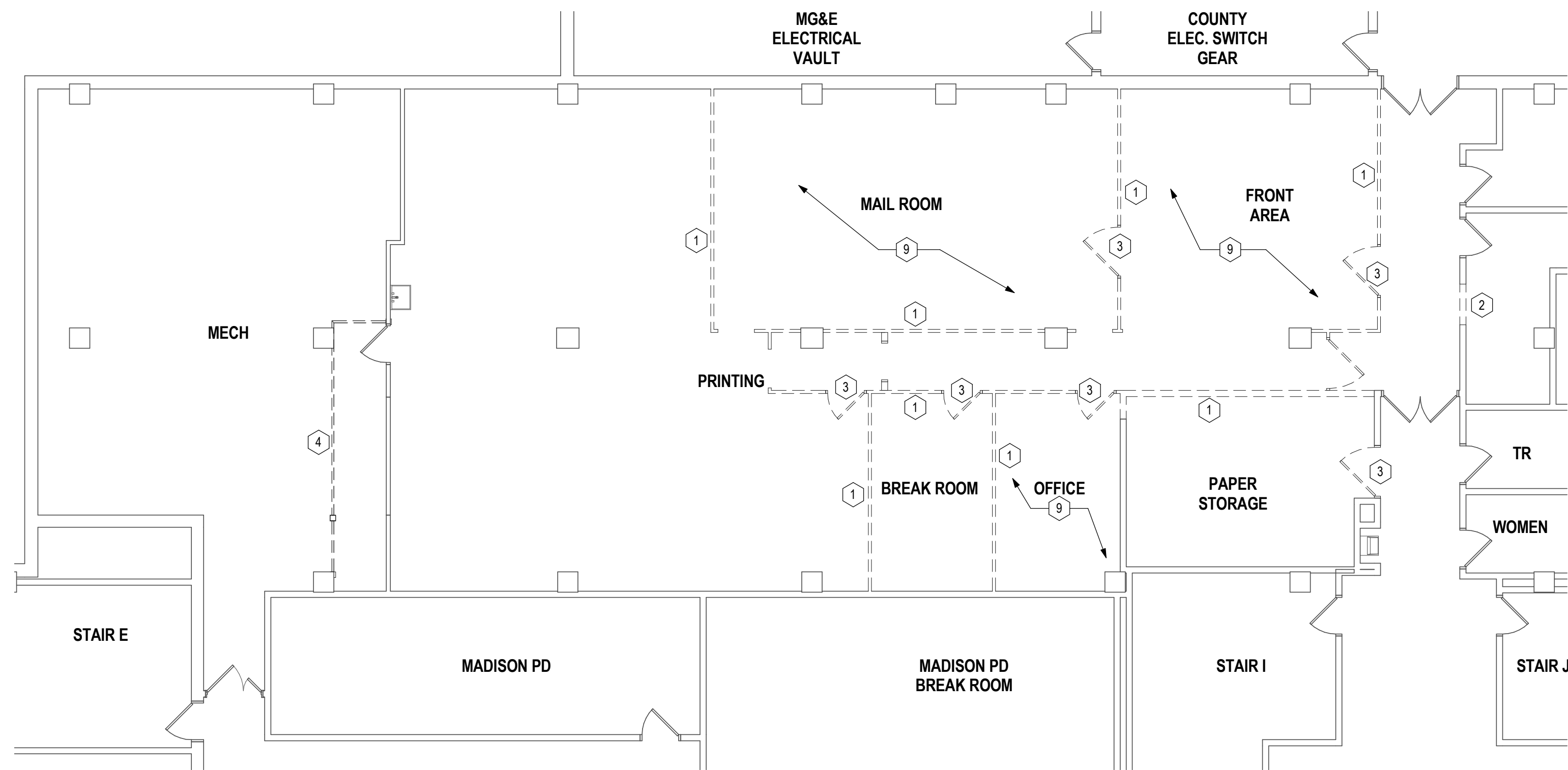
CODE COMPLIANCE PLAN



G1.0



2 DEMOLITION PLAN - RCP
1/8" = 1'-0"



1 DEMOLITION PLAN
1/8" = 1'-0"

DEMOLITION PLAN KEYNOTES

- INDICATES EXISTING WALL, DOOR, FIXTURE, ETC.
- - - - - INDICATES ITEM TO BE REMOVED
- 1 REMOVE WALL, DISCONNECT AND REMOVE ANY MEP AS NEEDED, COORDINATE WITH MEP PLANS
- 2 REMOVE PORTION OF WALL AS INDICATED ON PLAN
- 3 REMOVE ENTIRE DOOR AND FRAME
- 4 REMOVE CHAIN LINK FENCE
- 5 REMOVE CEILING TILES AND SUPPORTING STRUCTURE COMPLETE IN SUITE
- 6 ROTATE LIGHT FIXTURE AS INDICATED ON RCP FOR NEW WORK
- 7 REMOVE PORTION OF CEILING TO BUILD NEW WALL
- 8 REMOVE PORTION OF EXISTING CEILING AND SAVE FOR REINSTALLATION AFTER NEW WALL IS CONSTRUCTED
- 9 REMOVE CARPET AND PREPARE FLOOR FOR NEW FINISH

NOTES:
1. VERIFY WITH OWNER REGARDING SALVAGE OF DEMO ITEMS.
2. COORDINATE WITH MEP PLANS.

DEMOLITION GENERAL NOTES

- A. CONSTRUCTION IS PHASED SEE PHASING PLAN AND COORDINATE WITH OWNER.
- B. MAINTAIN ALL EXIT DOORS IN UNOBSTRUCTED OPERABLE CONDITION WITH SAFE PASSAGE WAY FROM THE BUILDING. COORDINATE WITH THE LOCAL FIRE MARSHAL.
- C. PROVIDE AND MAINTAIN BARRICADES, GATES, OR OTHER MEANS OF MAINTAINING PUBLIC SAFETY AT ALL AREAS OF CONSTRUCTION OR DEMOLITION.
- D. COORDINATE STORAGE LOCATIONS FOR SALVAGED EQUIPMENT WITH OWNER.
- E. ALL STRUCTURES SHOWN DASHED ON THIS PLAN SHALL BE COMPLETELY REMOVED FROM THE SITE AND DISPOSED OF BY THIS CONTRACT UNLESS OTHERWISE NOTED. THIS SHALL INCLUDE ALL ELECTRICAL, MECHANICAL, OR PLUMBING WITHIN THE REMOVED STRUCTURE. TERMINATE MEP AS REQUIRED. VERIFY GENERAL CONDITIONS IN FIELD PRIOR TO BIDDING.
- F. PREPARATION FOR NEW FINISHES SHALL INCLUDE REMOVAL OF FINISHES, REMOVAL OF TAPES, GLUES (MASTIC), NAILS, ETC. PATCHING OF HOLES AND CRACKS, AND UP TO 1" OF LEVELER COMPOUND IF REQUIRED TO PROVIDE AN ACCEPTABLE SURFACE FOR NEW FINISH INSTALLATION.
- G. COORDINATE REMOVAL OF ALL EXISTING CHALK BOARDS, MARKER BOARDS, OR BULLETIN BOARDS AND OTHER MISC. EQUIPMENT ON REMOVED WALLS WITH OWNER.
- H. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SHORING, BRACING, ETC. REQUIRED FOR REMOVAL WORK. WORK TO BE CERTIFIED BY STRUCTURAL ENGINEER IF REQUIRED.
- I. SEE MECHANICAL, ELECTRICAL, AND PLUMBING DEMOLITION SHEETS TO COORDINATE REMOVAL WORK.
- J. WORK WHICH RENDERERS THE EXISTING BUILDING NON-WEATHER TIGHT SHALL BE FITTED TO PROVIDE WEATHER TIGHT STRUCTURE PRIOR TO NEW WORK BEING INSTALLED WITHIN.
- K. ALL EXISTING ROOM NUMBERS AND NAMES SHOWN ON THIS PLAN ARE FOR INFORMATIONAL AND COORDINATION PURPOSES.
- L. COORDINATE REMOVAL AND PATCHING SHOWN WITH MECHANICAL, PLUMBING AND ELECTRICAL REMOVAL AND PATCHING DRAWINGS.
- M. OWNER WILL REMOVE LOOSE FURNISHINGS FROM THE SITE PRIOR TO START OF CONSTRUCTION.
- N. CONTRACTOR SHALL SALVAGE FIXED EQUIPMENT ITEMS AND SET THEM IN A DESIGNATED LOCATION FOR THE OWNER TO REMOVE TO STORAGE. ITEMS TO BE REINSTALLED WILL BE DELIVERED TO THE JOB SITE BY THE OWNER. SALVAGE ITEMS INCLUDE DOORS, WINDOWS, FRAMES, CHALKBOARDS, MARKER BOARDS, TACK BOARDS, WALL MOUNTED PROJECTION SCREENS, COAT RACKS AND OTHER MISCELLANEOUS ITEMS AS DIRECTED BY THE OWNER. ALSO SEE REMOVAL AND REMODELING NOTES.
- O. CONTRACTOR SHALL INSTALL TEMPORARY FRAME SPREADERS ON DOOR FRAMES TO BE SALVAGED, STORED AND REINSTALLED.

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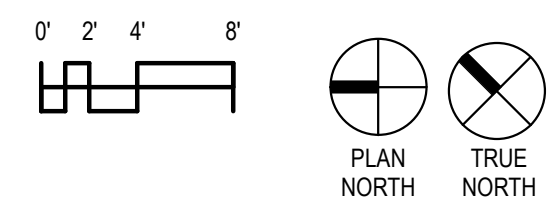
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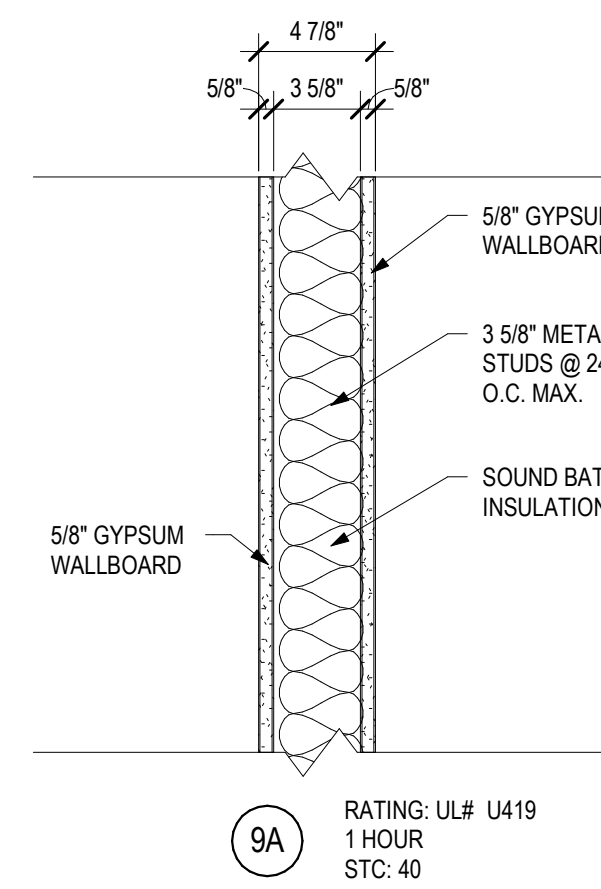
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PROJECT # 18031

DEMOLITION PLAN



D1.0



WALL TYPE

WALL DETAIL NOTES

- WALL TYPE DESIGNATION
- WALL FIRE RATING (IF INDICATED)
THIS WALL WOULD HAVE A 1-HOUR RATING
- WALL TYPE DESIGNATION
- WALL HAS NO FIRE RATING
- WALL IS NOT A SOUND WALL
- 1. TO ACHIEVE STC RATING, ADD FIBERGLASS BATT INSULATION TO THE ENTIRE WIDTH OF STUD CAVITY, TYP.

WALL TYPE GENERAL NOTES

- A. CONTINUE ALL PARTITION FRAMING AND GYPSUM BOARD TO UNDERSIDE OF RATED ROOF ASSEMBLY OR FLOOR DECK ABOVE, UNLESS INDICATED OTHERWISE.
- B. SOUND WALLS (INDICATED BY "STC" - SOUND TRANSFER COEFFICIENT); CAULK ALL UNFINISHED JOINTS BETWEEN GYPSUM BOARD PANELS AND BETWEEN GYPSUM BOARD PANELS AND FLOOR AND SIDE WALL MATERIALS WITH ONE BEAD OF SEALANT PER LAYER OF GYPSUM BOARD. ACOUSTICALLY SEAL ALL PENETRATIONS INCLUDING ELECTRICAL, MECHANICAL AND PIPING. LIMIT NECESSARY WALL PENETRATIONS TO ONE PER STUD CAVITY. AT RESILIENT CHANNELS, USE RECOMMENDED SCREW LENGTH IN ORDER TO MEET PRESCRIBED SOUND RATINGS.
- C. PENETRATIONS IN SOUND WALLS AND SMOKE AND FIRE RATED WALLS AND CONNECTIONS AT WALLS TO OTHER WORK SHALL MAINTAIN STC AND/OR FIRE RATING, SHALL BE IN ACCORDANCE WITH MANUFACTURERS RECOMMENDED DETAILS, AND SHALL COMPLY WITH APPLICABLE TESTING AGENCY REQUIREMENTS.
- D. WHERE WALLS AND/OR FURRING MEET, MAINTAIN A FLUSH SURFACE ON THE SIDE WHERE WALL SURFACE IS STRAIGHT OR CONTINUOUS, UNLESS INDICATED OTHERWISE.
- E. FIRE RATINGS SHOWN ARE THE RATINGS AVAILABLE PER NOTED TESTING AGENCY AND/OR IBC REQUIREMENTS. REFER TO FLOOR PLANS AND WALL TYPE SUBSCRIPTS FOR LOCATIONS OF FIRE RATED WALLS.
- F. PROVIDE WOOD BLOCKING IN PARTITION TYPES AS REQUIRED BY SPECIFICATIONS AND ACCESSORIES INDICATED ON DRAWINGS.

FRAME ASSEMBLIES GENERAL NOTES

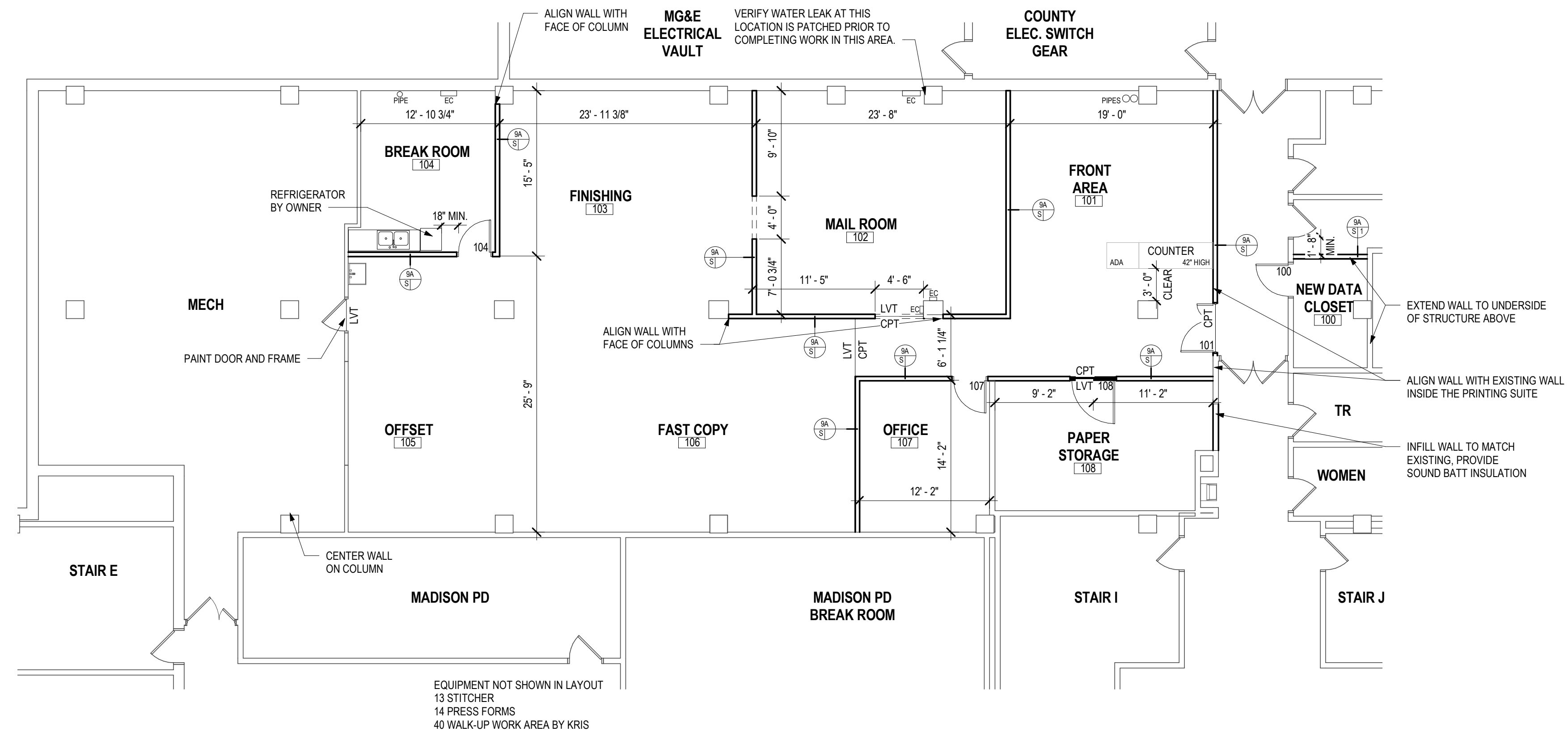
- A. PROVIDE SPECIFIED METAL STUD GAUGE UNLESS OTHERWISE NOTED.
- B. PROVIDE FIRE RATED GYPSUM BOARD AT FIRE RATED PARTITIONS AS REQUIRED BY TESTED ASSEMBLY.
- C. INSTALLATION OF GYPSUM BOARD, BACKER BOARD AND BASE BOARD SHALL CONFORM TO REQUIREMENTS FOR FIRE RATINGS AND ACOUSTICAL RATINGS.
- D. STUD FRAMING TO BE 1'-4" O.C. UNLESS NOTED OTHERWISE.
- E. PROVIDE MOISTURE RESISTANT GYPSUM BOARD AT WALLS WHERE SINKS ARE LOCATED.
- F. PROVIDE GLASS MAT GYPSUM TILE BACKER BOARD AT LOCATIONS OF WALL TILE.

FLOOR PLAN GENERAL NOTES

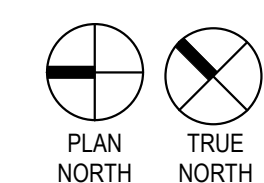
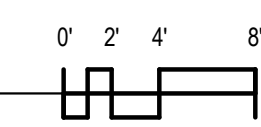
- A. VERIFY SIZE AND LOCATIONS OF ALL MECHANICAL OPENINGS. GENERAL CONTRACTOR TO PAINT AND SEAL LOUVER PERIMETER, TYPICAL.
- B. GENERAL CONTRACTOR TO PROVIDE WOOD BLOCKING BETWEEN WOOD/METAL STUDS AS REQUIRED FOR CASEWORK/HANDRAIL/TOILET ACCESSORIES ETC. MOUNTING.
- C. PROVIDE VINYL CARPET EDGE AT TRANSITIONS FROM CARPET TO DISSIMILAR FLOOR MATERIALS, UNLESS NOTED OTHERWISE (U.N.O.).
- D. VERIFY ALL ACTUAL CHASE DIMENSIONS WITH HVAC CONTRACTOR.
- E. ADA CLEARANCE CIRCLES AND BOXES SHOWN ON PLAN ARE FOR INFORMATION PURPOSES ONLY.
- F. DIMENSIONS ARE FROM FACE OF STUD TO FACE OF STUD UNLESS NOTED OTHERWISE.

