**RFB NO. 318029**

# 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. 318029
## FISH HATCHERY HIGHWAY GARAGE - CNG RETROFIT
## FISH HATCHERY HIGHWAY GARAGE
## 2302 FISH HATCHERY ROAD
## MADISON, WISCONSIN

Due Date / Time: **TUESDAY, APRIL 21, 2020 / 2:00 P.M.**

Location: **PUBLIC WORKS OFFICE**

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

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

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FOR INFORMATION ON THIS REQUEST FOR BIDS, PLEASE CONTACT:

Eric Urtes, AIA, Project Manager
Telephone No.: 608/266-4798
Fax No.: 608/267-1533
E-Mail: Urtes.Eric@countyofdane.com

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**DRAWINGS**
Plot drawings on 22” x 34” (ANSI D) paper for correct scale or size.

END OF SECTION

**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, APRIL 21, 2020**

**RFB NO. 318029**

**FISH HATCHERY HIGHWAY GARAGE - CNG RETROFIT**

**FISH HATCHERY HIGHWAY GARAGE**

**2302 FISH HATCHERY ROAD, MADISON, WI**

Dane County is inviting Bids for construction services to retrofit a highway department garage facility to accommodate repair work on Compressed Natural Gas (CNG) vehicles. Construction work includes installation of a CNG detection/ventilation system, building fire alarm system, electrical system upgrades, and architectural modifications. Only firms with capabilities, experience & expertise with similar projects should obtain this Request for Bids (RFB) document & submit Bids.

RFB document may be obtained on **March 12 (Thursday), 2020** after **2:00 p.m.** by downloading it from bids-pwht.countyofdane.com. Please call Eric Urtes, AIA - Project Mgr., at 608/266-4798 or e-mail: urtes.eric@countyofdane.com , or our Public Works office at 608/266-4018, for any questions or additional information.

All Bidders must be qualified as, or apply to be a Best Value Contractor before Bid Due Date. Complete Pre-qualification Application for Contractors at pwht.countyofdane.com/bvc_application.aspx or obtain one by calling 608/267-0119.

A pre-bid facility tour will be held March 25 (Wednesday), 2020 at 10:00 a.m. at the Fish Hatchery Highway Garage starting at the front lobby area. Bidders are strongly encouraged to attend this tour.

**PUBLISH:** **MARCH 10 & MARCH 17, 2020 - WISCONSIN STATE JOURNAL**
**MARCH 10 & MARCH 17, 2020 - THE DAILY REPORTER**

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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 March 25, 2020 at 10:00 a.m. at the Fish Hatchery Highway Garage, 2302 Fish Hatchery Road, Madison. Attendance by all bidders is optional, however bidders and subcontractors are strongly encouraged to attend.

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

## 2. DRAWINGS AND SPECIFICATIONS

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

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

## 3. INTERPRETATION

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

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

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

## 4. QUALIFICATIONS OF BIDDER (CONTRACTOR AND SUBCONTRACTOR)

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

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

2. Maintains permanent place of business.

3. Can be bonded for terms of proposed Contract.

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

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

B. County's Public Works Project Manager 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 Manager or designee all such information and data for this purpose as County's Public Works Project Manager 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 Specialist 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 Specialist
City-County Building, Room 356
210 Martin Luther King, Jr. Blvd.
Madison, WI 53703
608/266-4192

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 Specialist 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 Specialist 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. Not Applicable.

## 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**



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

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

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

ESB NAME: _____

CONTACT PERSON: _____

ADDRESS: _____

_____

PHONE NO & EMAIL.: _____

_____

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

**FORM C**



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

COMPANY NAME: _____

PROJECT NAME: _____

BID NO.: _____ BID DUE DATE: _____

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

**FORM D**

**DANE COUNTY**
**EMERGING SMALL BUSINESS REPORT - CERTIFICATION STATEMENT**

I, _____ , _____ of
Name Title

_____ certify to best of my knowledge and
Company

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

_____ _____
Bidder's Signature Date

Name of Bidding Firm: _____

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BID FORM

**BID NO. 318029**
**PROJECT: FISH HATCHERY HIGHWAY GARAGE - CNG RETROFIT**
**FISH HATCHERY HIGHWAY GARAGE**

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

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

**BASE BID - LUMP SUM:**
Dane County is inviting Bids for construction services to retrofit a highway department garage facility to accommodate repair work on Compressed Natural Gas (CNG) vehicles. Construction work includes installation of a CNG detection / ventilation system, building fire alarm system, electrical system upgrades, and architectural modifications. 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 Department of Public Works, Highway & Transportation must have this project completed by December 18, 2020. Assuming this Work can be started by June 16, 2020, 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 agrees to be qualified as a Best Value Contractor or will prove their exemption. New or updated applications are due on or before Bid Due Date / Time; qualification or rejection will be complete within five (5) business days after Bid Due Date.

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: _____

END OF SECTION

**THIS PAGE IS FOR BIDDERS' REFERENCE**

## DO NOT SUBMIT WITH BID FORM.

**BID CHECK LIST:**
These items **must** be included with Bid:
☐ Bid Form ☐ Bid Bond ☐ Fair Labor Practices Certification

**DANE COUNTY BEST VALUE CONTRACTING QUALIFICATION**

General Contractors & all Subcontractors must be qualified as a Best Value Contractor with the Dane County Public Works Engineering Division. Qualification & listing is not permanent & must be renewed every 24 months. Complete a *Best Value Contracting Application* online at:
pwht.countyofdane.com/bvc_application.aspx

**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?

**COUNTY OF DANE**

**PUBLIC WORKS CONSTRUCTION CONTRACT**

Contract No. _____ Bid No. 318029

Authority: 2019 RES -_____

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

**W I T N E S S E T H :**

**WHEREAS,** COUNTY, whose address is c/o Deputy Public Works Director, 1919 Alliant Energy Center Way, Madison, WI 53713, desires to have CONTRACTOR provide Fish Hatchery Highway Garage - CNG Retrofit at the Fish Hatchery Highway Garage, 2302 Fish Hatchery Road, Madison, ("the Project"); and

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

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

**1.** CONTRACTOR agrees to construct, for the price of $_____ the Project and at the CONTRACTOR'S own proper cost and expense to furnish all materials, supplies, machinery, equipment, tools, superintendence labor, insurance, and other accessories and services necessary to complete the Project in accordance with the conditions and prices stated in the Bid Form, General Conditions of Contract, the drawings which include all maps, plats, plans, and other drawings and printed or written explanatory matter thereof, and the specifications therefore as prepared by Engineering 370, LLC., (hereinafter referred to as "the Architect / Engineer"), and as enumerated in the Project Manual Table of Contents, all of which are made a part hereof and collectively evidence and constitute the Contract.