FINISH NOTES

- A. FLOOR FINISH TO BE CARPET TILES IN ROOMS 101 AND 107 AND CORRIDOR AS SHOWN ON PLANS.
INTERFACE - PROGRESSION II (142670A00)
COLOR: 106507 MORNING MIST, 25CM X 1M, ASHLAR INSTALLATION
FLOOR FINISH TO BE LVT IN THE REMAINDER OF THE SPACE. VINYL BASE THROUGHOUT.
INTERFACE - LEVEL SET (A00401)
COLOR: DISTRESSED WALNUT, 25CM X 1M, ASHLAR INSTALLATION
 - B. ALL WALLS TO BE PAINTED, COLOR TBD, PREPARED AS RECOMMENDED BY MANUFACTURER.
 - C. ACT CEILINGS TO BE 2x2 TILES. SEE REFLECTED CEILING PLAN FOR LOCATION.
ARMSTRONG (1774)
COLOR: WHITE, DUNE REGULAR, 24" X 24", 5/8" IN 15/16" GRID
 - D. PROVIDE TRANSITION STRIP BETWEEN DISSIMILAR FLOOR FINISHES. SEE SPECIFICATIONS FOR FURTHER INFORMATION
- CPT - CARPET TILES
LVT - VINYL TILE



1 FLOOR PLAN
1/8" = 1'-0"



CONSTRUCTION DOCUMENTS

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PROJECT # 18031

FLOOR PLAN

A1.0

| REFLECTED CEILING LEGEND | |
|-----------------------------|---------------------------|
| DESCRIPTION 8'-0" A.F.F. | CEILING HEIGHT A.F.F. |
| | 2x2 CEILING GRID |
| | EXPOSED TO STRUCTURE |
| | 2x4 FLUORESCENT FIXTURE |
| | 2x2 FLUORESCENT FIXTURE |
| | RECESSED CAN LIGHT |
| | FLUORESCENT STRIP FIXTURE |
| | SUPPLY CEILING DIFFUSER |
| | RETURN CEILING DIFFUSER |

| REFLECTED CEILING PLAN GENERAL NOTES | |
|---|--|
| A. | ALL CEILING ELEVATIONS ARE 8'-0" A.F.F. UNLESS NOTED OTHERWISE. |
| B. | ALL BULKHEAD ELEVATIONS ARE 7'-0" A.F.F. UNLESS NOTED OTHERWISE. |
| C. | PROVIDE CEILING GRID MAIN SUPPORT TEES AT LIGHT FIXTURES, DIFFUSERS, ETC. AS REQUIRED TO SUPPORT DEVICE. |
| D. | REFER TO ELECTRICAL DRAWINGS FOR FIXTURE INFORMATION. |
| E. | REFER TO HVAC DRAWINGS FOR FIXTURE/EQUIPMENT LOCATIONS. |
| F. | CENTER LIGHT FIXTURES, FIRE SPRINKLER HEADS, DIFFUSERS AND OTHER FIXTURES WITHIN CEILING TILE PANELS WHERE POSSIBLE, UNLESS NOTED OTHERWISE. |

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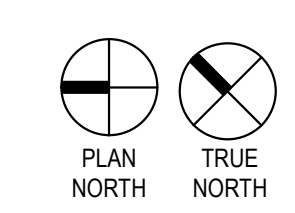
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PROJECT # 18031

REFLECTED CEILING PLAN



1 REFLECTED CEILING PLAN
1/8" = 1'-0"



| DOOR SCHEDULE | | | | | | | | | | | | | | | | |
|---------------|-----------------|--------|---------|---------|--------|------|----------|-----------|------|----------|--------|--------|-------------|----------|----------|---------------------------------|
| DOOR NO. | ROOM NAME | TYPE | DOOR | | | | | FRAME | | | | | FIRE RATING | HARDWARE | COMMENTS | |
| | | | W | H | T | ELEV | MATERIAL | UNDER CUT | ELEV | MATERIAL | HEAD | JAMB | | | | SILL |
| GROUND FLOOR | | | | | | | | | | | | | | | | |
| 100 | NEW DATA CLOSET | SINGLE | 3' - 0" | 6' - 8" | 1 3/4" | F | WD | | A | HM | 4/A6.1 | 4/A6.1 | 3C | | 1 | |
| 101 | PRINTING | DOUBLE | 4' - 6" | 6' - 8" | 1 3/4" | F | WD | | B | HM | 4/A6.1 | 4/A6.1 | 3C | | 2 | UNEVEN LEAVES, 1@3'-0", 1@1'-6" |
| 104 | BREAK ROOM | SINGLE | 3' - 0" | 6' - 8" | 1 3/4" | F | WD | | A | HM | 4/A6.1 | 4/A6.1 | 3A | | 5 | |
| 107 | OFFICE | SINGLE | 3' - 0" | 6' - 8" | 1 3/4" | F | WD | | A | HM | 4/A6.1 | 4/A6.1 | 3A | | 4 | |
| 108 | PAPER STORAGE | SINGLE | 4' - 0" | 6' - 8" | 1 3/4" | F | HM | | A | HM | 4/A6.1 | 4/A6.1 | 3B | | 3 | |

| HARDWARE SCHEDULE | | | | | | | | | | | | | |
|-------------------|---------|----------------|-----------------|-----------|------------|-------------------------|----------------------------|-----------------------------|-------------------|-----------------|----------------|---------|------|
| SET # | CLOSERS | | | | | | | LOCK SETS | | | | REMARKS | |
| | HINGES | ELECTRIC HINGE | METAL KICKPLATE | WALL STOP | HINGE STOP | OVERHEAD CLOSER W/ STOP | FLUSH BOLTS (HEAD & FLOOR) | ELECTRONIC ENTRANCE LOCKSET | STOREROOM LOCKSET | PASSAGE LOCKSET | OFFICE LOCKSET | | |
| 1 | X | | | | | X | | X | | | | | 1, 2 |
| 2 | X | X | XX | | XX | | X | X | | | | | 1, 2 |
| 3 | X | | X | | X | | | | | X | | | 2 |
| 4 | X | | | X | | | | | | | X | | 2 |
| 5 | X | | | X | | | | | | X | | | 2 |
| 6 | X | | | | | X | | | X | | | | 2 |

X = OVERALL DOOR
XX = BOTH LEAVES OF DOUBLE DOOR
1. SECURE DOORS. PROVIDE ELECTRONIC DOOR HARDWARE TO COORDINATE WITH BUILDING ENTRY/ SECURITY SYSTEM.
2. CONFIRM HARDWARE WITH OWNER AND TENANT REQUIREMENTS.
NOTE: HARDWARE TO INCLUDE 7-PIN MARSHALL-BEST WITH AN L KEYWAY, GRADE 1 CYLINDRICAL LEVER LOCK, HANDLE IS #14, FINISH 626, BACKSET 2.75".

DOOR SCHEDULE GENERAL NOTES

- A. WOOD DOORS TO BE PRE-FINISHED. PROVIDE FINISHED SAMPLES TO OWNER AND ARCHITECT FOR FINAL SELECTION.
- B. HOLLOW METAL FRAME HEADS TO BE 2", U.N.O.
- C. ALL SWING DOORS TO RECEIVE 1-1/2 PAIR BUTT (3 HINGES), U.N.O.
- D. PROVIDE LEVER HANDLE LOCK/LATCH SETS AT ALL DOORS, U.N.O.
- E. ALL FIRE DOORS ARE TO BE RATED ASSEMBLIES (DOOR AND FRAME TOGETHER), PROVIDE ALL REQUIRED HARDWARE, SMOKE SEALS, AND ACCESSORIES
- F. COORDINATE CARD READER DOOR LOCATIONS AND ACCEPTABLE PRODUCTS WITH OWNER
- G. MEANS OF EGRESS DOORS: LATCHES DO NOT REQUIRE MORE THAN 15 lbf TO RELEASE THE LATCH. LOCKS DO NOT REQUIRE USE OF A KEY, TOOL OR SPECIAL KNOWLEDGE FOR OPERATION.

DOOR SCHEDULE LEGEND

WD = WOOD
HM = HOLLOW METAL
ALUM = ALUMINUM
INS = INSULATED
ST = STEEL
FG = FULL GLASS
SC = SOLID CORE
PKT = POCKET
HC = HOLLOW CORE

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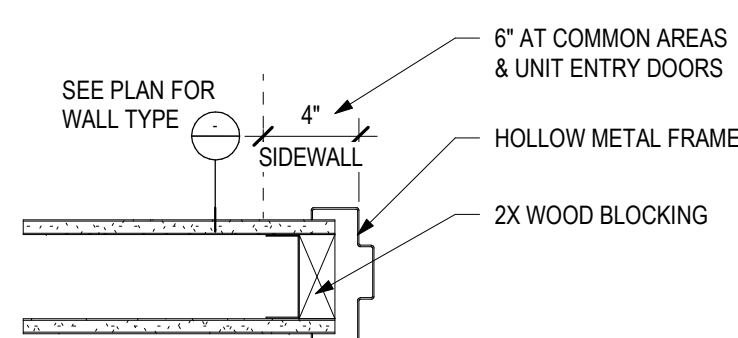
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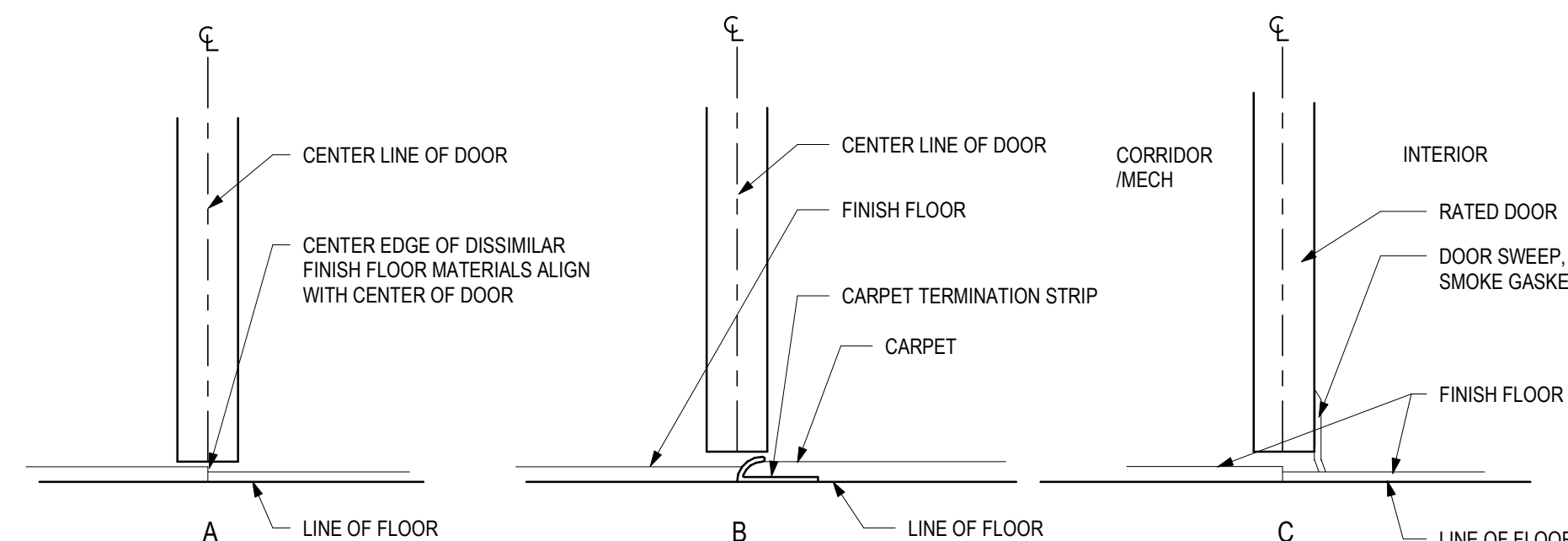
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**DOOR SCHEDULES,
DOOR TYPES,
DOOR & FRAME
ELEVATIONS**

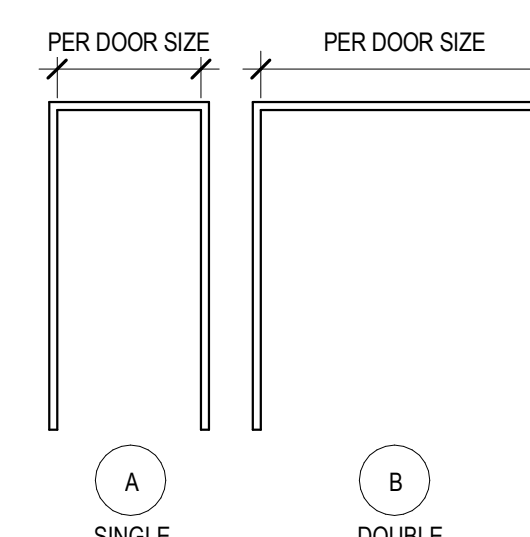
A6.1



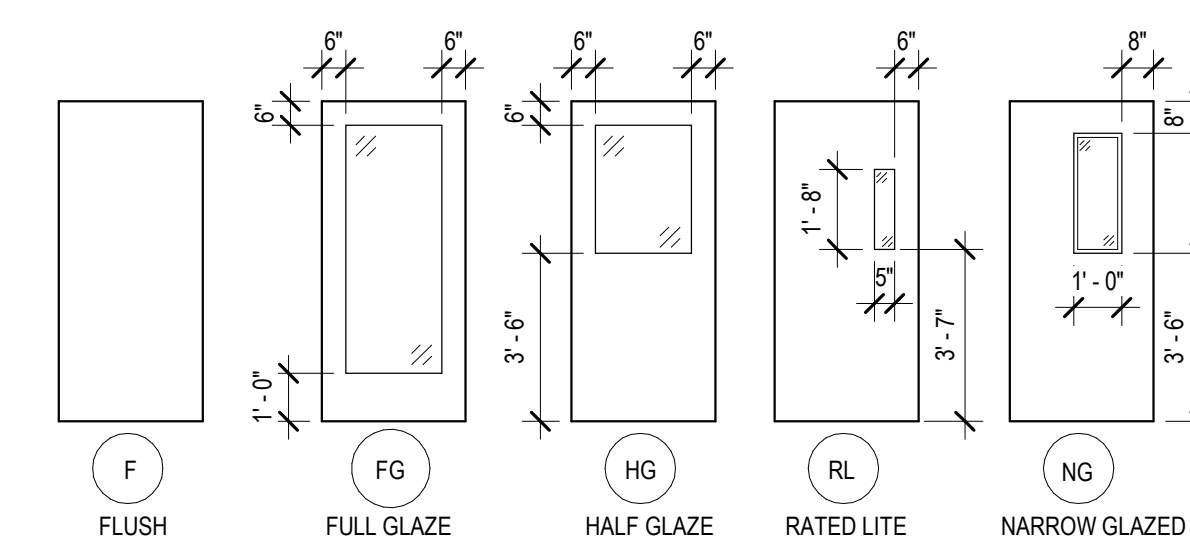
4 HEAD/JAMB - HM FRAME
1 1/2" = 1'-0"



3 DOOR SILL - INTERIOR
3" = 1'-0"



2 DOOR FRAME ELEVATIONS
1/4" = 1'-0"



1 DOOR TYPE ELEVATIONS
1/4" = 1'-0"

| PLUMBING FIXTURE SCHEDULE | | | | | | |
|---------------------------|--------------|--------|--------|------|------|---|
| P# | FIXTURE | WASTE | VENT | CW. | HW. | DESCRIPTION |
| KS-1 | KITCHEN SINK | 1-1/2" | 1-1/2" | 1/2" | 1/2" | STAINLESS STEEL (18 GA.) DOUBLE COMPARTMENT (14"x15-3/4"x8"D), SELF-RIMMING, BASKET STRAINERS (McQUIRE 151A), 1-1/2" TAIL PIECE, FAUCET WITH CENTERED 9" SPOUT, PULL-OUT SPRAY & SINGLE LEVER CONTROL W/FOOD WASTE DISPOSER (1/2 HP). EQUAL TO DAYTON DXR3322-MR2 (2-HOLE OFFSET) W/AMERICAN STANDARD 4101.350 SINGLE HANDLE FAUCET. DISPOSAL EQUAL TO BADGER 5 (1/2 HP, 120V, 6.3 AMPS). |
| SS-1 | SERVICE SINK | 1-1/2" | 1-1/2" | 1/2" | 1/2" | FLOOR-MOUNTED (24"x24"x16"D) UTILITY SINK W/MANUAL FAUCET WITH 6" SWING SPOUT. EQUAL TO MUSTEE 17F W/CHICAGO 891-ABCP FAUCET. |
| IB-1 | ICE BOX | - | - | 1/2" | - | RECESSED ICE BOX OUTLET, 1/4 TURN BALL VALVE W/HAMMER ARRESTOR. EQUAL TO IFS AB9700-HA. |

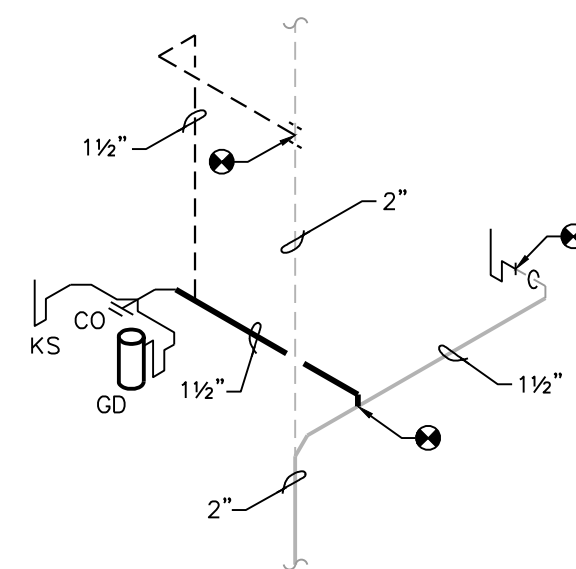
| PLUMBING SYMBOL SCHEDULE | |
|--------------------------|-----------------------------|
| SYMBOL | DESCRIPTION |
| | EXISTING WASTE ABOVE GROUND |
| | EXISTING COLD WATER |
| | EXISTING HOT WATER |
| | EXISTING VENT |
| | WASTE ABOVE GROUND |
| | COLD WATER |
| | HOT WATER |
| | VENT |
| | CONNECT TO EXISTING |

GENERAL PLUMBING NOTES:

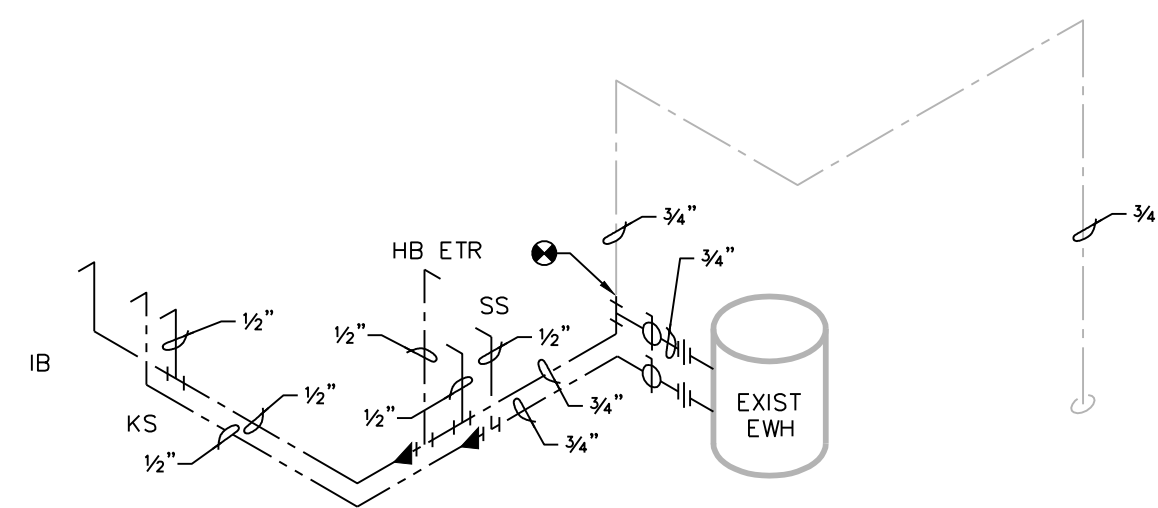
- CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF PLUMBING WORK REQUIRED.
- COORDINATE AND SCHEDULE ALL PLUMBING WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
- REFER TO DIVISION 1 SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.