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

**3.** During the term of this Contract, CONTRACTOR agrees to take affirmative action to ensure equal employment opportunities. The CONTRACTOR agrees in accordance with Wisconsin Statute 111.321 and Chapter 19 of the Dane County Code of Ordinances not to discriminate on the basis of age, race, ethnicity, religion, color, gender, disability, marital status, sexual orientation, national origin, cultural differences, ancestry, physical appearance, arrest record or conviction record, military participation or membership in the national guard, state defense force or any other reserve component of the military forces of the United States, or political beliefs. Such equal opportunity shall include, but not be limited to, the following: employment,

upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation. CONTRACTOR agrees to post in conspicuous places, available to all employees and applicants for employment, notices setting forth the provisions of this paragraph.

**4.** CONTRACTOR shall file an Affirmative Action Plan with the Dane County Contract Compliance Specialist 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 Office of Equity & Inclusion, 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 Specialist 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 and subcontractors must be qualified as, or apply to be a Best Value Contractor with Dane County Public Works Engineering Division before Bid Due Date. All contractors must be qualified as a Best Value Contractor to perform any work under this Contract.

**10.** Not Used.

**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 [Deputy Public Works, Waste & Renewables] Director.

**FOR COUNTY:**

Joseph T. Parisi, County Executive Date

Scott McDonell, County Clerk Date

# AIA® Document A310™ – 2010

## *Bid Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

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

**OWNER:**
*(Name, legal status and address)*

**BOND AMOUNT:**

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

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

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

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

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

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

Signed and sealed this day of

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

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

Init.
/

# AIA® Document A312™ – 2010

## *Performance Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

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

**OWNER:**
*(Name, legal status and address)*

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

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

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

**CONSTRUCTION CONTRACT**
Date:

Amount:

Description:
*(Name and location)*

**BOND**
Date:
*(Not earlier than Construction Contract Date)*

Amount:

Modifications to this Bond: ☐ None ☐ See Section 16

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

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

*(FOR INFORMATION ONLY — Name, address and telephone)*

**AGENT** or **BROKER:**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**§ 14 Definitions**

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

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

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

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

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

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

**§ 16** Modifications to this bond are as follows:



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

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

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

# AIA® Document A312™ – 2010

## *Payment Bond*

**CONTRACTOR:**
*(Name, legal status and address)*

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

**OWNER:**
*(Name, legal status and address)*

**CONSTRUCTION CONTRACT**
Date:

Amount:

Description:
*(Name and location)*

**BOND**
Date:
*(Not earlier than Construction Contract Date)*

Amount:

Modifications to this Bond: ☐ None ☐ See Section 18

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**§ 16 Definitions**

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

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

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

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

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

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

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

**§ 18** Modifications to this bond are as follows:



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

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

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.

SECTION 00 72 12

GENERAL CONDITIONS OF CONTRACT

TABLE OF CONTENTS

## 1. CONSTRUCTION DOCUMENTS

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

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

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

## 2. DEFINITIONS

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

## 3. ADDITIONAL INSTRUCTIONS AND DRAWINGS

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

## 4. SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

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

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

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

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

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

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

G. Contractor shall keep on site of the Work, approved or conformed copy of Shop Drawings and shall at all 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 does not need to pay State and local sales & use taxes. See Wisconsin Statute 77.54 (9m).

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

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

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

**13. CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE**

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

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

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

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

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

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

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

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

**14. WEATHER CONDITIONS**

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

## 15. PROTECTION OF WORK AND PROPERTY

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

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

## 16. INSPECTION AND TESTING OF MATERIALS

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

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

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

D. Cost of any testing performed by manufacturers or Contractor for substantiating acceptability of proposed substitution of materials and equipment, or necessary conformance testing in conjunction with manufacturing processes or factory assemblage, shall be borne by Contractor or manufacturer responsible.

## 17. REPORTS, RECORDS AND DATA

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

**18. CHANGES IN THE WORK**

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

B. If Contractor claims that by any instructions given by Architect / Engineer, Department, by drawings or otherwise, regarding performance of the Work or furnishing of material under

Contract, involves extra cost, Contractor shall give Department written notice of cost thereof within two (2) weeks after receipt of such instructions and in any event before proceeding to execute work, unless delay in executing work would endanger life or property.

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

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

**19. EXTRAS**

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

**20. TIME FOR COMPLETION**

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

**21. CORRECTION OF WORK**

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

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

**22. SUBSURFACE CONDITIONS FOUND DIFFERENT**

A. If Contractor encounters subsurface or latent conditions at site materially differing from those shown on Drawings or indicated in Specifications, Contractor shall immediately give notice to Architect / Engineer and Public Works Project Manager of such conditions before they are disturbed. Architect / Engineer will thereupon promptly investigate conditions, and if Architect / Engineer finds that they materially differ from those shown on Drawings or indicated in Specifications, Architect / Engineer will at once make such changes as necessary, any increase or decrease of cost resulting from such changes to be adjusted in manner provided in above Article 18 entitled "Changes in the Work".

## 23. RIGHT OF DEPARTMENT TO TERMINATE CONTRACT

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

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

## 24. CONSTRUCTION SCHEDULE AND PERIODIC ESTIMATES

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

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

C. Progress Reporting:
   1. Contractor shall update and publish Construction Schedule on monthly basis. Revisions to Schedule shall be by Contractor and made in same detail as original Schedule and accompanied by explanation of reasons for revision; and shall be subject to approval by Department.
   2. Failure of Contractor to keep Schedule in updated format shall result in County hiring firm specializing in construction schedule development and deducting those costs associated with updating process from payments due Contractor.
   3. Contractor shall submit show actual percentage of each activity completed, estimated future progress, and anticipated completion time.