PLUMBING PLAN NOTES:

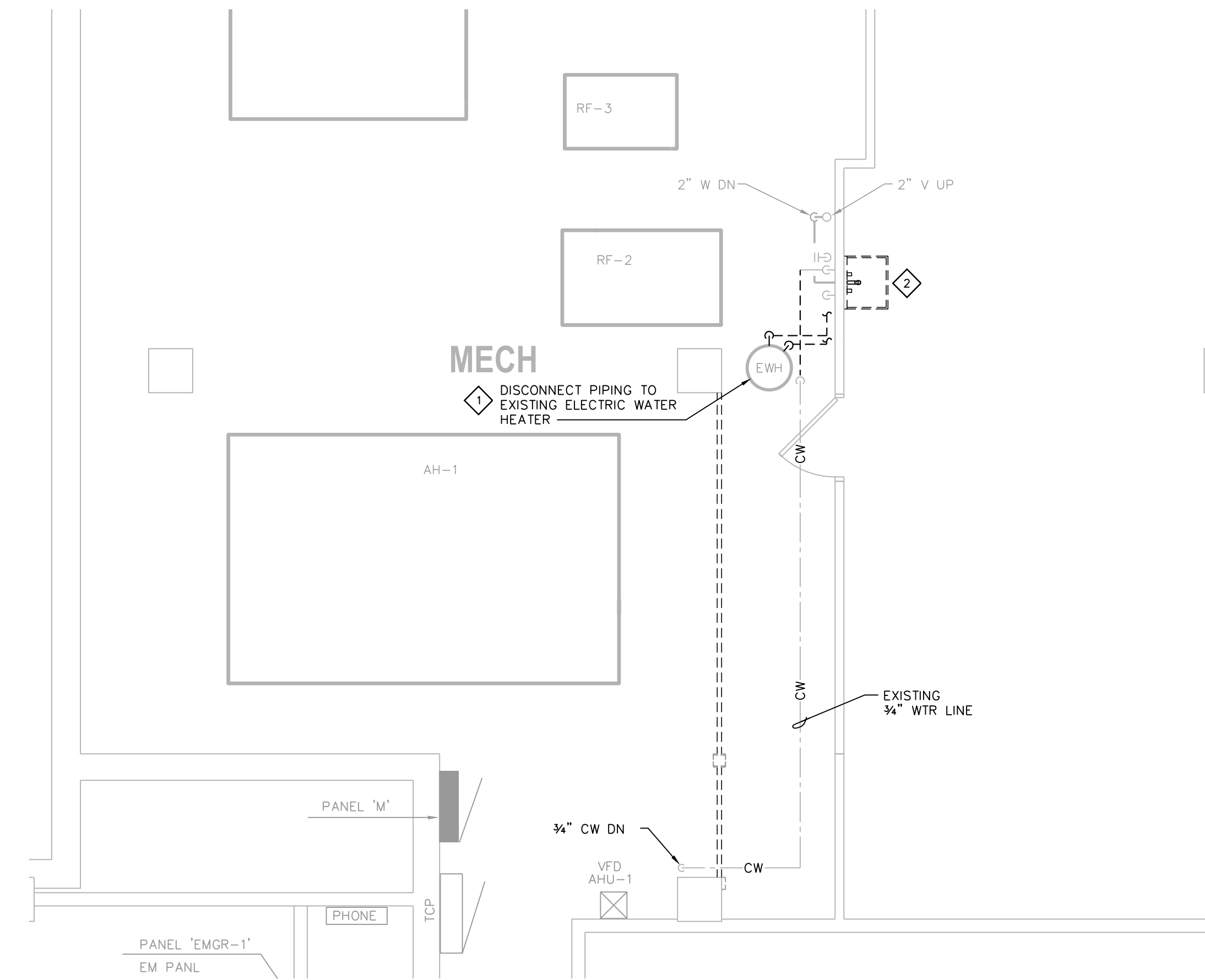
- DISCONNECT HOT AND COLD WATER PIPING CONNECTIONS TO EXISTING ELECTRIC WATER HEATER.
- DISCONNECT AND REMOVE EXISTING SERVICE SINK. PROTECT ROUGH-IN'S FOR REUSE WITH NEW FIXTURE PER PLUMBING PLAN.



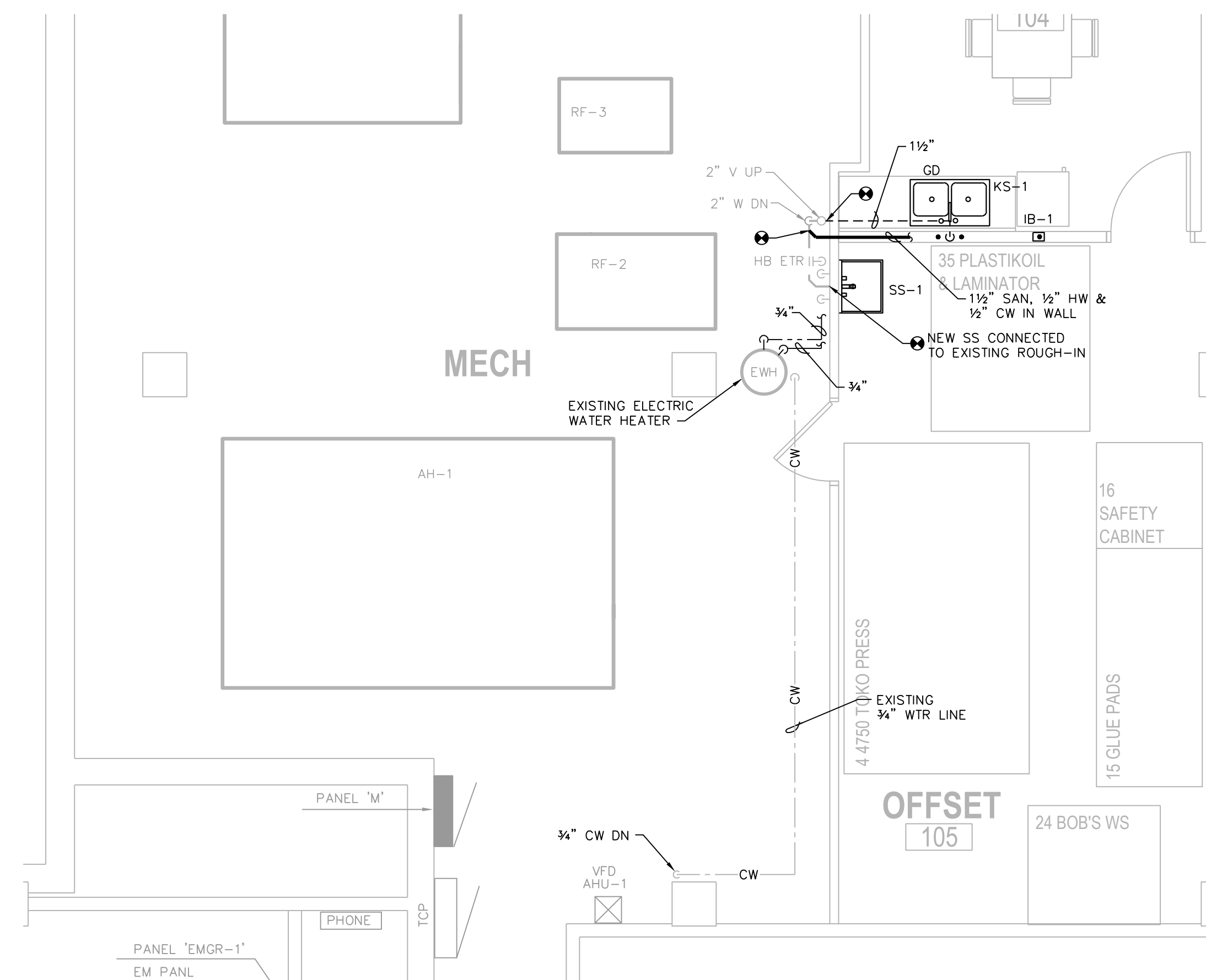
3 WASTE & VENT RISER
SCALE: NONE



4 WATER PIPING RISER
SCALE: NONE



1 PARTIAL PLUMBING DEMOLITION PLAN
1/4" = 1'-0"



2 PARTIAL PLUMBING PLAN
1/4" = 1'-0"

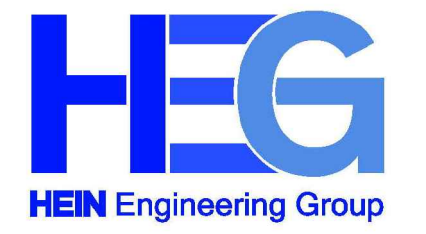
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PROJECT # 18031

PLUMBING PLANS, SCHEDULES & RISERS

P1.0



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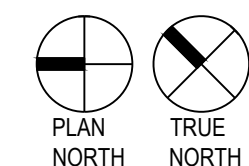
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PROJECT # 18031

FIRE PROTECTION PLANS

FP1.0



FIRE PROTECTION GENERAL NOTES:

- CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF FIRE PROTECTION WORK REQUIRED.
- COORDINATE AND SCHEDULE ALL FIRE PROTECTION WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
- FIRE PROTECTION CONTRACTOR SHALL PROVIDE A COMPLETE HYDRAULICALLY CALCULATED WET SPRINKLER SYSTEM. COORDINATE DESIGN WITH OTHER TRADES AND GENERAL CONTRACTOR.
- THE SPRINKLER DESIGN SHALL MEET REQUIREMENTS OF NFPA 13 AND LOCAL FIRE MARSHAL/INSPECTOR FOR APPROVAL.
- DESIGN BASIS GENERAL SPACE: LIGHT HAZARD (0.10 GPM/SFZ0).
- NOTE: EXISTING SPRINKLER HEADS ARE STANDARD RESPONSE TYPE.
- REUSE EXISTING FIRE PROTECTION BRANCH PIPING TO FULLEST EXTENT.

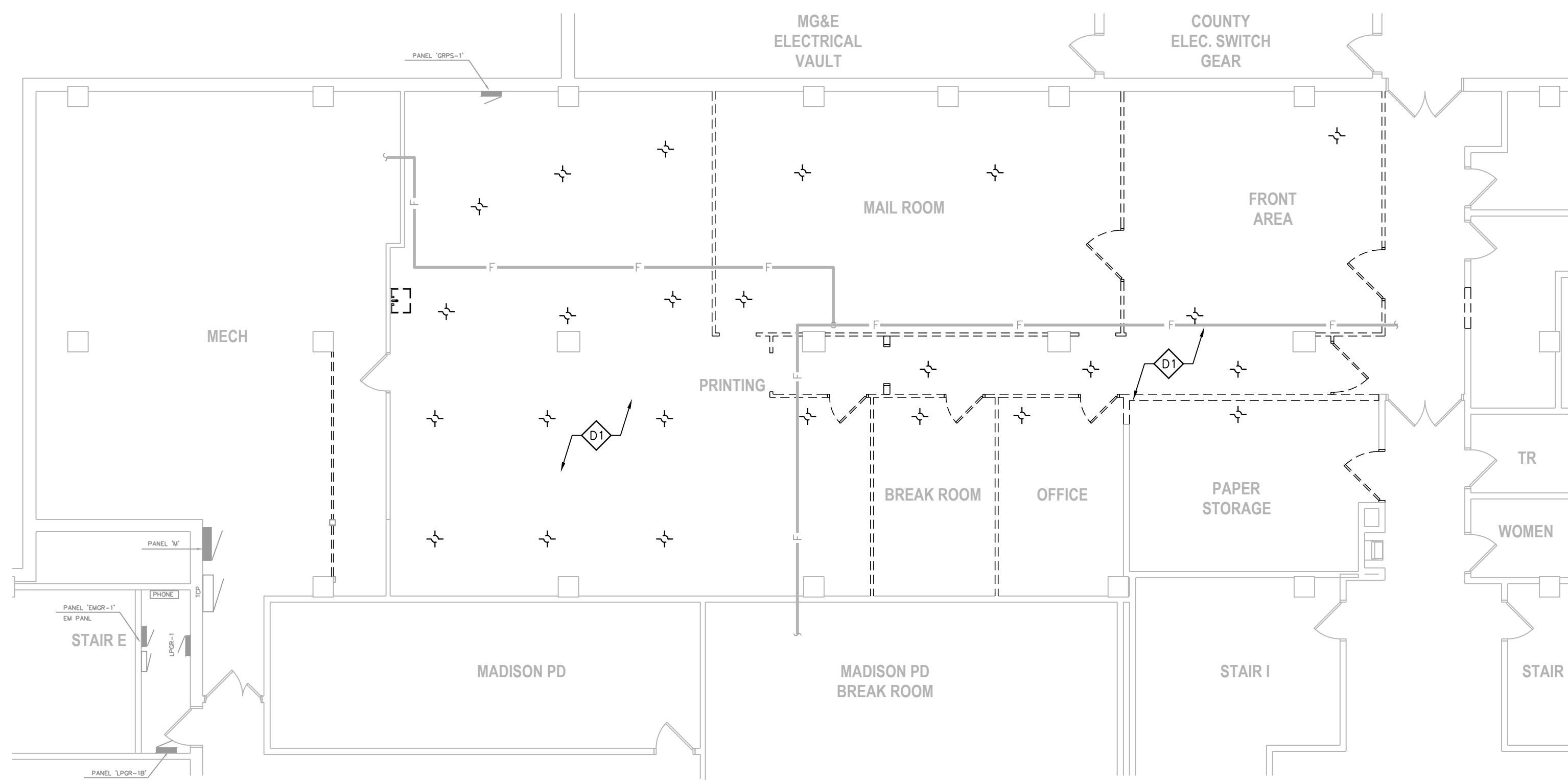
FIRE PROTECTION DEMOLITION PLAN NOTES:

- DISCONNECT EXISTING SPRINKLER HEAD AND BRANCH PIPING. PROTECT PIPING FOR CONTINUATION WITH NEW PLAN.

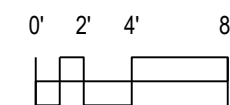
FIRE PROTECTION PLAN NOTES:

- EXTEND NEW SEMI-RECESSED SPRINKLER HEADS AND BRANCH PIPING TO NEW CEILING GRID LOCATIONS. UL APPROVED FLEXIBLE BRANCH PIPING IS ACCEPTABLE.

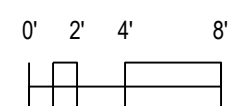
| FIRE PROTECTION SYMBOL SCHEDULE | |
|---------------------------------|--|
| SYMBOL | DESCRIPTION |
| ⊕ | DEMO CEILING SEMI-RECESSED SPRINKLER |
| ⊕ | EXISTING CEILING SEMI-RECESSED SPRINKLER |
| ⊕ | CEILING SEMI-RECESSED SPRINKLER |
| ○ | UPRIGHT SPRINKLER |

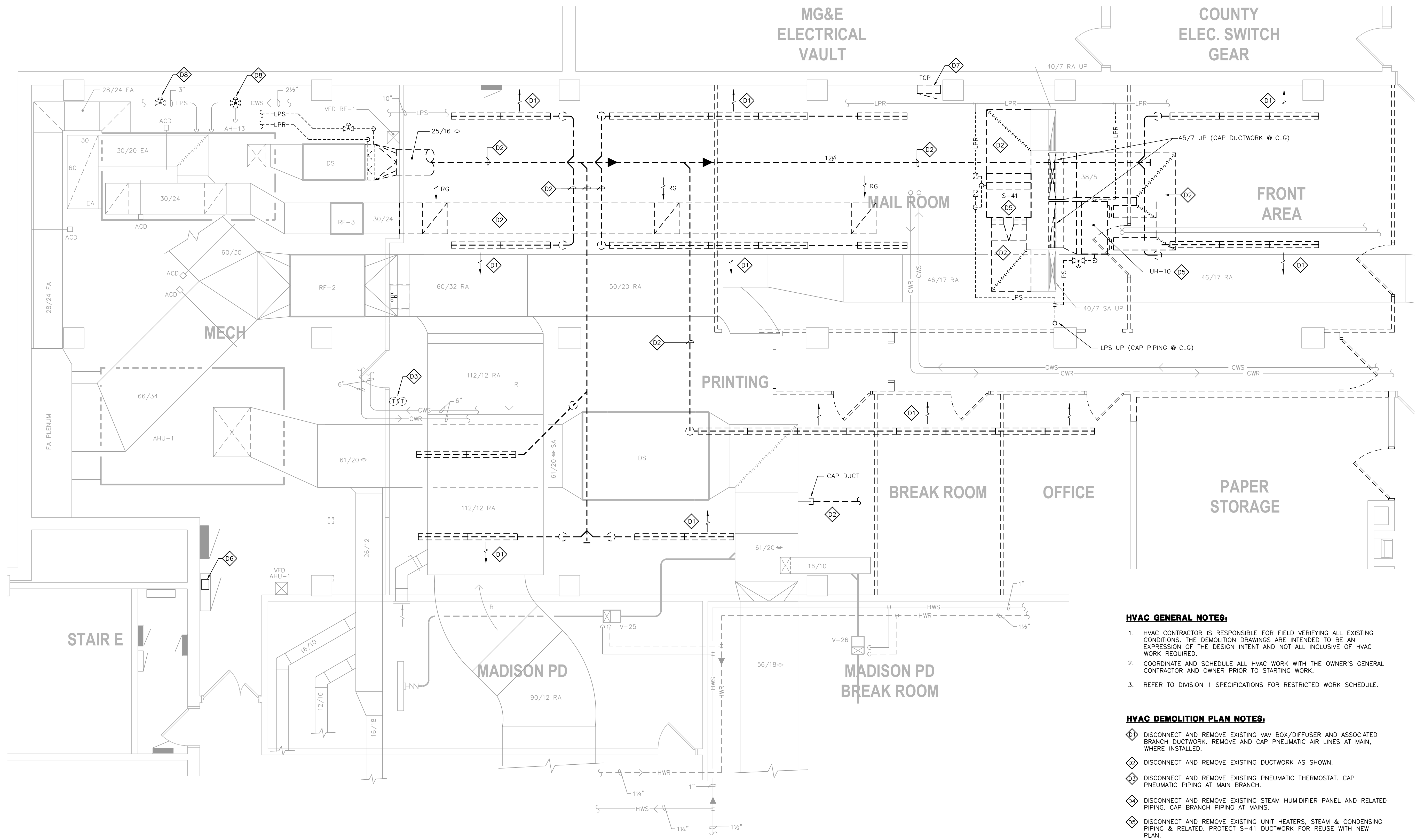


1 FIRE PROTECTION DEMOLITION PLAN
 1/8" = 1'-0"



2 FIRE PROTECTION PLAN
 1/8" = 1'-0"





1 HVAC DEMOLITION PLAN
 1/4" = 1'-0"
 0 1' 2' 4'

HVAC GENERAL NOTES:

1. HVAC CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE DEMOLITION DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF HVAC WORK REQUIRED.
2. COORDINATE AND SCHEDULE ALL HVAC WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
3. REFER TO DIVISION 1 SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.

HVAC DEMOLITION PLAN NOTES:

- D1 DISCONNECT AND REMOVE EXISTING VAV BOX/DIFFUSER AND ASSOCIATED BRANCH DUCTWORK. REMOVE AND CAP PNEUMATIC AIR LINES AT MAIN, WHERE INSTALLED.
- D2 DISCONNECT AND REMOVE EXISTING DUCTWORK AS SHOWN.
- D3 DISCONNECT AND REMOVE EXISTING PNEUMATIC THERMOSTAT. CAP PNEUMATIC PIPING AT MAIN BRANCH.
- D4 DISCONNECT AND REMOVE EXISTING STEAM HUMIDIFIER PANEL AND RELATED PIPING. CAP BRANCH PIPING AT MAINS.
- D5 DISCONNECT AND REMOVE EXISTING UNIT HEATERS, STEAM & CONDENSING PIPING & RELATED. PROTECT S-41 DUCTWORK FOR REUSE WITH NEW PLAN.
- D6 DISCONNECT AND REMOVE EXISTING AH-13 DDC CONTROLS (JCI) AND PNEUMATIC PIPING AT MAINS. REPLACE DDC CONTROLS WITH ALERTON BACnet DDC NETWORK CONTROLS. REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS.
- D7 DISCONNECT AND REMOVE EXISTING S-41 UNIT HEATER ELECTRIC/PNEUMATIC CONTROLS AND PNEUMATIC TRANSDUCERS. CAP EXISTING PNEUMATIC PIPING AT MAINS.
- D8 REMOVE PNEUMATIC ACTUATORS AND PREPARE VALVES FOR CONVERSION TO ELECTRIC ACTUATION.