D. Responsibility for timely completion requires:

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

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

## 25. PAYMENTS TO CONTRACTOR

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

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

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

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

E. Application and Certificate for Payment for preparatory work and materials delivered and suitably stored at site to be incorporated into the Work at some future period, will be given due consideration. Requesting payment for materials stored off site, may be rejected, however, if deemed essential for reasons of job progress, protection, or other sufficient cause, requests will be considered, conditional upon submission by Contractor of bills of sale, photographs and such other procedures as will adequately protect County's interest such as storage in bonded warehouse with adequate coverage. If there is any error in payment, Contractor is obligated to notify Department immediately, but no longer than ten (10) business days from receipt of payment.

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

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

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

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

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

K. Every contractor engaged in performance of any contract for Department of Public Works, Highway & Transportation shall submit to this Department, as requested and with final application for payment for work under said contract, affidavit(s) as required to prove that all debts and claims against this Work are paid in full or otherwise satisfied, and give final evidence of release of all liens against the Work and County.

**26. WITHHOLDING OF PAYMENTS**

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

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

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

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

## 27. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

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

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

## 28. PAYMENTS BY CONTRACTOR

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

## 29. CONTRACT SECURITY

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

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

## 30. ASSIGNMENTS

A. Contractor shall not assign whole or any part of this Contract or any moneys due or to become due hereunder without written consent of Department. In case Contractor assigns all or any part of any moneys due or to become due under this Contract, instrument of assignment shall contain clause substantially to effect that it is agreed that right of assignee in and to any moneys due or to become due to Contractor shall be subject to prior claims of all persons, firms and corporations for services rendered or materials supplied for performance of the Work called for in this Contract.

## 31. MUTUAL RESPONSIBILITY OF CONTRACTORS

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

boards, commissions, agencies, officers, employees and representatives against any such claim.

## 32. SEPARATE CONTRACTS

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

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

## 33. SUBCONTRACTS

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

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

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

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

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

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

## 34. PROJECT MANAGER'S AUTHORITY

A. Public Works Project Manager shall:
   1. Administer and ensure compliance with Construction Documents;

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

## 35. ARCHITECT / ENGINEER'S AUTHORITY

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

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

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

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

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

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

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

## 36. STATED ALLOWANCES

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

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

## 37. ESTIMATES OF QUANTITIES

A. Whenever estimated quantities of work to be done and materials to be furnished under this Contract are shown in any of Construction Documents, they are given for use in comparing

bids and right is especially reserved to increase or diminish them as they may be deemed reasonably necessary or desirable by Department to complete the Work included in this Contract, and cost for such increase or diminution shall be adjusted in manner provided for in General Conditions of Contract Article 18 entitled "Changes in the Work".

**38. LANDS AND RIGHTS-OF-WAY**

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

**39. GENERAL GUARANTEE**

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

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

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

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

**40. CONFLICTING CONDITIONS**

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

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

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

**41. NOTICE AND SERVICE THEREOF**

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

## 42. PROTECTION OF LIVES AND HEALTH

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

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

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

A. Affirmative Action Provisions.
   1. During term of their Contract, Contractor agrees not to discriminate on basis of race, religion, color, sex, handicap, age, sexual preference, marital status, physical appearance, or national origin against any person, whether recipient of services (actual or potential), employee, or applicant for employment. Such equal opportunity shall include but not be limited to following: employment, upgrading, demotion, transfer, recruitment, advertising, layoff, termination, training, rates of pay, and any other form of compensation or level of service(s). Contractor agrees to post in conspicuous places, these affirmative action standards so as to be visible to all employees, service recipients and applicants for this paragraph. Listing of prohibited bases for discrimination shall no be construed to amend in any fashion state or federal law setting forth additional bases and exceptions shall be permitted only to extent allowable in state or federal law.
   2. Contractor is subject to this Article only if Contractor has ten (10) or more employees and receives $10,000.00 or more in annual aggregate contracts with County. Contractor shall file and Affirmative Action Plan with Dane County Contract Compliance Officer in accord with Chapter 19 of Dane County Code of Ordinances. Such plan must be filed within fifteen (15) business days of effective date of this Contract and failure to do so by said date shall constitute ground for immediate termination of Contract by County. Contractor shall also, during term of this Contract, provide copies of all announcements of employment opportunities to County's Contract Compliance Office, and shall report annually number of persons, by race, sex and handicap status, who apply for employment, and, similarly classified, number hired and number rejected.
   3. Contact Dane County Contract Compliance Officer at Dane County Contract Compliance Office, 210 Martin Luther King, Jr. Blvd., Room 421, Madison, WI 53703, 608/266-4114.
   4. In all solicitations for employment placed on Contractor's behalf during term of this Contract, Contractor shall include statement to affect Contractor is "Equal Opportunity Employer". Contractor agrees to furnish all information and reports required by County's Contract Compliance Officer as same relate to affirmative action and nondiscrimination, which may include any books, records, or accounts deemed appropriate to determine compliance with Chapter 19, Dane County Code of Ordinances, and provision of this Contract.

B. Minority / Women / Disadvantaged / Emerging Small Business Enterprises.

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

## 44. COMPLIANCE WITH FAIR LABOR STANDARDS

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

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

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

## 45. DOMESTIC PARTNERSHIP BENEFITS

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

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

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

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

**48. CLAIMS**

A. No claim may be made until Department's Deputy 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 Deputy Public Works Director the claim may be filed under Wisconsin Statute 893.80. Work shall progress during period of any dispute or claim. Unless specifically agreed between parties, venue will be in Dane County, Wisconsin.