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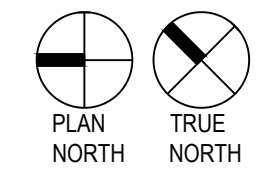
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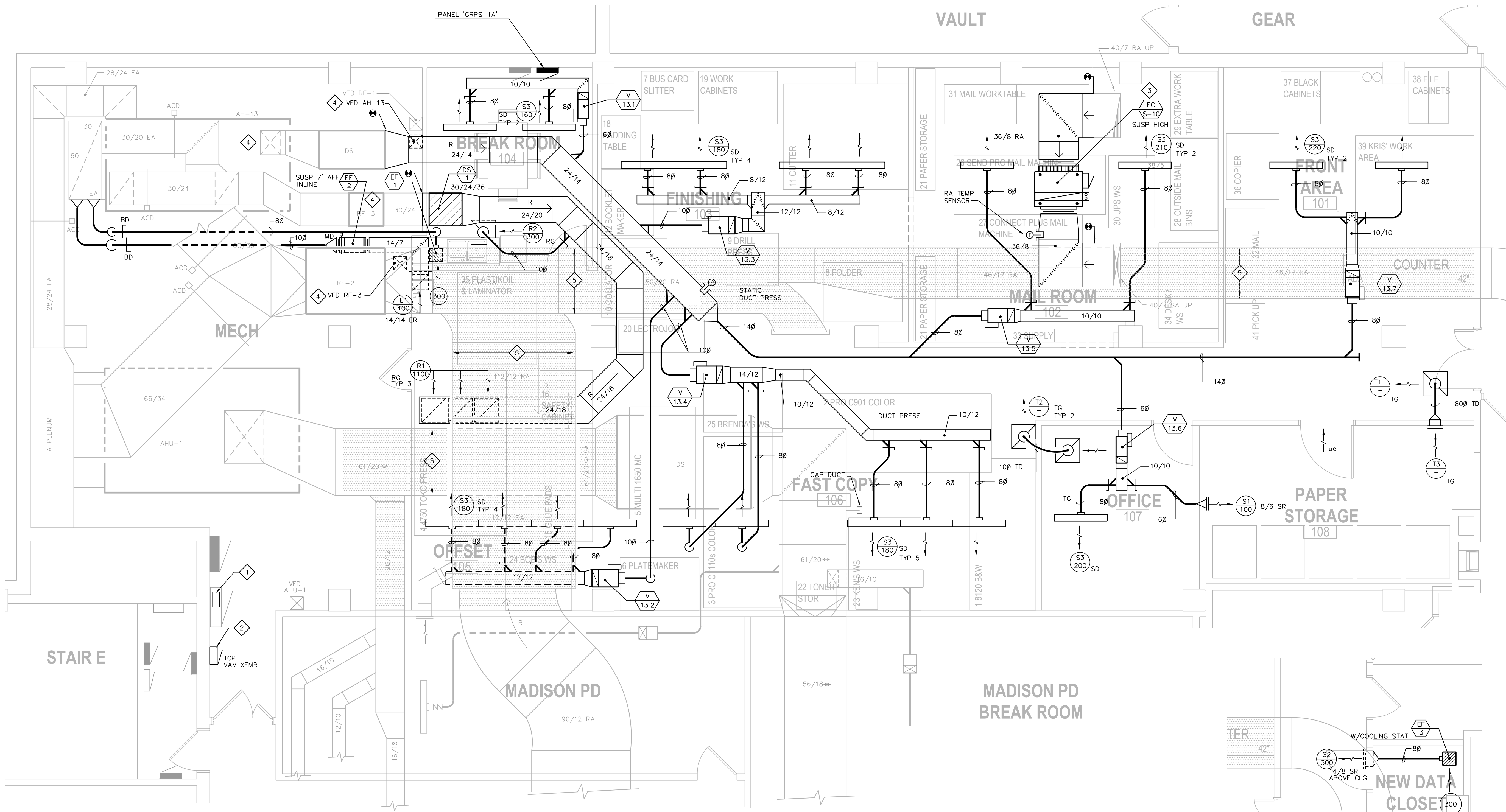
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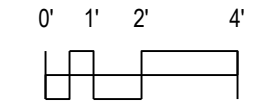
HVAC DEMOLITION PLAN

DH1.0





1 HVAC DUCTWORK PLAN
 1/4" = 1'-0"

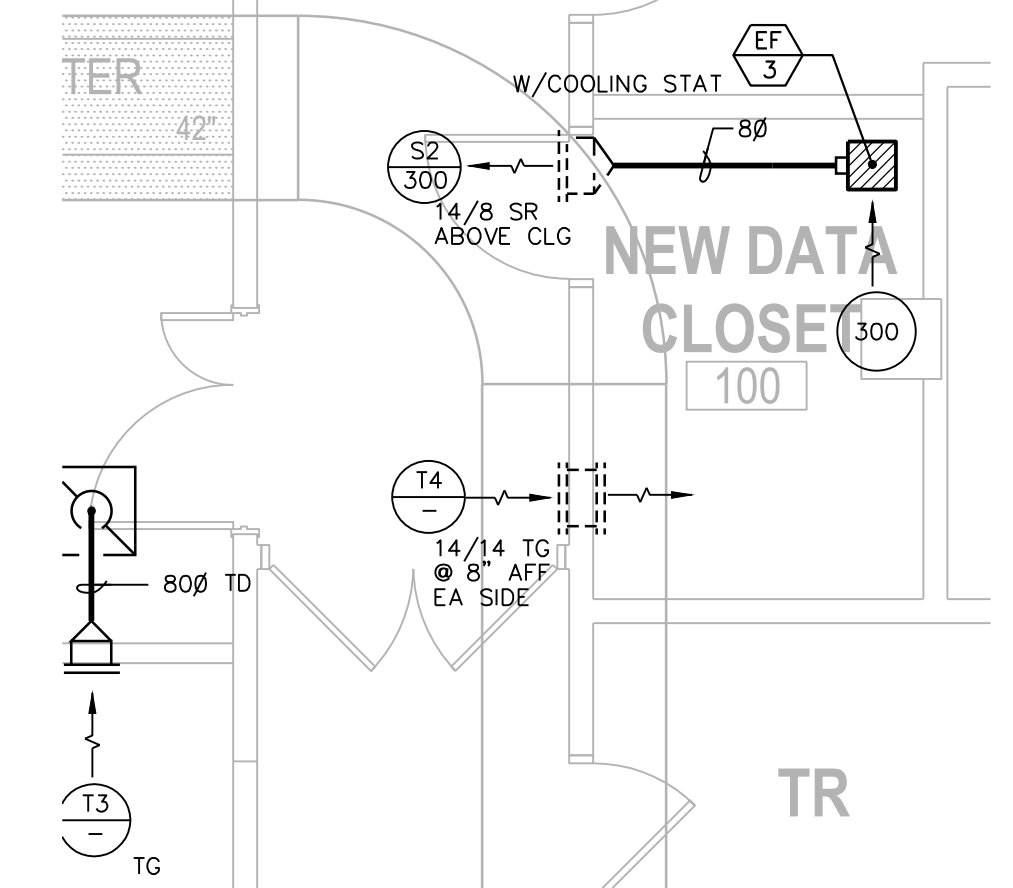


GENERAL NOTES:

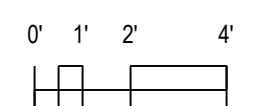
- HVAC CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE HVAC DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF HVAC WORK REQUIRED.
- COORDINATE AND SCHEDULE ALL HVAC WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
- REFER TO DIVISION I SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.
- COORDINATE CEILING LAYOUT WITH GENERAL CONTRACTOR AND LIGHTING PLANS.

HVAC PLAN NOTES:

- COORDINATE NETWORK DDC CONTROLS WIRING TO NEW TEMPERATURE CONTROLS IN EXISTING CONTROL PANEL FOR AIR HANDLER AH-13 AND VAV CONTROL NETWORK.
- NEW DDC CONTROL TRANSFORMER FOR CONTROL POWER.
- PROVIDE DDC CONTROLLER FOR FAN COIL AND REPLACE EXISTING PLENUM SPACE SENSOR WITH NEW RA TEMP SENSOR. INCLUDE FAN COIL FC S-10 ON CONTROLS NETWORK.
- NEW FAN MOTOR AND VFD FOR AH-13 & RF-3 BY HVAC CONTRACTOR. WIRING BY ELECTRICAL TRADE.
- INSULATE EXISTING SUPPLY AIR (SA) & RETURN AIR (RA) DUCTWORK WITH SOUND LAGGING 2" WRAP. REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS.



2 PARTIAL PLAN HVAC - DATA CLOSET 100
 1/4" = 1'-0"



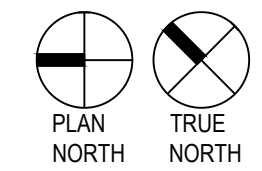
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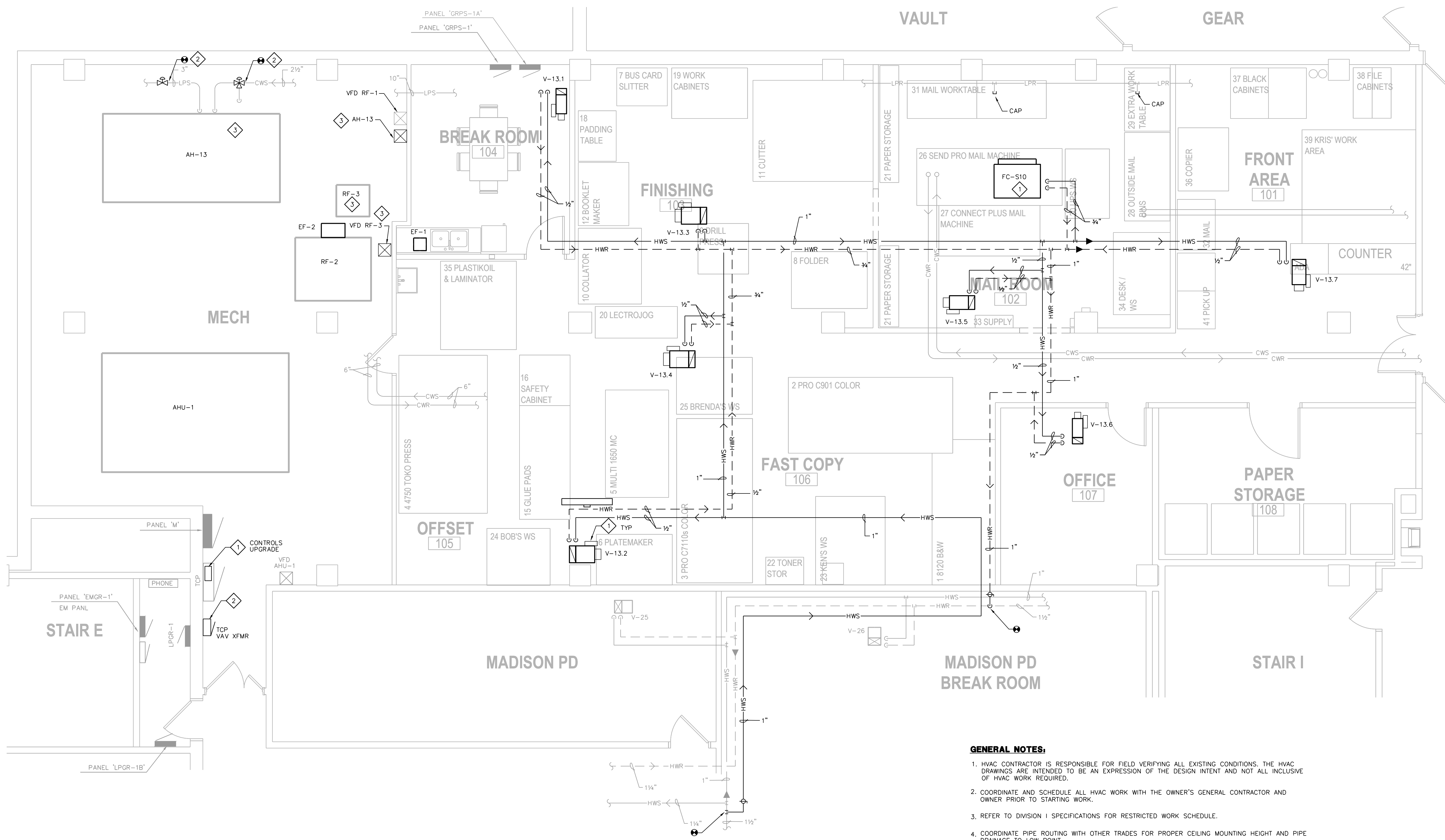
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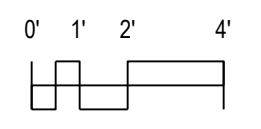
HVAC DUCTWORK PLAN



H1.0



1 HVAC PIPING PLAN
1/4" = 1'-0"



GENERAL NOTES:

- HVAC CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE HVAC DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF HVAC WORK REQUIRED.
- COORDINATE AND SCHEDULE ALL HVAC WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
- REFER TO DIVISION I SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.
- COORDINATE PIPE ROUTING WITH OTHER TRADES FOR PROPER CEILING MOUNTING HEIGHT AND PIPE DRAINAGE TO LOW POINT.

HVAC PLAN NOTES:

- COORDINATE NETWORK DDC CONTROLS WIRING TO NEW TEMPERATURE CONTROLS AT EXISTING TCP AND VAV BOX/FAN COIL CONTROLLERS WITH BAS VENDOR.
 - REPLACE EXISTING PNEUMATIC STEAM & CHILLED WATER CONTROL VALVE ACTUATORS WITH NEW ELECTRIC ACTUATORS AS PART OF NEW CONTROL SYSTEM. REFER TO SPECIFICATIONS FOR FURTHER REQUIREMENTS.
 - NEW AH-13 & RF-3 MOTOR & VFD'S FOR TEMPERATURE CONTROL UPGRADE. WIRING BY ELECTRICAL TRADE.
 - CONTROLS TRANSFORMER(24V) FOR VAV BOX CONTROLS & FAN COIL FC-S10 CONTROLS.
- ⊕ = CONNECT TO EXISTING

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HVAC PIPING PLAN

| FAN COIL SCHEDULE | |
|-----------------------------|-------------------------------|
| GENERAL TAG | FC S-10 |
| MANUFACTURER | ENVIRO-TEC |
| MODEL NO. | HPP |
| SIZE | 14 |
| TYPE | SUSPENDED DUCTED RETURN |
| DIMENSIONS (WxHxD) | 43 3/8"x32 1/2"x16 3/4" |
| RECESSED DEPTH | N.A. |
| ARRANGEMENT | DRAW TURN |
| FAN MOTOR | STD |
| CFM | 1500 |
| ESP ("WC) | 0.30 |
| RPM | 1000 (HIGH SPEED) |
| COIL WATERFLOW (GPM) | 4.2 |
| WPD (FT) | 2.2 |
| TYPE | STD |
| HEATING HEATING CAP (MBH) | 64.9 |
| EAT (deg F) | 70 |
| LAT (deg F) | 109.1 |
| EWT/LWT (deg F) | 160/130 |
| CONTROL TYPE CONTROL VALVES | HOT WATER CONTROL VALVE 2-WAY |
| FAN SWITCH | SPEED CONTROL @ UNIT |
| THERMOSTAT | BY T.C.C. |
| FILTERS TYPE | 2" MERV 8 (0.19" WC APD) |
| SIZE | 20x16 + 16x16 |
| ELECTRICAL HP | 2 @ 1/4 |
| VOLTAGE/PHASE | 208/1 |
| FLA | 3.2 |
| REMARKS | ① ② WT=177 LBS |

| EXHAUST FAN SCHEDULE | | | |
|---------------------------|----------------|---------------------|-----------------|
| TAG | EF-1 | EF-2 | EF-3 |
| MANUFACTURER | BROAN | GREENHECK | BROAN |
| MODEL NO. | L300 | 50-95-VG | L300 |
| AREA SERVED | BREAK ROOM 104 | GENERAL EXHAUST | DATA CLOSET 100 |
| CFM | 300 | 400 | 300 |
| ESP *WG | 1/4" | 1/2" | 1/4" |
| RPM | 905 | 1514 | 905 |
| MOUNTING | CEILING | SPRING VIB. HANGERS | CEILING |
| DRIVE | DIRECT | DIRECT | DIRECT |
| SONES (INLET/RADIATED) | 3.3/- | 7.8/4.7 | 3.3/- |
| ELECTRICAL MOTOR HP (BHP) | FRAC | 1/6 | FRAC |
| FAN F.L.A. | 2.6 | 4.4 | 2.6 |
| VOLTAGE/PHASE | 115/1 | 115/1 | 115/1 |
| CONTROL | WALL TIMER SW | OCCUPIED BLDG MODE | COOLING STAT |
| REMARKS | CEILING EF ① | INLINE EF ①②③④⑤⑥⑦ | CEILING EF ⑦ |

NOTE: ALL EF LINE VOLTAGE CONTROLS WIRED BY E.C.