**49. ANTITRUST AGREEMENT**

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

**50. INSURANCE**

A. Contractor Carried Insurance:
   1. Contractor shall not commence work under this Contract until Contractor has obtained all insurance required under this Article and has provided evidence of such insurance to Risk Manager, 425 City-County Building, 210 Martin Luther King Jr. Blvd., Madison, WI 53703. Contractor shall not allow any subcontractor to commence work until insurance required of subcontractor has been so obtained and approved. Company providing insurance must be licensed to do business in Wisconsin.
   2. Worker's Compensation Insurance:
      a) Contractor shall procure and shall maintain during life of this Contract, Worker's Compensation Insurance as required by statute for all of Contractor's employees engaged in work at site of project under this Contract and, in case of any such work sublet, Contractor shall require subcontractor similarly to provide Worker's Compensation Insurance for all of latter's employees to be engaged in such work unless such employees are covered by protection afforded by Contractor's Worker's Compensation Insurance.
      b) If any claim of employees engaged in hazardous work on project under this Contract is not protected under Worker's Compensation Statute, Contractor shall provide and

shall cause each subcontractor to provide adequate Employer's Liability Insurance for protection of such of Contractor's employees as are not otherwise protected.

3. Contractor's Public Liability and Property Damage Insurance:
   a) Contractor shall procure and maintain during life of this Contract, Contractor's Public Liability Insurance and Contractor's Property Damage Insurance in amount not less than $1,000,000 bodily injury, including accidental death, to any one person, and subject to same limit for each person, in amount not less than $1,000,000 on account of one accident, and Contractor's Property Damage Insurance in amount not less then $1,000,000 or combined single limit of at least $1,000,000 with excess coverage over and above general liability in amount not less than $5,000,000. Contractor shall add "Dane County" as additional insured for each project.
   b) Contractor's Public Liability and Property Damage Insurance shall include Products, Completed Operation, and Contractual Liability under Insurance Contract. "Contractor shall in all instances save, defend, indemnify and hold harmless County and Architect / Engineer against all claims, demands, liabilities, damages or any other costs which may accrue in prosecution of the Work and that Contractor will save, defend, indemnify and hold harmless County and Architect / Engineer from all damages caused by or as result of Contractor's operations" and each shall be listed as additional insured on Contractor's and subcontractors' 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.

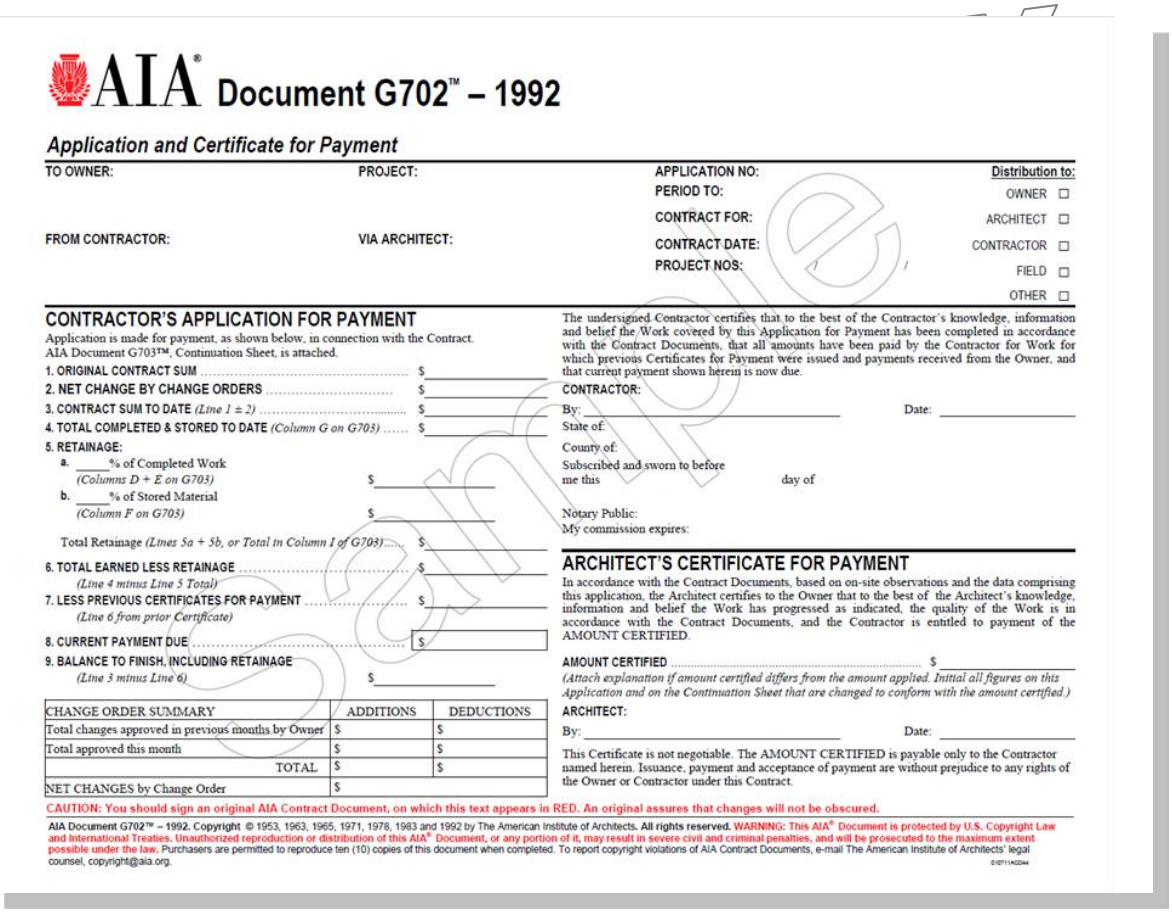
END OF SECTION

SECTION 00 73 00

SUPPLEMENTARY CONDITIONS

## 1. APPLICATION & CERTIFICATE FOR PAYMENT

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



AIA® Document G702™ – 1992

*Application and Certificate for Payment*

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

**CONTRACTOR'S APPLICATION FOR PAYMENT**

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

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

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

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

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

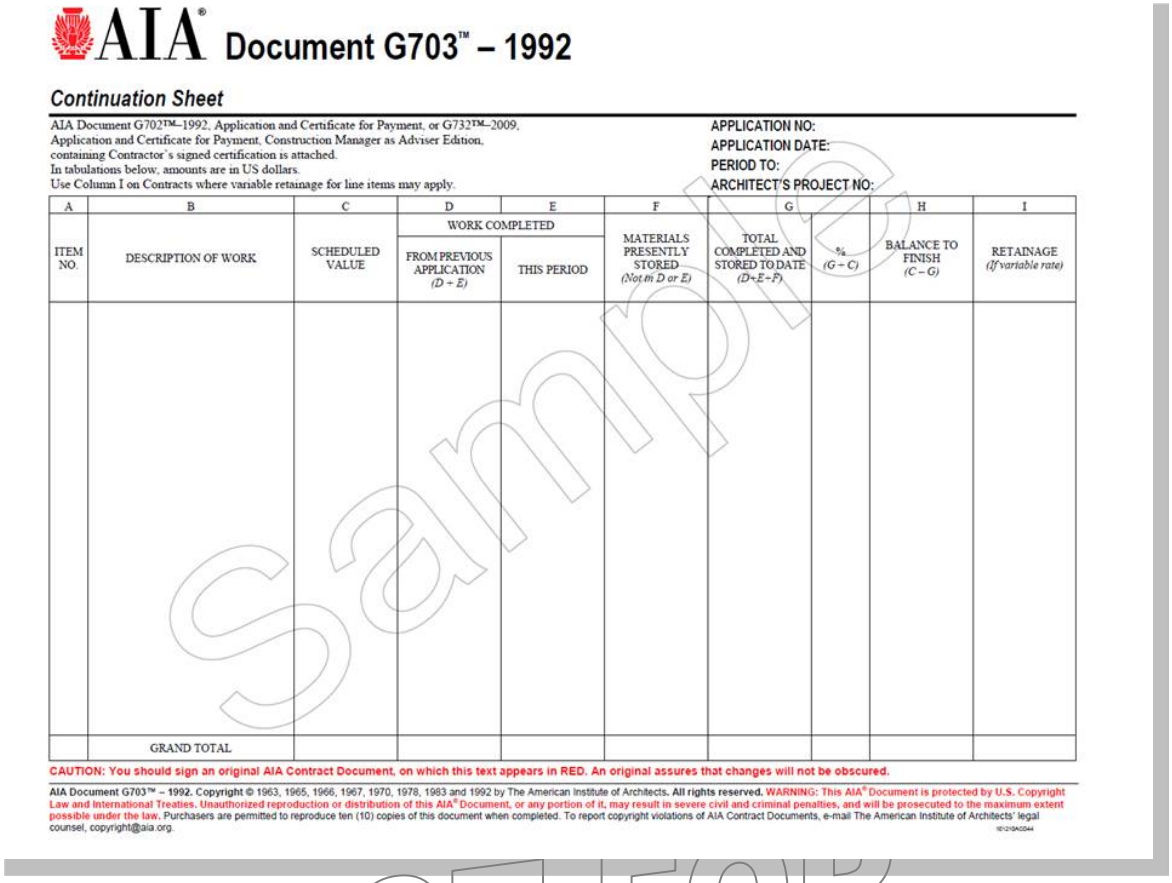
**ARCHITECT'S CERTIFICATE FOR PAYMENT**

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

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

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

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



AIA® Document G703™ – 1992

*Continuation Sheet*

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

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

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

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







**2. INSURANCE**

A. Not Used.

**3. ASBESTOS DISPOSAL PROCEDURES**

A. Not Used.

END OF SECTION

Department of Public Works, Highway & Transportation
**Public Works Engineering Division**
**608/266-4018**

Gerald J. Mandli, P.E.
**Commissioner / Director**

Joseph T. Parisi
**County Executive**

**Deputy Director**
Todd Draper

1919 Alliant Energy Center Way
Madison, Wisconsin 53713
Fax: 608/267-1533
www.countyofdane.com/pwht/public_works.aspx

# BEST VALUE CONTRACTING APPLICATION

## CONTRACTORS / LICENSURE APPLICANTS

The Dane County Department of Public Works requires all contractors & subcontractors to be a best value contractor before being hired. Application documents are due to the County prior to Bid Due Date. Approval or rejection shall be within five (5) days of Bid Due Date. 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 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 application. Failure to do so could result in suspension, revocation of the contractor's 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: https://dwd.wisconsin.gov/apprenticeship/.

## EXEMPTIONS

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

| SEC. | PROOF OF RESPONSIBILITY | CHECK IF APPLICABLE |
|---|---|---|
| 1 | Does your firm possesses all technical qualifications and resources, including equipment, personnel and financial resources, necessary to perform the work required for any project or obtain the same through the use of responsible, qualified subcontractors? | Yes: ☐ No: ☐ |
| 2 | Will your firm possess all valid, effective licenses, registrations or certificates required by federal, state, county, or local law, which are necessary for the type of work to be performed including, but not limited to, those for any type of trade work or specialty work? | Yes: ☐ No: ☐ |
| 3 | Will your firm meet all bonding requirements as required by applicable law or contract specifications? | Yes: ☐ No: ☐ |
| 4 | Will your firm meet all insurance requirements as required by applicable law or specifications, including general liability insurance, workers compensation insurance and unemployment insurance requirements? | Yes: ☐ No: ☐ |
| 5 | Will your firm maintain a substance abuse policy for employees hired for public works contracts that comply with Wis. Stats. Sec. 103.503? | Yes: ☐ No: ☐ |
| 6 | Will your firm fully abide by the equal opportunity and affirmative action requirements of all applicable laws, including County ordinances? | Yes: ☐ No: ☐ |
| 7 | In the past three (3) years, has your firm had control or has another corporation, partnership or other business entity operating in the construction industry controlled it? If so, please attach a statement explaining the nature of the firm relationship? | Yes: ☐ No: ☐ If Yes, attach details. |
| 8 | In the past three (3) years, has your firm had any type of business, contracting or trade license, certification or registration revoked or suspended? | Yes: ☐ No: ☐ If Yes, attach details. |
| 9 | In the past three (3) years, has your firm been debarred by any federal, state or local government agency? | Yes: ☐ No: ☐ If Yes, attach details. |
| 10 | In the past three (3) years, has your firm defaulted or failed to complete any contract? | Yes: ☐ No: ☐ If Yes, attach details. |
| 11 | In the past three (3) years, has your firm committed a willful violation of federal, state or local government safety laws as determined by a final decision of a court or government agency authority. | Yes: ☐ No: ☐ If Yes, attach details. |
| 12 | In the past three (3) years, has your firm been in violation of any law relating to your contracting business where the penalty for such violation resulted in the imposition of a penalty greater than $10,000? | Yes: ☐ No: ☐ If Yes, attach details. |
| 13 | Is your firm an active Wisconsin Trade Trainer as determined by the Wisconsin Bureau of Apprenticeship Standards? | Yes: ☐ No: ☐ |
| 14 | Is your firm exempt from being qualified with Dane County? | Yes: ☐ No: ☐ If Yes, attach reason for exemption. |
| 15 | 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 qualified with the County or become so within five (5) days after the Bid Due Date? | Yes: ☐ No: ☐ |
| 16 | Contractor has been in business less than one year? | Yes: ☐ No: ☐ |
| 17 | Is your firm a first time Contractor requesting a one time exemption, but, intend to comply on all future contracts and are taking steps typical of a “good faith” effort? | Yes: ☐ No: ☐ |