① INTERLOCK EF-1 WITH BUILDING CONTROLS-OCCUPIED MODE SCHEDULE.
 ② ECM MOTOR WITH UNIT-MOUNTED POTENTIOMETER FOR BALANCING.
 ③ SPRING/NEOPRENE VIBRATION ISOLATION HANGERS.
 ④ MOTORIZED (115V) OPPOSED BLADE, LOW-LEAKAGE DAMPER.
 ⑤ DIRECT-COUPLED EXTERNAL ACTUATOR (BELIMO).
 ⑥ NEMA 1 DISCONNECT SWITCH UNIT-MOUNTED.
 ⑦ INSULATED HOUSING.

| VARIABLE AIR VOLUME TERMINALS SCHEDULE | | | | | | | |
|--|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| GENERAL TAG | V-13.1 | V-13.2 | V-13.3 | V-13.4 | V-13.5 | V-13.6 | V-13.7 |
| SERVICE | BREAK ROOM 104 | OFFSET 105 | FINISHING 103 | FAST COPY 106 | MAL ROOM 102 | OFFICE 107 | FRONT AREA 101 |
| MANUFACTURER | ENVIRO TECH | ENVIRO TECH | ENVIRO TECH | ENVIRO TECH | ENVIRO TECH | ENVIRO TECH | ENVIRO TECH |
| MODEL NO. | SDR-WC | SDR-WC | SDR-WC | SDR-WC | SDR-WC | SDR-WC | SDR-WC |
| CONNECTIONS ARR. | LH | RH | LH | LH | RH | LH | RH |
| SIZE | 6 | 10 | 10 | 10 | 8 | 6 | 6 |
| INLET | 6"ø | 10"ø | 10"ø | 10"ø | 8"ø | 6"ø | 6"ø |
| OUTLET (WxH) | 10"x10" | 14"x12 1/2" | 14"x12 1/2" | 14"x12 1/2" | 12"x10" | 10"x10" | 10"x10" |
| MIN. CFM CLG/MAX. CFM HTG | 110/110 | 220/220 | 220/220 | 270/270 | 130/130 | 90/90 | 140/140 |
| MAX. CFM | 360 | 720 | 720 | 900 | 420 | 300 | 440 |
| UNIT APD("WG) @MAX | 0.14 | 0.11 | 0.11 | 0.16 | 0.08 | 0.10 | 0.09 |
| VAV ACTUATOR | ELECTRIC | ELECTRIC | ELECTRIC | ELECTRIC | ELECTRIC | ELECTRIC | ELECTRIC |
| VAV CONTROL | DDC | DDC | DDC | DDC | DDC | DDC | DDC |
| H/W HEATING COIL TYPE EAT @ MIN HTG | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 | 1R/10 FPI/1CKT 55 |
| LAT (F) | 85.9 | 89.8 | 89.8 | 88.1 | 87.8 | 86.3 | 87.5 |
| CAP. (MBH) @ MIN. HTG | 3.7 | 8.3 | 8.3 | 9.7 | 4.6 | 3.0 | 4.9 |
| GPM | 0.3 | 0.5 | 0.5 | 0.7 | 0.3 | 0.3 | 0.3 |
| EWT (F) | 160 | 160 | 160 | 160 | 160 | 160 | 160 |
| WPD (FT) | 0.1 | 0.3 | 0.3 | 0.4 | 0.1 | 0.1 | 0.1 |
| SOUND (AHR1-B85E) RAD NC | 18 | <15 | <15 | 15 | <15 | 15 | <15 |
| DIS NC | 16 | <15 | <15 | <15 | <15 | <15 | <15 |
| REMARKS | ① ② | ① ② | ① ② | ① ② | ① ② | ① ② | ① ② |

① MINIMUM AIR FLOW/MAXIMUM HEATING FLOW.
 ② VAV BOX ACTUATOR AND DDC CONTROLS FURNISHED AND FIELD INSTALLED BY THE TEMP. CONTROL CONTRACTOR.

| DIFFUSERS, REGISTERS AND GRILLES SCHEDULE | | | | | | | |
|---|--------------|--------------|--------------------------|----------|-----------------------|---------|---------------------|
| TAG | MANUFACTURER | MODEL | SIZE NECK (WxH) FACE (L) | MOUNTING | SERVICE | CFM | REMARKS |
| S1 | CARNES | RNGMV | 8"x6" | - | SURFACE/WALL SUPPLY | 100 | ①③ ALUM SR DD |
| S2 | CARNES | RNGMV | 14"x8" | - | SURFACE/WALL SUPPLY | 300 | ①③ ALUM SR DD |
| S3 | CARNES | F-22 | 8"ø | 48" | T-BAR/CLG SUPPLY | 160-220 | ①③⑥⑦ 2-SLOT 2-WAY |
| R1 | CARNES | RALMH-NT | 22"x22" | 24"x24" | T-BAR/CLG RETURN | 1100 | ②④ ALUM LOUVERED RG |
| R2 | CARNES | RALMH-NT | 10"ø | 24"x24" | T-BAR/CLG RETURN | 300 | ②④ ALUM LOUVERED RG |
| T1 | CARNES | SPRB-224-07D | 8"ø | 24"x24" | T-BAR/CLG TRANSFER | - | ②④⑧ PERF TG |
| T2 | CARNES | SPRB-224-07D | 10"ø | 24"x24" | T-BAR/CLG TRANSFER | - | ②④⑧ PERF TG |
| T3 | CARNES | RSHAH | 10"x10" | - | SURFACE/WALL TRANSFER | - | ① HD LOUVERED TG |
| T4 | CARNES | RSHAH | 16"x16" | - | SURFACE/WALL TRANSFER | - | ① HD LOUVERED TG |
| E1 | CARNES | RNJMH | 10"x10" | - | SURFACE/CLG EXHAUST | 400 | ①③ ALUM LOUVERED ER |

REMARKS:
 DD = DOUBLE DEFLECTION
 SD = SINGLE DEFLECTION
 CD = CEILING DIFFUSER
 RG = RETURN GRILLE
 RR = RETURN REGISTER
 SR = SUPPLY REGISTER
 SG = SUPPLY GRILLE
 TG = TRANSFER GRILLE

① WHITE FINISH
 ② WHITE FACE PANEL WITH BLACK INTERIOR FINISH.
 ③ OPPOSED BLADE DAMPER.
 ④ T-BAR PANEL.
 ⑤ INSULATED PLENUM.
 ⑥ CENTER T-BAR.
 ⑦ CENTER NOTCH (CROSS T-BAR).
 ⑧ DROP FACE.

| AIR HANDLING UNIT SCHEDULE | |
|-------------------------------|----------------------------------|
| GENERAL TAG | EXISTING AH-13 |
| LOCATION | MECH RM |
| SERVICE | PRINT SHOP |
| MANUFACTURER | CARRIER |
| MODEL/SIZE | 39ED13 |
| ARRANGEMENT | TOP DISCHARGE |
| SUPPLY FAN CFM | 6000 |
| O.A.% (CFM) | 10.0% (600) |
| O.V. VELOCITY | - |
| EXTERNAL S.P. ("W.G.) | 2.75 |
| TOTAL S.P. ("W.G.) | 4.50 |
| RPM | TBD |
| MOTOR HP (BHP) | 10 ③ |
| VOLTAGE/PHASE | 460/3 |
| FAN WHEEL SIZE/TYPE | 15" BI FAN |
| SYSTEM TYPE | vav w/VFD ① |
| H/W HTG COIL AIR EAT | (EXISTING) HC-1 W/FACE/BYPASS 45 |
| LAT | 87 |
| APD ("W.G.) | 0.10 |
| FV (FPM) | - |
| STEAM PRESS PSIG | 3 |
| LB/HR | 317 |
| TOTAL CAP (MBH) | 273.8 |
| COOLING COIL AIR EAT | (EXIST) CC-1 79.3/67 |
| LAT (db/wb °F) | 55/54 |
| APD ("W.G.) | 0.80 |
| FV (FPM) | 550 |
| CHILLED WATER TOTAL CAP (MBH) | 248.0 |
| WTF | 45 |
| GPM | 54 |
| FILTER BOX TYPE | HORIZONTAL SIDE ACCESS |
| PREFILTER MEDIA | 30% (MER 6) |
| FACE AREA (S.F.) | 12.0 |
| APD ("W.G.) | 0.25 |
| VIBRATION ISOLATION TYPE | EXTERNAL ISOLATION |
| RETURN FAN MODEL/SIZE | RF-3 (EXIST) |
| ARRANGEMENT | INLINE |
| CFM | 6000 |
| ESP ("W.G.) | 1/2" |
| RPM | TBD |
| MOTOR HP (BHP) | 5 ③ |
| VOLTAGE/PHASE | 460/3 |
| FAN WHEEL SIZE/TYPE | 18" CENTRIFUGAL |
| SYSTEM TYPE | vav w/VFD |
| REMARKS | ① ② |

TBD = TO BE DETERMINED
 ① EXISTING AIR HANDLER UNIT TO BE CONVERTED TO VAV WITH ADDITION OF NEW SUPPLY FAN & RETURN FAN VFD'S.
 ② REBALANCE AIR HANDLING UNIT @ 67% VAV TERMINAL AIR DIVERSITY (4000 CFM).
 ③ REPLACE EXISTING MOTORS WITH VFD COMPATIBLE PREMIUM EFFICIENCY MOTORS & GROUNDING RINGS ON SHAFT.

| DUCT SILENCER | | | | | | | | | | | | | | | | | | |
|---------------|-----------------|----------|------|--------------------|-------------|--|--------------------|--------------|---|-----|-----|-----|------|------|---------|------|-----------------|--|
| TAG | MEGR | MODEL | TYPE | FACE DIM. WxH (IN) | LENGTH (IN) | AIR FLOW CFM | SILENCER APD "W.C. | VELOCITY FPM | DYNAMIC INSERTION LOSS db @ OCTAVE BAND | | | | | | REMARKS | | | |
| DS-1 | VIBRO-ACOUSTICS | RD-LV-F4 | RD | 30"x24" | 36" | 3600 | 0.13 | -720 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | RF-3 RETURN AIR | |
| | | | | | | DYNAMIC INSERTION LOSS PER ASTM E477-06A | | | | | | | | | | | | |
| | | | | | | RD = RECTANGULAR DISSIPATIVE | | | | | | | | | | | | |

| HVAC SYMBOL SCHEDULE | |
|----------------------|---|
| SYMBOL | DESCRIPTION |
| | SQUARE/RECTANGULAR SUPPLY DIFFUSER, GRILLE OR REGISTER-HORIZONTAL MOUNT |
| | SQUARE/RECTANGULAR RETURN/EXHAUST REGISTER OR GRILLE-HORIZONTAL MOUNT |
| | SUPPLY REGISTER OR GRILLE VERT. MOUNT |
| | RETURN/EXHAUST REGISTER OR GRILLE VERT. MOUNT |
| | VERTICAL SUPPLY DUCT UP |
| | VERTICAL RETURN/EXHAUST DUCT UP |
| | VERTICAL SUPPLY DUCT DOWN |
| | VERTICAL RETURN/EXHAUST DUCT DOWN |
| | VOLUME DAMPER |
| | AUTOMATIC CONTROL DAMPER |
| | BACKDRAFT DAMPER |
| | FIRE DAMPER |
| | FLEXIBLE CONNECTION |
| | ROUND/FLEXIBLE DUCT |
| | ROUND RIGID DUCT |
| | SQUARE ELBOW W/TURNING VANES |
| | RADIUS ELBOW, R/D = 1.5 |
| | RADIUS TAKEOFF R/D = 1.5 "X"=TAKE-OFF WIDTH |
| | DUCT RISE(R) OR DROP(D) |
| | TRANSITION |
| | DIFFUSER/REGISTER/GRILLE TYPE CFM |
| | EXHAUST CFM |
| | EQUIPMENT SYMBOL NO. |
| | SPACE SENSOR |

| HVAC SYMBOL SCHEDULE | |
|----------------------|----------------------------------|
| SYMBOL | DESCRIPTION |
| | PIPING |
| | HOT WATER SUPPLY |
| | HOT WATER RETURN |
| | PIPE UP |
| | PIPE DOWN |
| | TWO WAY TEMP CONTROL VALVE (ACV) |
| | BALL VALVE |
| | BALANCING VALVE |
| | CALIBRATED BALANCING VALVE |
| | INLINE STRAINER |
| | UNION |
| | THERMOMETER |
| | PRESSURE GAUGE |
| | FLEXIBLE CONNECTION |
| | T & P TEST WELL |
| | AIR VENT |
| | M = MANUAL |
| | VACUUM BREAKER |
| | REDUCER, CONCENTRIC |
| | REDUCER, ECCENTRIC |
| | IMMERSION WELL |
| | PIPE MTD IMMERSION SENSOR |
| | DUCT PRESSURE SENSOR |

| EQUIPMENT SYMBOLS | |
|-------------------|---------------------|
| | VARIABLE VOLUME BOX |
| | FAN COIL |
| | AIR HANDLING UNIT |
| | RETURN FAN |
| | EXHAUST FAN |
| | DUCT SILENCER |

| ABBREVIATIONS | |
|---------------|---------------------------|
| ACD | AUTOMATIC CONTROL DAMPER |
| ACV | AUTOMATIC CONTROL VALVE |
| AD | ACCESS DOOR |
| EA | EXHAUST AIR |
| FA | FRESH AIR |
| RA | RETURN AIR |
| SA | SUPPLY AIR |
| BOD | BOTTOM OF DUCT |
| OED | OPEN END DUCT |
| Ø | ROUND DUCT DIAMETER |
| DG | DOOR GRILLE |
| TD | TRANSFER GRILLE |
| TD | TRANSFER DUCT |
| UC | UNDERCUT DOOR |
| TCP | TEMPERATURE CONTROL PANEL |

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 Project No. H1821

CCB PRINTING SERVICES
 210 MARTIN LUTHER KING, JR. BLVD.,
 MADISON, WI 53703

RFB No. 318037

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PROJECT # 18031

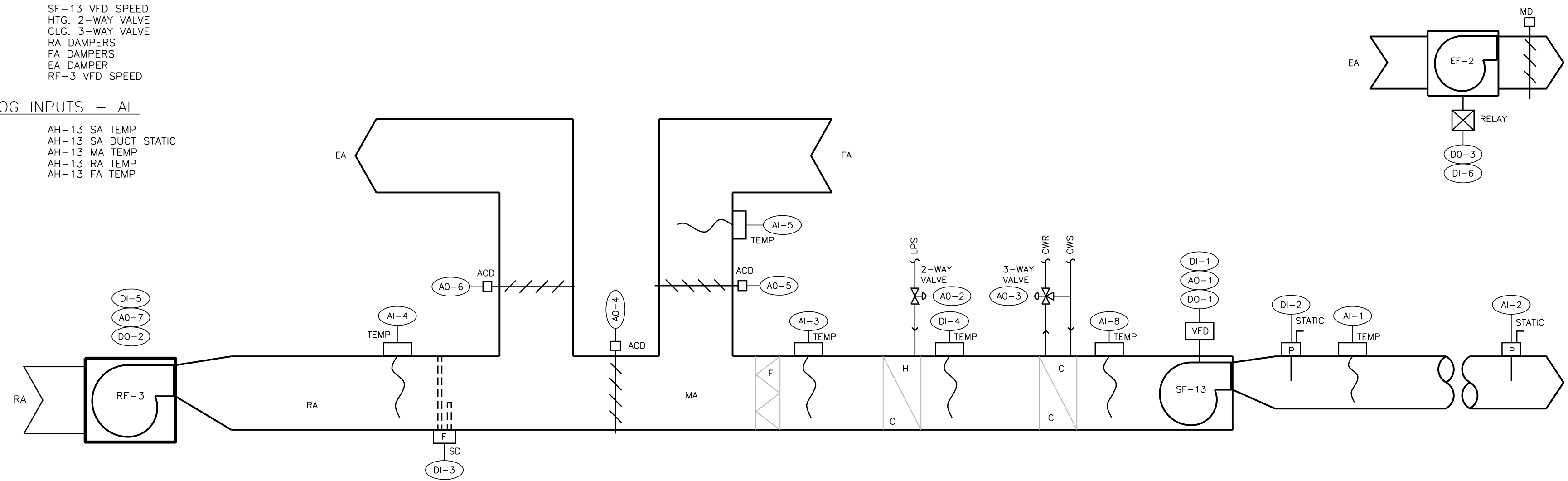
HVAC DETAILS & SCHEDULES

H2.0

CONTROL POINTS

| DIGITAL OUTPUTS - DO | | ANALOG OUTPUTS - AO | |
|----------------------|------------------|---------------------|------------------|
| DO-1 | SF-13 START/STOP | AO-1 | SF-13 VFD SPEED |
| DO-2 | RF-3 START/STOP | AO-2 | HTG. 2-WAY VALVE |
| DO-3 | EF-2 START/STOP | AO-3 | CLG. 3-WAY VALVE |
| | | AO-4 | RA DAMPERS |
| | | AO-5 | FA DAMPERS |
| | | AO-6 | EA DAMPER |
| | | AO-7 | RF-3 VFD SPEED |

| DIGITAL INPUTS - DI | | ANALOG INPUTS - AI | |
|---------------------|-------------------------------|--------------------|----------------------|
| DI-1 | SF-1 STATUS | AI-1 | AH-13 SA TEMP |
| DI-2 | AH-13 HIGH STATIC LIMIT ALARM | AI-2 | AH-13 SA DUCT STATIC |
| DI-3 | AH-13 SA SMOKE ALARM | AI-3 | AH-13 MA TEMP |
| DI-4 | HC-1 COIL TEMP FREEZE STAT | AI-4 | AH-13 RA TEMP |
| DI-5 | RF-3 STATUS | AI-5 | AH-13 FA TEMP |
| DI-6 | EF-2 STATUS | | |



1 TEMPERATURE CONTROL SCHEMATIC - AH-13 & EF-2
N.T.S.

CCB PRINTING SERVICES

210 MARTIN LUTHER KING, JR. BLVD.,
MADISON, WI 53703

RFB No. 318037

| <p>7 VAV BOX REHEAT COIL PIPING DETAIL HT-195B</p> | <p>6 FAN COIL HW PIPING DETAIL</p> | <p>5 TRANSFER DUCT/GRILLE DETAIL</p> | <p>4 EXHAUST FAN DETAIL CEILING MTD</p> | <p>3 PIPE HANGER DETAIL HT-31</p> | <p>2 PIPE/DUCT WALL PENETRATION DETAIL DL-42</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|--|--|---|---|--------|---|--------|---|--------|---|--------|---|--------|---|--------|---|--------|---|---------|----------|---|---|---|---|------------|----|-----|----|-----|---------------|----|----|----|-----|---|---|--|--|
| <p>14 HIGH PRESSURE DUCT VAV BRANCH TAKEOFF DETAIL</p> | <p>13 DUCT LINER DETAIL</p> <p>METAL NOSING: USE METAL NOSING ON EVERY LEADING EDGE. PER DETAIL 'A' BELOW. NOSING MAY BE FORMED ON DUCT OR BE CHANNEL OR ZEE ATTACHED BY SCREWS, RIVETS, OR WELDS.</p> <table border="1"> <thead> <tr> <th>NO. PINS</th> <th>LINEAR INTERIOR WIDTH</th> </tr> </thead> <tbody> <tr><td>0</td><td>9'-0"</td></tr> <tr><td>1</td><td>9'-16"</td></tr> <tr><td>2</td><td>9'-28"</td></tr> <tr><td>3</td><td>9'-40"</td></tr> <tr><td>4</td><td>9'-52"</td></tr> <tr><td>5</td><td>9'-64"</td></tr> <tr><td>6</td><td>9'-76"</td></tr> <tr><td>7</td><td>9'-88"</td></tr> <tr><td>8</td><td>9'-100"</td></tr> </tbody> </table> <p>THE VELOCITY RATED SIDE OF LINER (COATED) MUST FACE THE AIRFLOW.</p> <table border="1"> <thead> <tr> <th>VELOCITY</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> </tr> </thead> <tbody> <tr> <td>0-2500 FPM</td> <td>3"</td> <td>12"</td> <td>4"</td> <td>18"</td> </tr> <tr> <td>2501-6000 FPM</td> <td>3"</td> <td>6"</td> <td>4"</td> <td>16"</td> </tr> </tbody> </table> | NO. PINS | LINEAR INTERIOR WIDTH | 0 | 9'-0" | 1 | 9'-16" | 2 | 9'-28" | 3 | 9'-40" | 4 | 9'-52" | 5 | 9'-64" | 6 | 9'-76" | 7 | 9'-88" | 8 | 9'-100" | VELOCITY | A | B | C | D | 0-2500 FPM | 3" | 12" | 4" | 18" | 2501-6000 FPM | 3" | 6" | 4" | 16" | <p>12 INLINE EXHAUST FAN DETAIL</p> <p>INSTALLATION NOTES:</p> <ol style="list-style-type: none"> ELECT. DISCONNECT BY E.C. INLINE FAN SUPPORT RODS SPRING VIBRATION ISOLATOR HANGER SUPPORTS EXHAUST DUCTWORK FLEXIBLE DUCT CONNECTION MOTOR DRIVE & GUARD PROVIDE SERVICE ACCESS MOTORIZED BACKDRAFT DAMPER | <p>11 STANDARD DUCT FITTINGS N.T.S. J-10</p> | <p>10 TURNING VANES IN ELBOW N.T.S. DL-55</p> | <p>8 BRANCH DUCT TAKEOFF DETAIL-ROUND FLEXIBLE DL-2</p> |
| NO. PINS | LINEAR INTERIOR WIDTH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 9'-0" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 7 | 9'-88" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | 9'-100" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VELOCITY | A | B | C | D | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0-2500 FPM | 3" | 12" | 4" | 18" | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| NO. PINS | LINEAR INTERIOR WIDTH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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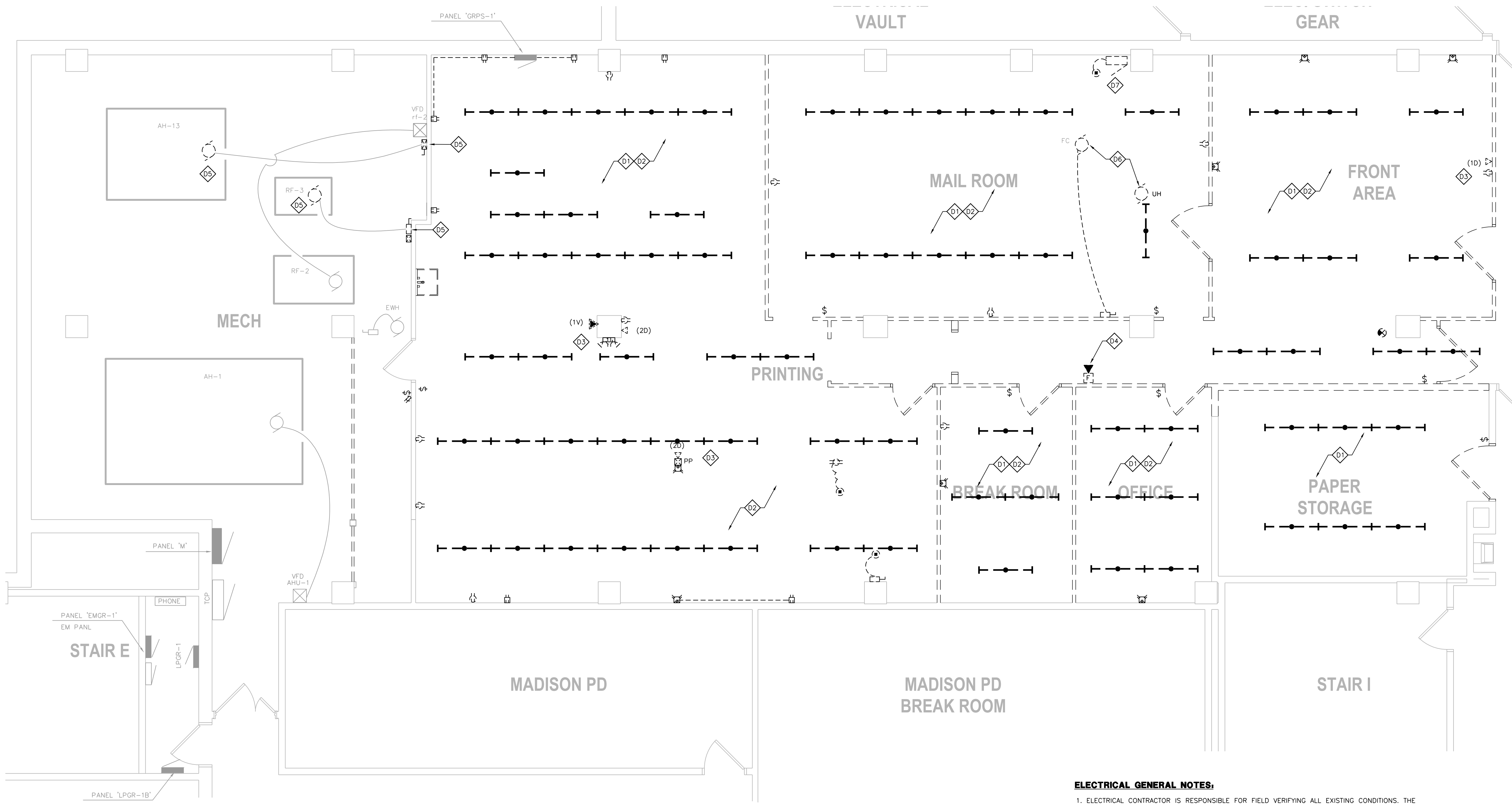
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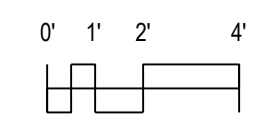
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PROJECT # 18031

HVAC DETAILS



1 ELECTRICAL DEMOLITION PLAN
1/4" = 1'-0"



- ELECTRICAL GENERAL NOTES:**
1. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFYING ALL EXISTING CONDITIONS. THE ELECTRICAL DEMOLITION DRAWINGS ARE INTENDED TO BE AN EXPRESSION OF THE DESIGN INTENT AND NOT ALL INCLUSIVE OF ELECTRICAL WORK REQUIRED.
 2. COORDINATE AND SCHEDULE ALL ELECTRICAL WORK WITH THE GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
 3. REFER TO DIVISION I SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.

- ELECTRICAL DEMOLITION PLAN NOTES:**
- D1 DISCONNECT AND REMOVE EXISTING LIGHT FIXTURES AND SWITCHING. REMOVE CONDUCTORS AND RACEWAY BACK TO 1ST JCT BOX OR PANELBOARD 'GRPS-1'.
 - D2 DISCONNECT AND REMOVE RECEPTACLES. REMOVE CONDUCTORS AND RACEWAYS BACK TO 1ST JCT BOX OR TO PANELBOARD 'GRPS-1'.
 - D3 DISCONNECT AND REMOVE VOICE & DATA RACEWAYS. VOICE AND DATA CABLING REMOVAL BY THIS CONTRACTOR BACK TO EXISTING PATCH PANEL. DISCONNECT AND REMOVE POWER POLES (PP).
 - D4 DISCONNECT FIRE ALARM CABLING AND DEVICE. COORDINATE WITH FIRE ALARM REMODELING.
 - D5 DISCONNECT AND REMOVE MAGNETIC STARTER/DISCONNECT FOR REWIRING WITH NEW VFD PROVIDED BY HVAC TRADE. DISCONNECT AND REMOVE AH-13 & RF-3 FAN MOTOR WIRING FOR REPLACEMENT MOTOR BY HVAC TRADE.
 - D6 DISCONNECT AND REMOVE DISCONNECT AND WIRING TO EXISTING FAN COIL AND UNIT HEATER. COORDINATE WORK WITH HVAC CONTRACTOR.
 - D7 DISCONNECT AND REMOVE POWER TO TEMPERATURE CONTROL PANEL. COORDINATE WORK WITH HVAC CONTRACTOR.

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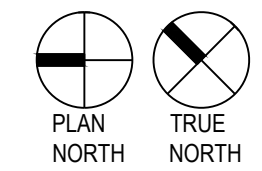
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PROJECT # 18031

ELECTRICAL DEMOLITION PLAN

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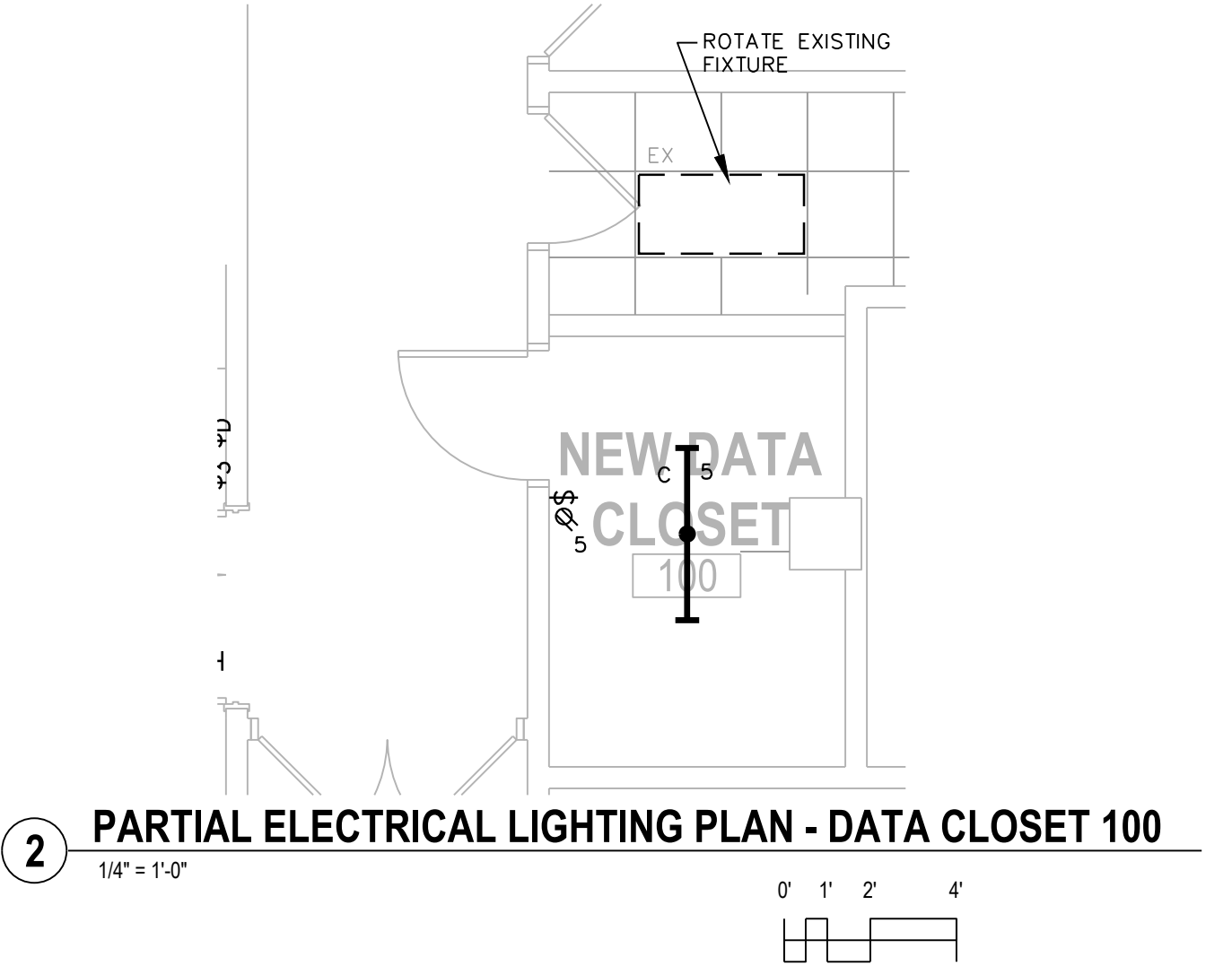
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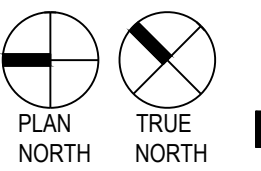
1 ELECTRICAL LIGHTING PLAN
 1/4" = 1'-0"

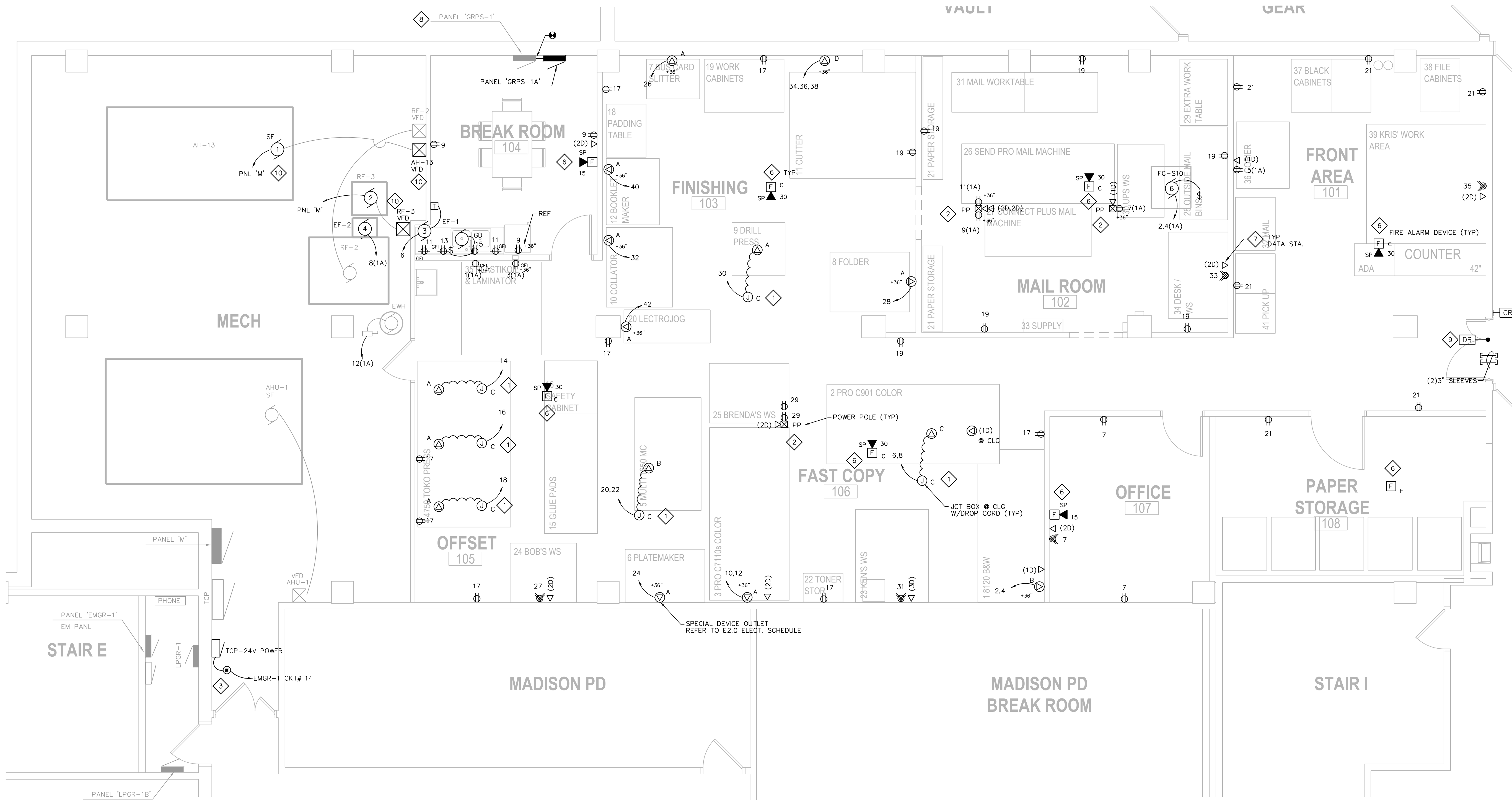
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 2. COORDINATE AND SCHEDULE ALL ELECTRICAL WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
 3. REFER TO DIVISION 1 SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.
 4. COORDINATE FINAL DEVICE MOUNTING HEIGHTS AND LOCATIONS WITH OWNER PRIOR TO INSTALLING RACEWAYS.
 5. ALL LIGHTING CIRCUITS FROM PANEL 'GRPS-1', EXCEPT EMERGENCY EXIT & EGRESS LIGHTING SERVED FROM PANEL 'EMGR-1'.

- ELECTRICAL LIGHTING PLAN NOTES:**
- 1 REIRCUIT NEW EGRESS LIGHTING AND EXIT LIGHTS TO EXISTING EMERGENCY POWER PANEL 'EMGR-1'.



2 PARTIAL ELECTRICAL LIGHTING PLAN - DATA CLOSET 100
 1/4" = 1'-0"





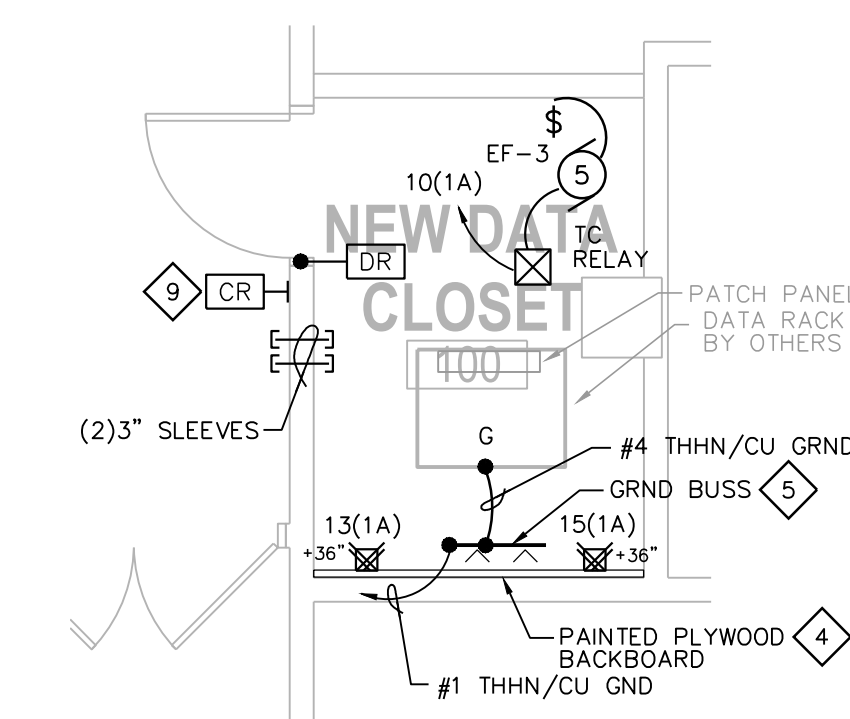
1 ELECTRICAL POWER/LV PLAN
1/4" = 1'-0"

ELECTRICAL GENERAL NOTES:

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- COORDINATE AND SCHEDULE ALL ELECTRICAL WORK WITH THE OWNER'S GENERAL CONTRACTOR AND OWNER PRIOR TO STARTING WORK.
- REFER TO DIVISION I SPECIFICATIONS FOR RESTRICTED WORK SCHEDULE.
- COORDINATE FINAL DEVICE MOUNTING HEIGHTS AND LOCATIONS WITH OWNER PRIOR TO INSTALLING RACEWAYS.

ELECTRICAL PLAN NOTES:

- PROVIDE FLUSH CEILING JUNCTION BOX WITH STRAIN-RELIEF DROP CORD TO ELECTRICAL DEVICE OUTLET AS SCHEDULED. COORDINATE DEVICE MOUNTING HEIGHT WITH OWNER.
- PROVIDE POWER POLE (PP) WITH LINE & LOW-VOLTAGE COMPARTMENTS FOR DEVICE CABLING. FIELD VERIFY PP HEIGHT.
- COORDINATE HVAC CONTROL PANEL POWER & LOCATION WITH HVAC TRADE.
- PROVIDE PAINTED 3/4" (48"H) PLYWOOD BACKBOARD 24" AFF AS SHOWN.
- PROVIDE 18"x2"x1/8" COPPER GND BUSS WITH INSULATED STANDOFFS. REFER TO DETAIL SHEET E2.0. EXTEND #1 THHN/CU CONDUCTOR TO EXISTING SERVICE GROUND. PROVIDE #4 THHN/CU GROUND CONDUCTOR TO RACK BY OTHERS.
- EXTEND NEW FIRE ALARM DEVICES TO EXISTING FIRE ALARM SYSTEM. VERIFY ALL LOCATIONS W/GENERAL CONTRACTOR AND OTHER TRADES PRIOR TO STARTING INSTALLATION. OBTAIN CITY OF MADISON FD APPROVAL. REFER TO SECTION 28 30 00 FIRE ALARM SYSTEMS FOR FURTHER REQUIREMENTS.
- DATA CABLES FROM WALL STATION TO DATA RACK PATCH PANEL IN DATA CLOSET 100 BY OWNER IT VENDOR; RACEWAYS BY ELECTRICAL CONTRACTOR.
- LABEL EXISTING PANEL 'GRPS-1' AND CIRCUIT BREAKER SERVING PANEL AT MAIN ELECTRICAL SERVICE SWITCHBOARD.
- DOOR ACCESS RACEWAY SYSTEM BY ELECTRICAL CONTRACTOR, CABLING BY OWNER'S DOOR ACCESS VENDOR.
- REWIRE NEW FAN MOTORS AND VFD'S PROVIDED BY HVAC TRADE. REUSE EXISTING CONDUCTORS AND RACEWAYS.