# 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: _____

(Application is invalid without signature)

Print Name: _____ Date: _____

Title: _____

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

# REMEMBER!

**RETURN ALL TO FORMS AND ATTACHMENTS, OR QUESTIONS TO:**

**TODD DRAPER**
**EMAIL: DRAPER@COUNTYOFDANE.COM**
**OFFICE: (608) 267-0119, FAX: (608) 267-1533**

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

# APPENDIX A

**APPRENTICEABLE TRADES:**

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

END OF SECTION

SECTION 00 73 11

FAIR LABOR PRACTICES CERTIFICATION

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

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

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

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

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

_____ _____

Officer or Authorized Agent Signature Date

_____

Printed or Typed Name and Title

_____

Printed or Typed Business Name

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

For reference, Dane County Ordinance 25.09 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.

END OF SECTION

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. 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 to retrofit the Main Highway Facility Garage to accommodate Compressed Natural Gas fueling.

B. Permits: Prior to commencement of the Work, Contractor to secure any and all necessary permits for completion of the Work and facility occupancy. Provide Public Works Project Manager with copies of all permits.

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

1.3 CONTRACTOR USE OF PREMISES

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

B. Coordinate utility outages and shutdowns with Owner.

1.4 APPLICATIONS FOR PAYMENT

A. Submit one (1) notarized electronic copies, in PDF format, of each application on AIA G702™ and G703™ forms or approved contractors invoice form.

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

C. Payment Period: Monthly.

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

1.5 CHANGE PROCEDURES

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

1.6 ALTERNATES

A. Not Used.

1.7 LUMP SUM ALLOWANCES FOR WORK

A. Not Used.

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 Manager 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) hours per week during progress of the Work.

B. Contractor shall not change their project superintendent or project manager for duration of the Work without written permission of Public Works Project Manager.

C. Architect / Engineer shall have representative on site regularly 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. Arrange for temporary parking areas to accommodate construction personnel with Dane County highway staff. Parking shall be available at the Work site.

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. Work shall be done 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.

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

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

D. Each Contractor shall arrange with Owner to make necessary alterations, do new work, make connections to all utilities, etc., and 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.

E. 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.

F. Contractor is not responsible for providing & maintaining temporary toilet facilities.

1.27 PROTECTION

A. Contractor shall protect from damage / injury all trees, shrubs, hedges, plantings, grass, 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.

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

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

1.32 SUBSTITUTIONS

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

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

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

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

1.33 STARTING SYSTEMS

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

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

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

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

1.34 DEMONSTRATION AND INSTRUCTIONS

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

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

C. Owner may choose to 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 Public Works Project Manager with original marked up redlines of Construction Documents' drawings and specifications that shall include all Addendums, Change Orders, Construction Bulletins, on-site changes, field corrections, etc. These are project As-Built Drawings & Specifications. Record Drawings & Specifications shall be created from these As-Builts by Public Works.

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.

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 - General 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 Rathsack 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.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Wood | _____ cu. yds.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Wood Pallets | _____ units | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| PVC Plastic | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Asphalt & Concrete | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Bricks & Masonry | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Vinyl Siding | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Cardboard | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Metals | _____ cu. yds.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Unpainted Gypsum / Drywall | _____ cu. yds.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Shingles | _____ cu. yds.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Fluorescent Lamps | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Foam Insulation | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Carpet Padding | _____ cu. ft.<br>_____ lbs. | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Barrels & Drums | _____ units | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Glass | _____ cu. yds.<br>_____ tons | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |

## WASTE MANAGEMENT PLAN FORM

| | | | |
|---|---|---|---|
| Other | _____ | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Other | _____ | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Other | _____ | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Other | _____ | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |
| Other | _____ | _____ Recycled _____ Reused<br>_____ Landfilled _____ Other | Name:_____ |

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

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

1.03 RELATED WORK

A. Recycling, Section 01 74 19.

1.04 SUBMITTALS

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

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

1.05 DEFINITIONS

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

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

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

1.06 QUALITY ASSURANCE

A. Comply with governing codes and regulations.

1.07 RECORD DRAWINGS

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

1.08 SAFETY

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

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

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

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

1.09 PERMITS

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

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

1.010 DISCONNECTION OF SERVICES

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

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

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

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

1.011 REMOVAL/SALVAGING OF ITEMS

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

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

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

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

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

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

PART 2 - PRODUCTS

2.01 EQUIPMENT

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

PART 3 - EXECUTION

3.01 GENERAL

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

3.02 PROTECTION OF EXISTING WORK AND FACILITIES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.03 DEMOLITION

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

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

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

3.04 RECYCLING

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

3.05 SCHEDULE

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

B. Items to remain (if clarification required).

3.06 CLEANING

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

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

END OF SECTION 02 41 19

**SECTION 04 20 00**
**UNIT MASONRY**

## PART 1 - GENERAL

### SCOPE

This section describes the products and execution requirements relating to furnishing and installation of Unit Masonry and related items for this project. Included are the following topics:



### RELATED WORK

Applicable provisions of Division 01 govern work under this Section.