2 PARTIAL PLAN - NEW DATA CLOSET
1/4" = 1'-0"

DATE OF ISSUE: 8/29/2018

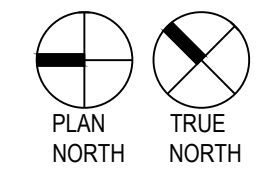
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PROJECT # 18031

ELECTRICAL POWER/LV PLAN

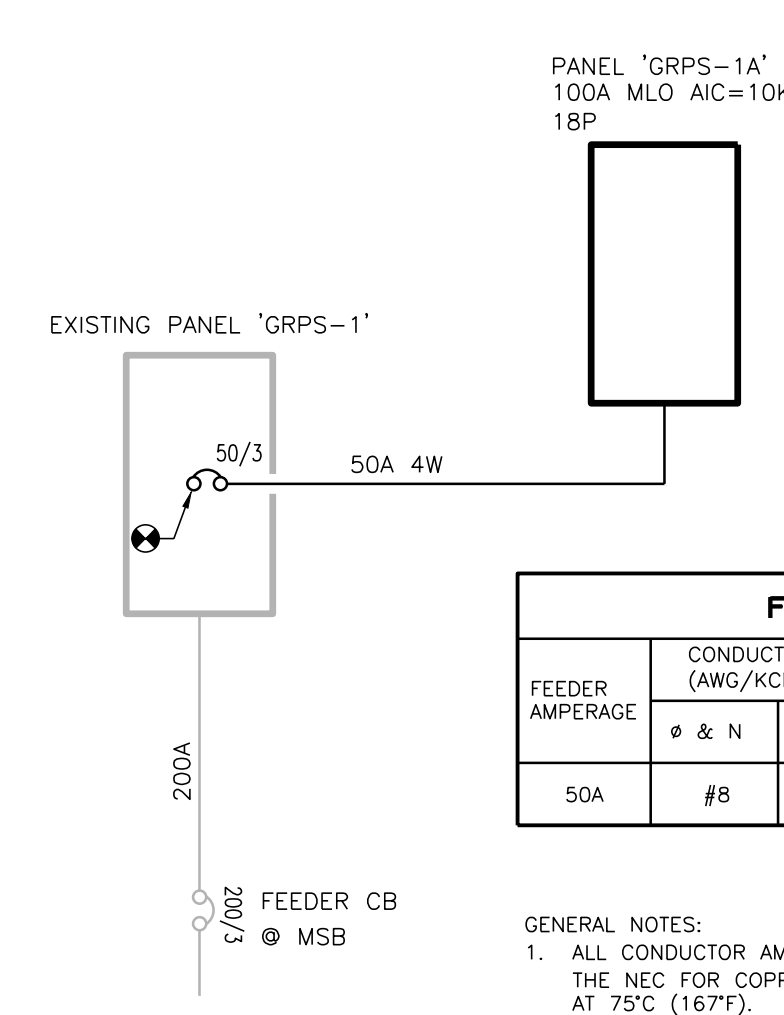
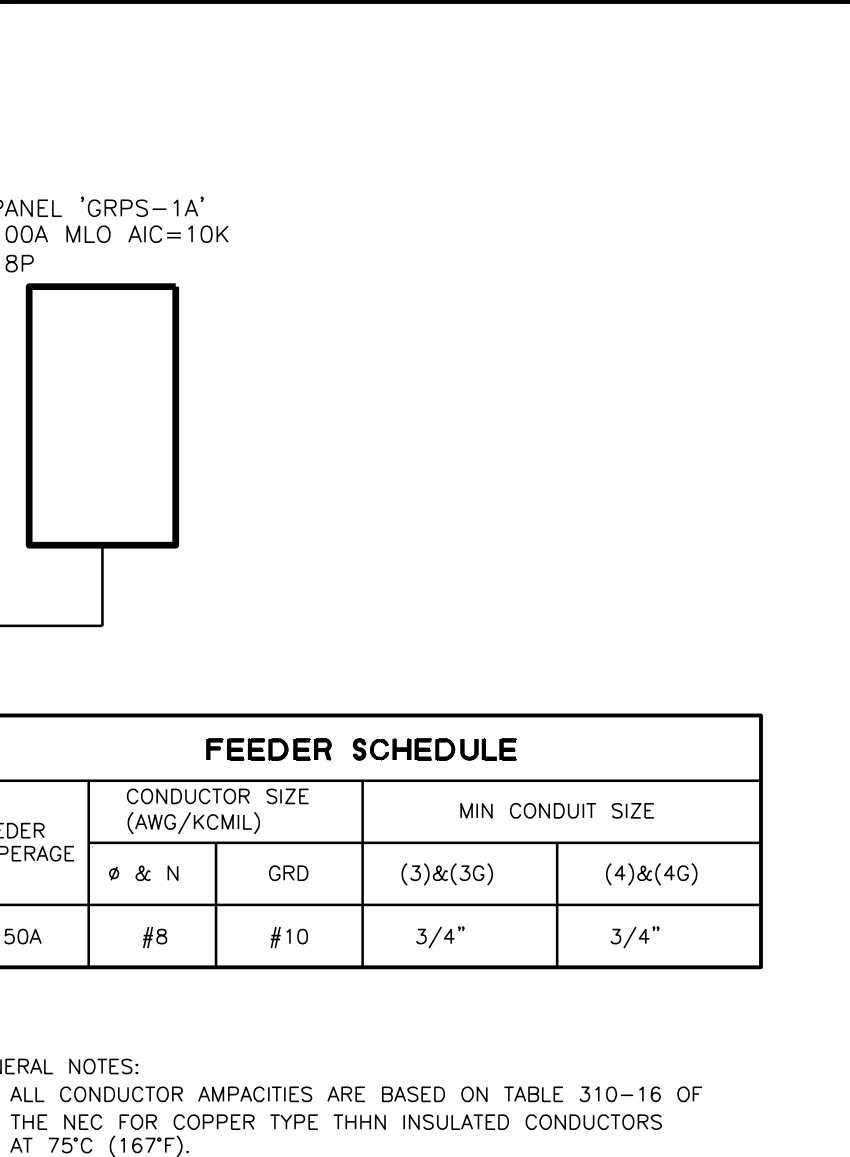
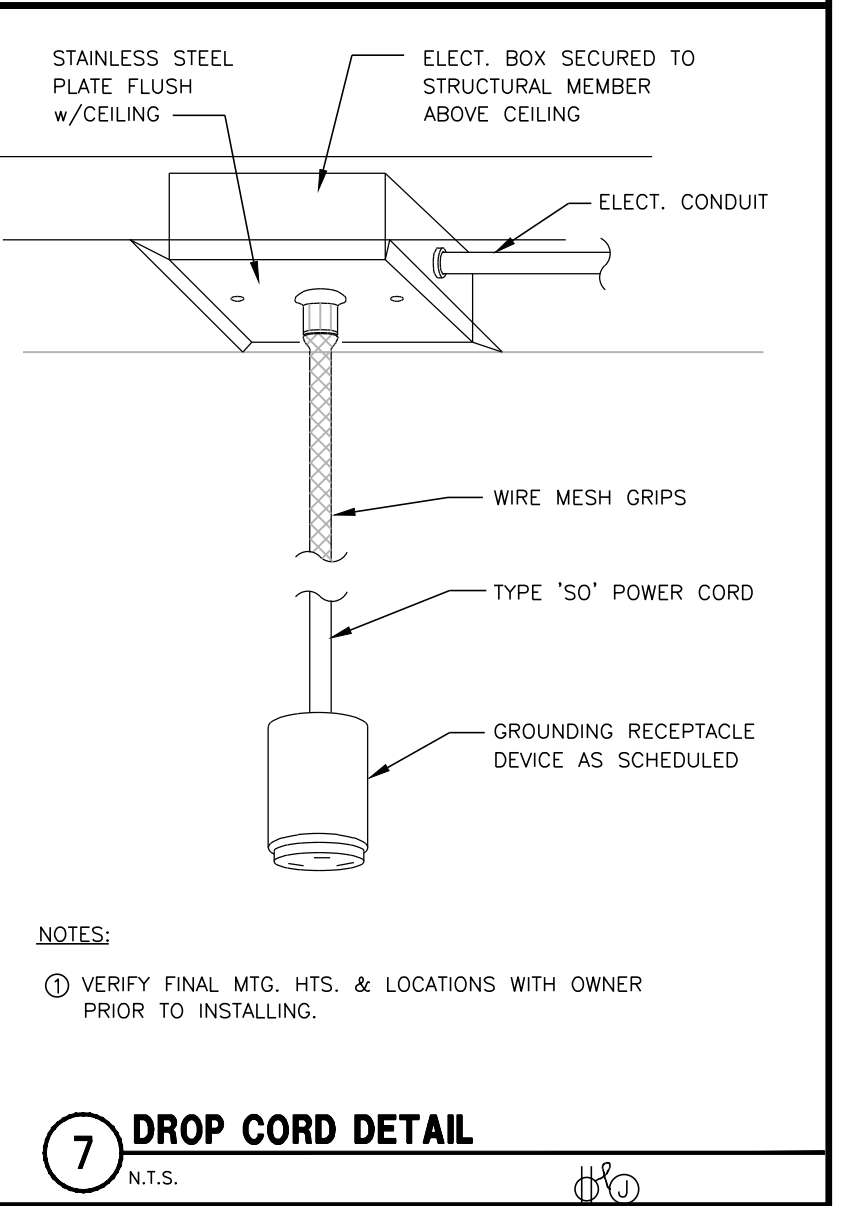
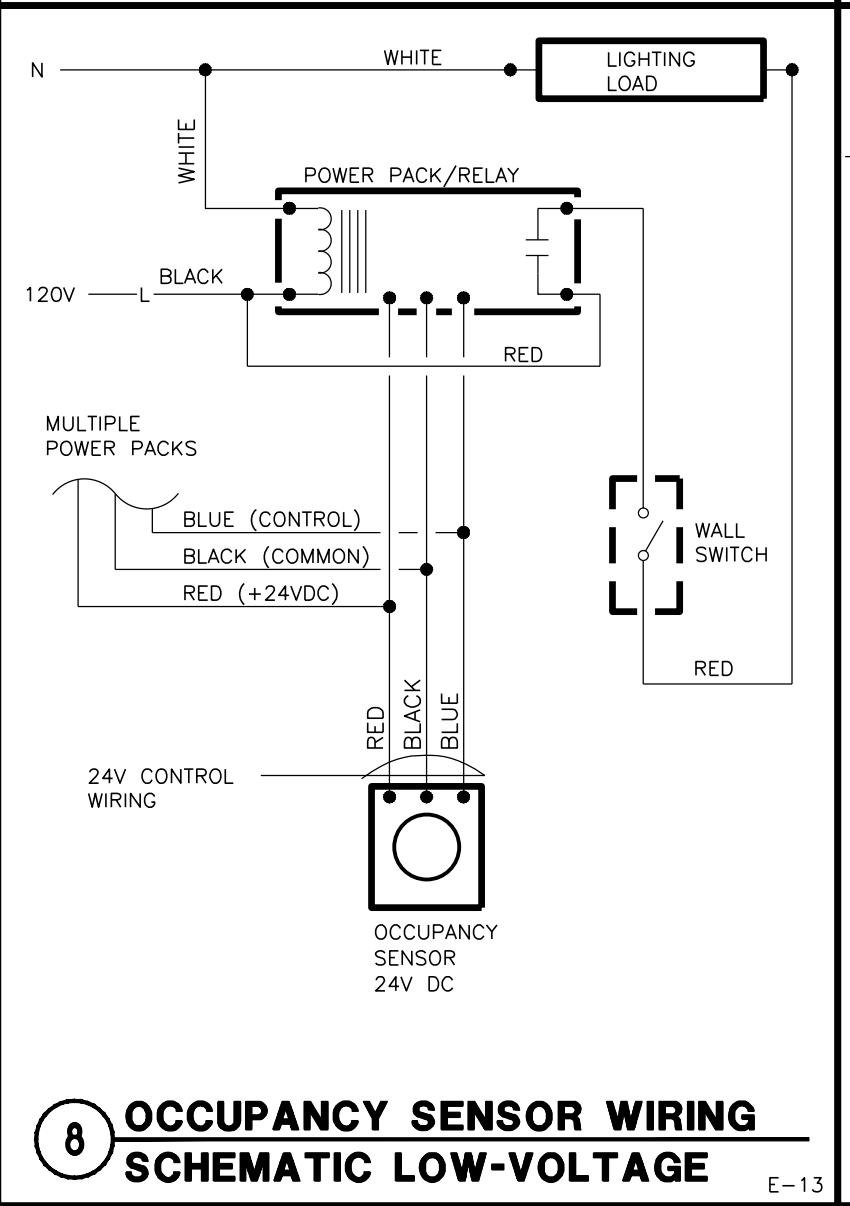
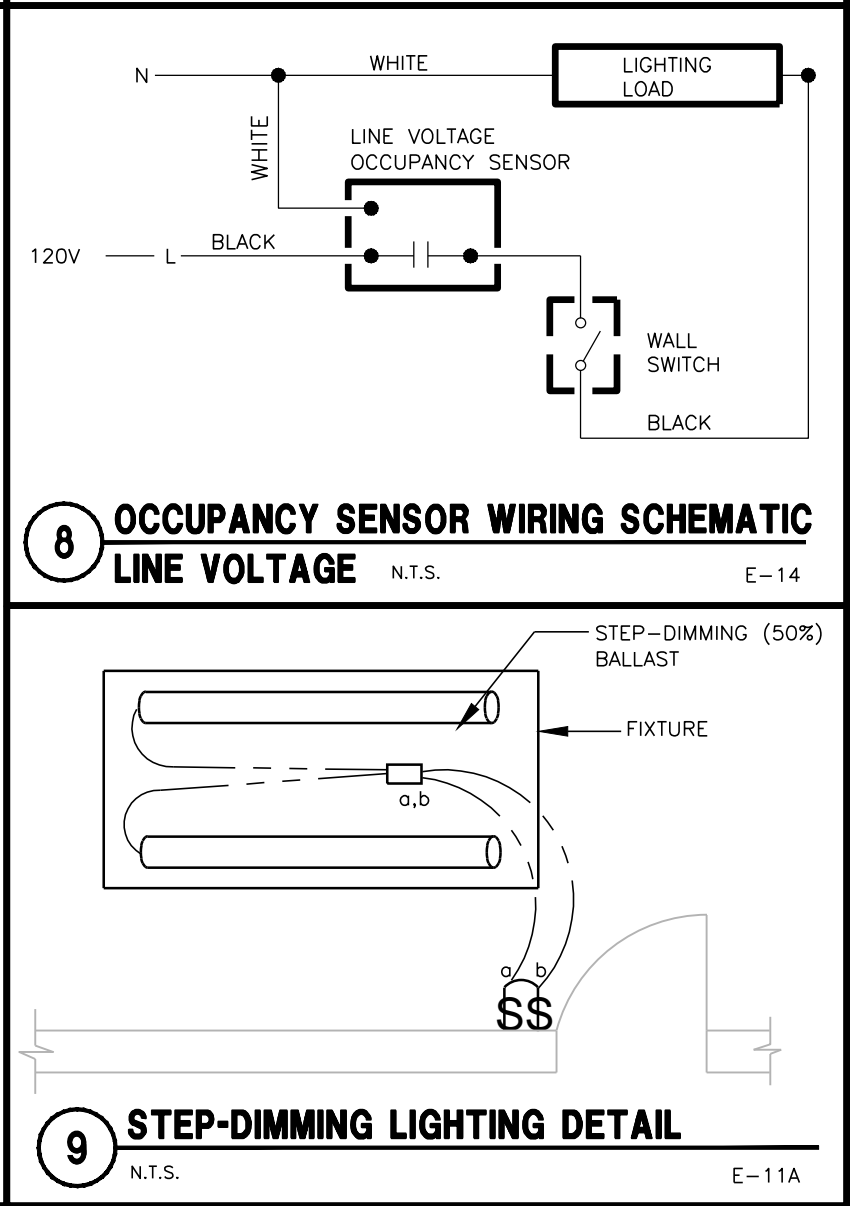
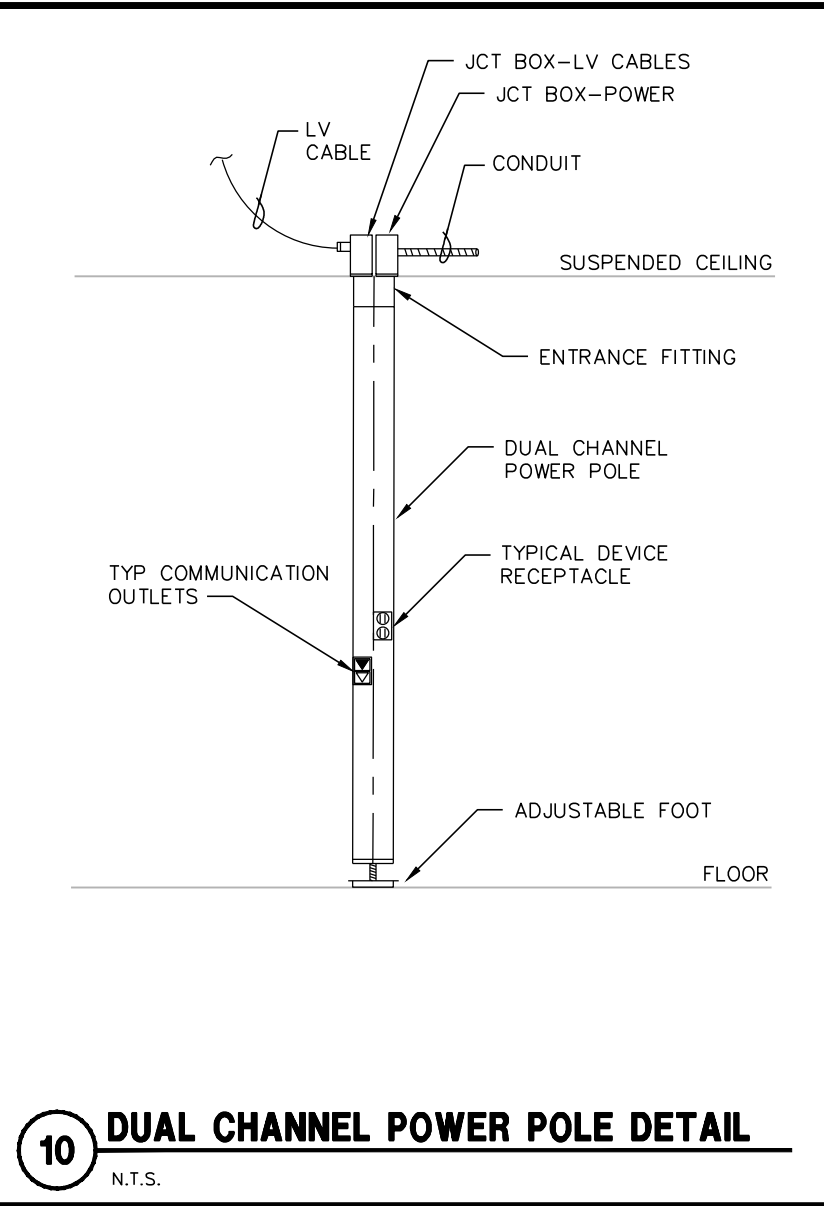
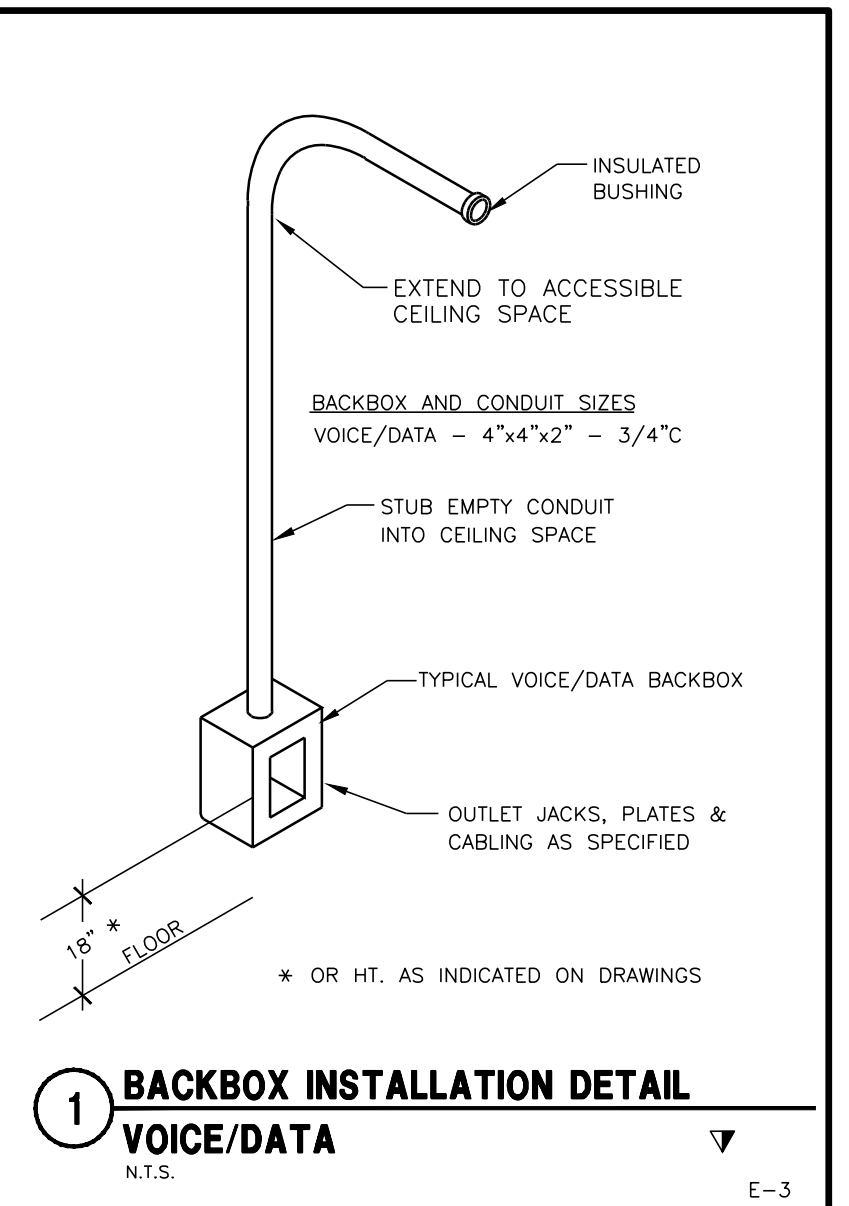
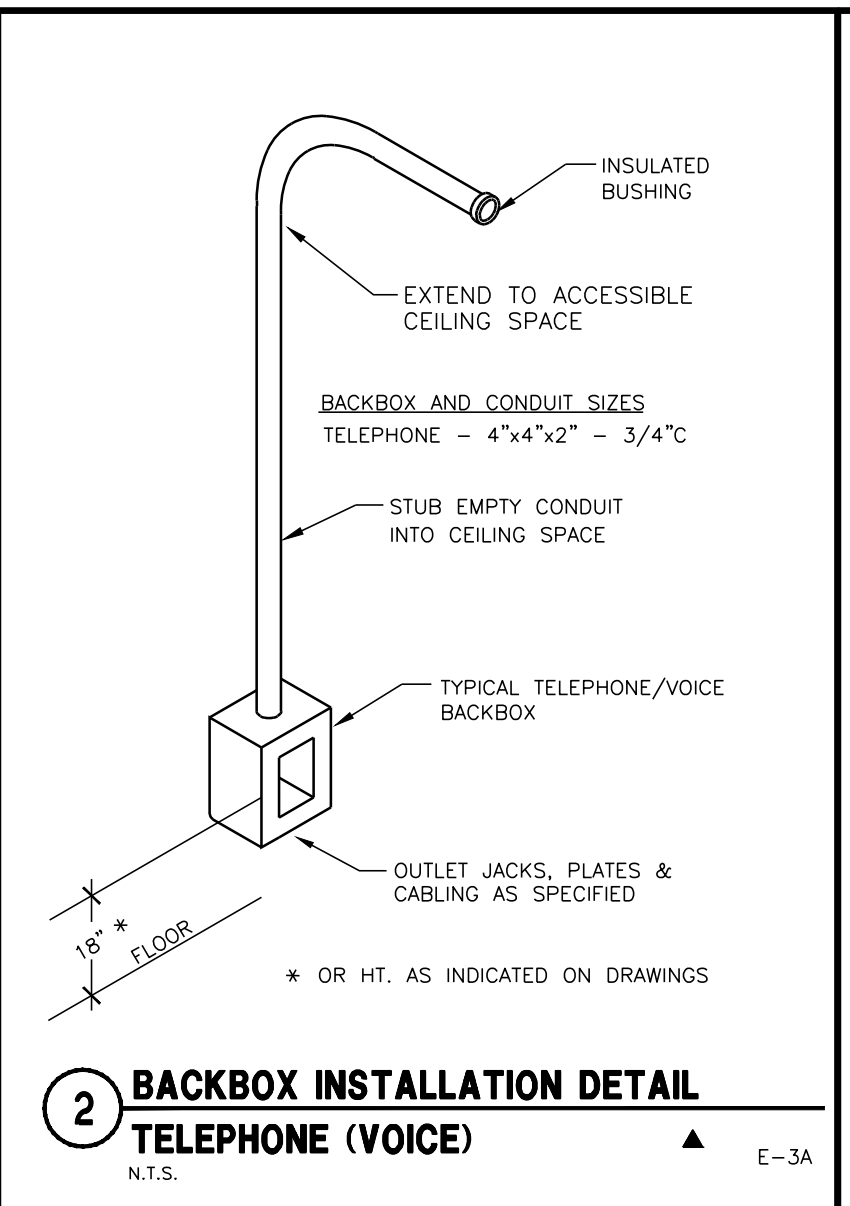
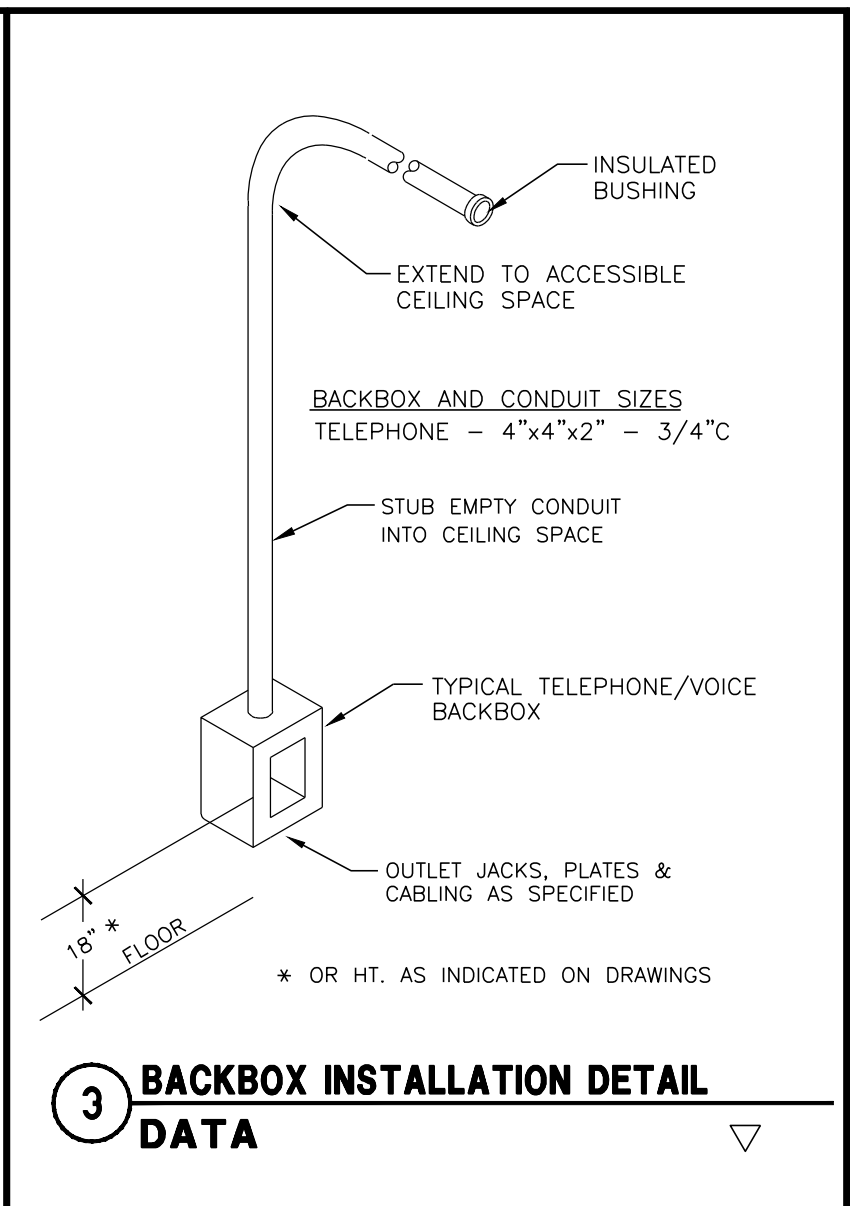
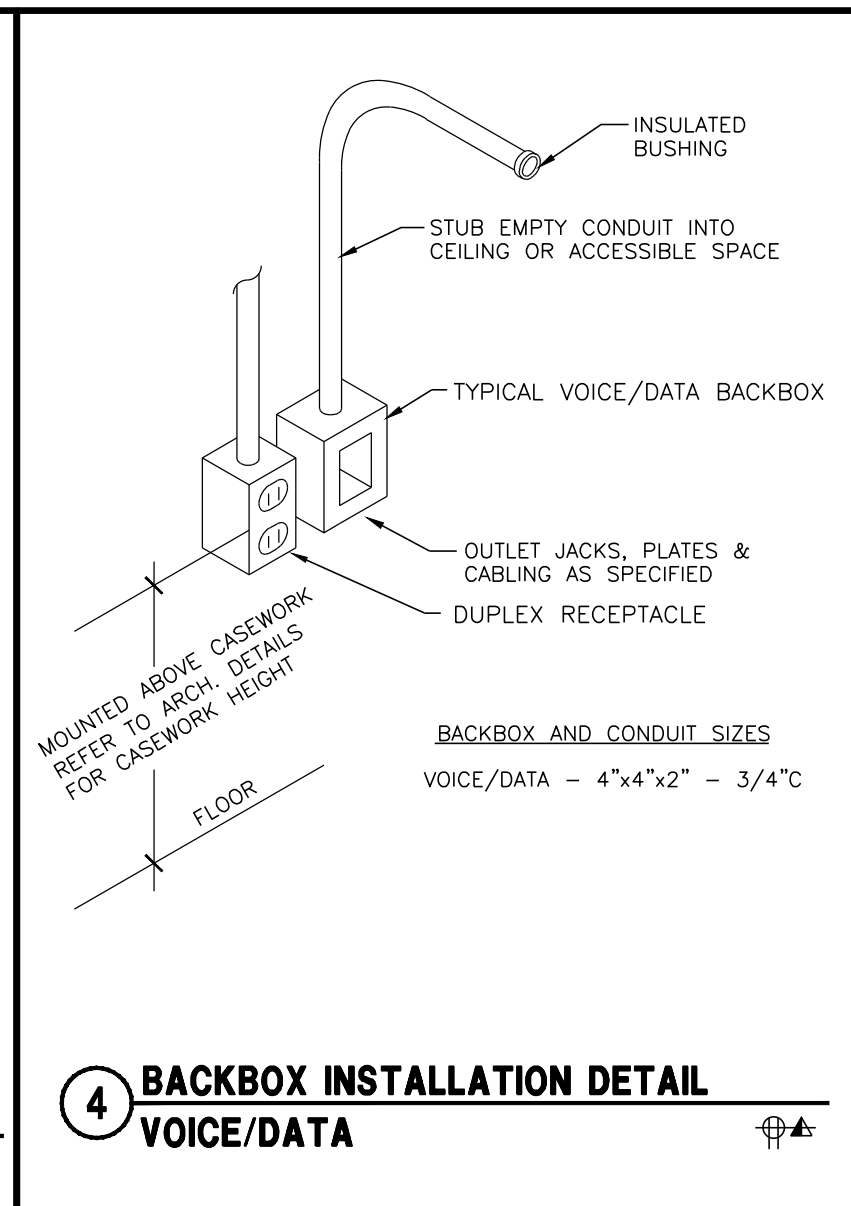
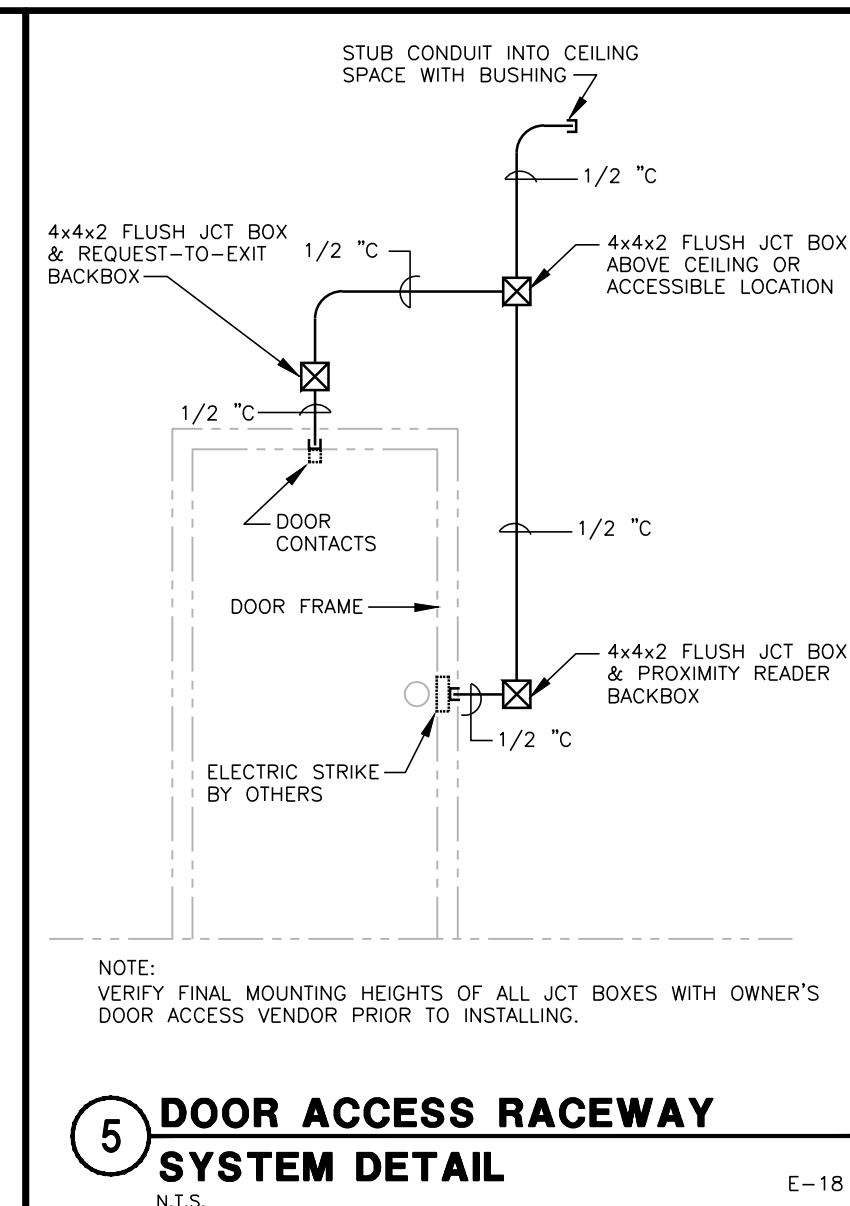
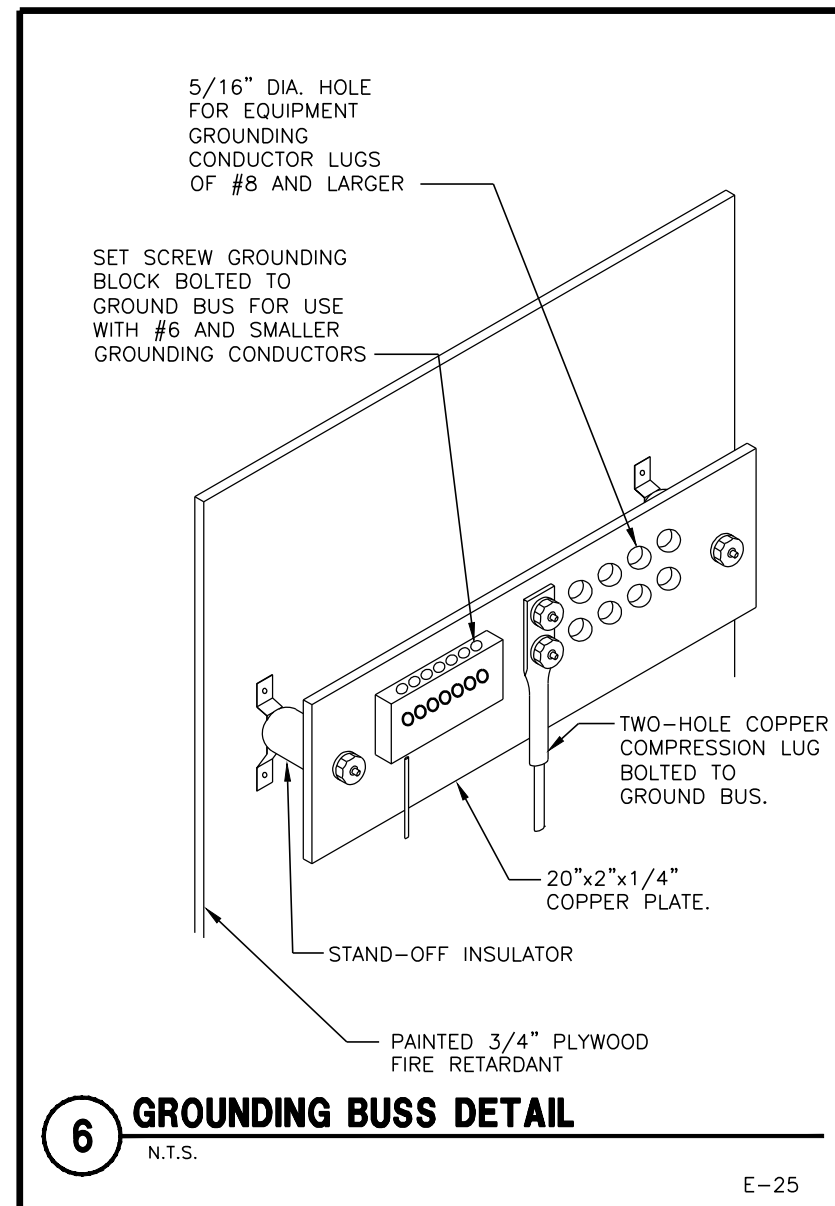
E1.1