### REFERENCE STANDARDS

Abbreviations of standards organizations referenced are as follows:

ACI American Concrete Institute
ASCE American Society of Civil Engineers
ASTM American Society for Testing and Materials
TMS The Masonry Society

### SUBMITTALS

Product Data: Submit manufacturer's product data for each type of masonry unit, accessory and other manufactured products. Provide a mock up of a in place of patch to match condition for review prior to proceeding with installation.

### COORDINATION

Examine all parts of the supporting structure and the conditions under which the masonry work is to be installed, and notify the Contractor in writing of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the installation of masonry work until unsatisfactory conditions have been corrected in a manner acceptable to this Section contractor.

Review installation procedures of other work by Subcontractors whose work must be coordinated with the masonry work.

The Contractor shall coordinate all work.

Consult with all Subcontractors and material suppliers whose involvement will be affected by the work of this Section.

**QUALITY ASSURANCE**

Source Limitations for Masonry Units and Mortar Materials: One source from a single manufacturer for each product utilized.

**DELIVERY, STORAGE AND HANDLING**

Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp or contaminated.

Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

**PROJECT/SITE CONDITIONS**

Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry. Protect base of walls from mortar splatter by spreading coverings on ground and over wall surface. Protect floor from mortar droppings. Protect surfaces of door frames and steel channel with painted and integral finishes, from mortar droppings.

## PART 2 - PRODUCTS

**MASONRY UNITS, GENERAL**

Provide special shapes or sizes as indicated on the Drawings or where cutting of units would expose the cut in the completed work.

Referenced masonry unit standards allow a certain percentage of units to exceed tolerances and to contain chips, cracks or other imperfections exceeding limits stated in the standard. Do not use units where such imperfections, including tolerances that vary more than the amount stated in the standard, will be exposed in the completed Work.

**CONCRETE MASONRY UNITS**

Materials and Physical Properties: Concrete block units shall be made from materials and manufactured to comply with all applicable requirements of ASTM C90, Solid Units of Normal Weight, typically cored. No integral water repellent is permitted.

Source: All units shall be from one source and of uniform color and texture.

Size: Concrete block units shall be 7-5/8" x 15-5/8" x thickness indicated on Drawings. Concrete brick may be of size as appropriate to facilitate the work. Field verify and match existing masonry.

Special Shapes: Provide where required for corners, jambs or other special conditions specifically indicated including applications which cannot be produced by cutting of standard size units.

Protection: Concrete masonry units shall be protected from the elements for a minimum time of seven days immediately prior to being incorporated into the Work.

**MORTAR AND GROUT MATERIALS**

Portland Cement: Shall conform to ASTM C150, Type I. Only one brand and kind of Portland cement from one source shall be used for the work unless prior written approval is obtained from the A/E. Brands are subject to approval of the A/E based upon the mortar color desired and obtainable by use of the various brands readily available. No white cement or nonstaining cement will be required.

Lime: Shall be pressure-hydrated, non air-entrained and conform to ASTM C207, Type S.

Masonry Sand: Shall be clean, sharp, free from loam, silt, vegetable matter, salts, and other injurious substances, and shall conform to ASTM C144. Sand is further subject to approval of the A/E, based on mortar color desired and obtainable by use of local sands readily available, and shall be from one source.

Aggregate for Grout: ASTM C404.

Water: Shall be potable, fresh, clean, clear, and free of injurious amounts of oil, acid, alkali, salts, organic matter or other detrimental substances, and handled in clean containers.

Plasticizer: Not permitted.

Water Repellent: Not permitted.

Coloring Pigments: Not permitted.

Other Admixtures: Shall not be used at any time and will not be knowingly approved. Use of special air-entraining admixtures, chlorides or nitrates, with or without approval, will be sufficient cause to require removal and replacement of all masonry work containing or treated with same.

The autoclave expansion of the cementitious portion of the mortar materials, when mixed in proportions required under “mortar mixes,” shall not exceed one-half percent when tested according to ASTM C151. The air content of any mortar required under “mortar mixes” shall not exceed six percent when tested according to ASTM C231 and/or ASTM C173 and/or ASTM C457.

Fully or partial premixed mortar materials will be considered for approval when each requirement of the individual materials is complied with and is so stated on the container, or certified, along with proportions and quantities.

**INDIVIDUAL TIES AND ANCHORS:**

Materials and Coatings: Provide galvanized (zinc coated) steel units conforming to Class B requirements of ASTM A153, unless otherwise specified.

Juncture of Concrete Masonry Back-up with Concrete Columns: Provide corrugated dovetail tie 1" wide by 12 gauge by 5-1/2" long, fitted to 12 gauge dovetail anchor; equivalent to Hohmann & Barnard, Inc. # 303 corrugated dovetail brick tie with mill galvanized finish.

**MORTAR MIXES**

Conventional Job Mixed Mortar: Measure materials for mortars by volume, in a manner whereby proportions can be controlled within two percent. Mix materials dry and then water to bring to proper consistency for use. Mix materials in the approved type machine mixer of adequate capacity for 3 to 5 minutes after all materials have been introduced, until materials are evenly distributed throughout the batch and the mixture is uniform in color with a workable consistency.

Silo Metered and Bulk Container Mortar: Shall comply with ASTM C1714. Use materials specified hereinbefore and proportion mixes as specified hereinafter. Add water and mix according to system manufacturer’s recommendations.

Use maximum water consistent with good workability and freedom from smearing the face of masonry work. Use no mortar that has stood more than one hour after initial mixing. Mortar less than one hour old shall be reasonably retempered as necessary to maintain its workability, but used before it is one hour old or otherwise discarded. No anti-freeze ingredient or contaminate of any type will be permitted.

Mortar for Concrete Block: Shall be ASTM C270, Type N, Cement-Lime Mortar conforming to the proportion specification requirements. (1:1:6).