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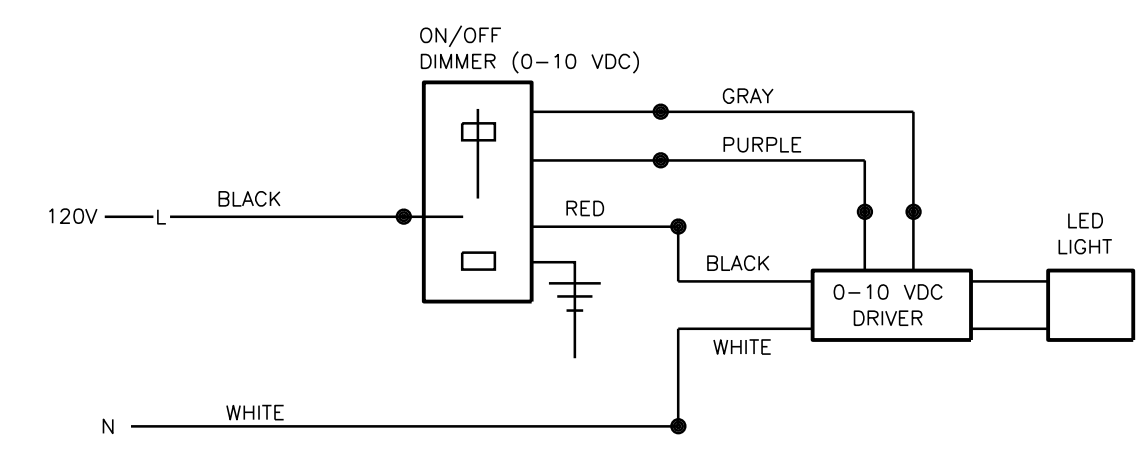
210 MARTIN LUTHER KING, JR. BLVD.,
MADISON, WI 53703

RFB No. 318037



| FEEDER SCHEDULE | | | | |
|-----------------|----------------------------|-----|------------------|----------|
| FEEDER AMPERAGE | CONDUCTOR SIZE (AWG/KCMIL) | | MIN CONDUIT SIZE | |
| | # & N | GRD | (3)&(3C) | (4)&(4C) |
| 50A | #8 | #10 | 3/4" | 3/4" |

GENERAL NOTES:
1. ALL CONDUCTOR AMPACITIES ARE BASED ON TABLE 310-16 OF THE NEC FOR COPPER TYPE THHN INSULATED CONDUCTORS AT 75°C (167°F).



DATE OF ISSUE: 8/29/2018

REVISIONS:

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PROJECT # 18031

ELECTRICAL DETAILS