The proportions listed above are Portland cement, lime, damp loose sand, respectively by volume. The proportions are listed only as samples for the required type mortars and shall be modified as necessary, within tolerances, to suit the particular masonry sand being used.

## PART 3 - EXECUTION

### EXAMINATION

Examine Work of other Section Contractors on which or to which unit masonry is to be built, supported or attached, to determine completeness and proper alignment to receive unit masonry. Do not commence masonry work until all related noncompliant work has been corrected.

Before installation of masonry, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

### PREPARATION

Verify that items provided by other Section Contractors are properly sized and located.

Verify that anchorages embedded in concrete are properly placed.

Establish lines, levels, and coursing. Protect from disturbance.

Provide temporary bracing during erection of masonry work. Maintain in place until building structure provides permanent bracing.

### INSTALLATION, GENERAL

Build interior concrete masonry walls to actual width of masonry units using units of widths indicated.

Leave openings for equipment to be installed before completing masonry. After equipment is installed, complete masonry to match the construction immediately adjacent to opening.

Use full size units without cutting where possible. If cutting is required to provide a continuous pattern or to fit adjacent construction, cut units with motor-driven saws to provide cuts that are straight and true, resulting in clean, sharp unchipped edges of the units. Allow typical cut units to surface dry before laying. Install cut units with cut surfaces and, where possible, cut edges concealed.

Select and arrange units for exposed masonry to produce a uniform blend of colors and textures.

### TOLERANCES

Dimensions and Locations of Elements: For dimensions in cross section or elevation do not vary by more than minus 1/4 inch or plus 1/2 inch.

For location of elements in plan do not vary from that indicated by more than minus ± 1/2 inch in 20 feet or ± 3/4 inch total.

For location of elements in elevation do not vary from that indicated by more than ± 1/4 inch in a story height or ± 3/4 inch total.

Lines and Levels: For bed joints, do not vary from level by more than ± 1/4 inch in 10 feet, or ± 1/2 inch maximum.

For horizontal lines, do not vary from level by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or ½ inch maximum.

For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum. Total vertical alignment of exposed head joints may have double these tolerances.

For lines and surfaces, do not vary from straight or plane by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.

For faces of adjacent exposed masonry units, do not vary from flush alignment by more than ± 1/8 inch.

Joints: For bed joints, do not vary from thickness indicated by more than ± 1/8 inch.

For head and collar joints, do not vary from thickness indicated by more than minus 1/4 inch or plus 3/8 inch.

If the above tolerances cannot be met due to previous construction, notify the A/E.

**LAYING MASONRY WYTHES**

Lay out walls in advance for alignment of head joints with uniform joint thicknesses and for accurate location of openings, movement joints, returns, and offsets. Maintain horizontal joint plane through all wythes of masonry. Fully bond intersections, and external and internal corners. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

Bond Pattern for All Masonry: Lay masonry in 1/2 running bond. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4 inch horizontal face dimensions at corners or jambs.

Adjusting Units: Adjust the final position of each masonry unit while the mortar is still plastic. To replace or reposition a unit after mortar has begun to set, remove the unit, replace the mortar with plastic mortar, and replace the unit.

Tooling: Tool all mortar joints exposed in the finished work, including the bed joints.

Tool exposed joints when "thumb-print" hard with a round jointer, slightly larger than width of joint and of sufficient length to obtain a straight and true mortar joint. Tooling shall be performed so that the mortar is compressed and the joint surface is sealed and in intimate contact with the edge of the masonry unit. This may require some craft persons to complete work after normal working hours. All crafts persons involved in the project shall utilize new hardened steel jointers of the same size when beginning to lay masonry on the project.

Stopping and Resuming Work: Stop off horizontal run of masonry by racking back 1/2 length of unit in each course from those in course below. Do not tooth except where necessary around openings. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar.

Built-in Work: As construction progresses, build in items specified in this and other Sections. Include built-in metal frames, anchor bolts, reglets, and other items to be built into the work supplied by other Section Contractors. Bed anchors of hollow metal frames in mortar joints. Build in items plumb and level. Fill in solidly with masonry around built-in items. Use ASTM C 476 grout or job mortar with high flow to slush full voids between masonry and hollow metal door frames.

Cutting and Fitting: Cut and fit masonry units for steel channels, door and openings. Cooperate fully with other Contractors to ensure correct size, shape and location.

Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into the core.

Fill cores in concrete masonry units directly under lintels with mortar or grout.

Fill cores in concrete masonry units with mortar or grout above and below where portions of anchors are to be installed.

**MORTAR BEDDING AND JOINTING**

For Concrete Masonry Units: Lay units with face shells fully bedded in mortar and with head joints of depth equal to bed joints. For starting courses on concrete, lay units fully bedded in mortar, including areas under cells.

Bed and head joints in masonry shall be of a nominal 3/8 inch thickness.

**MASONRY JOINT REINFORCEMENT**

Install entire length of longitudinal wire in mortar bed joints with a minimum cover of 3/4 inch on exterior side of walls.

Do not bend typical continuous masonry joint reinforcement in the construction process.

Lap continuous masonry joint reinforcement ends a minimum of 6 inches.

Space continuous masonry joint reinforcement a minimum of 16 inches on center vertically.

Provide reinforcement no more than 8 inches above and below wall openings and extending 12 inches beyond openings. Such reinforcement is in addition to continuous reinforcement when not coincident.

Interrupt joint reinforcement in a wythe wherever a movement joint occurs.

Provide continuity at concrete masonry wall intersections by using prefabricated T-shaped units or wire mesh with cores filled.

Provide continuity at corners by using prefabricated L-shaped units.

**REPAIRING AND POINTING**

Remove and replace to A/E's satisfaction masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units as intended. Install new units to match adjoining units and install in fresh mortar, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent work, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

**LAYING, PROTECTION AND CLEANING**

All masonry shall be in final acceptance condition within 24 hours after laying and shall be maintained in that condition, by meeting or exceeding the degree of cleanliness required, demonstrated on the approved sample panel.

Lay masonry utilizing all necessary care to achieve cleanliness. Remove excess mortar from exposed exterior and interior masonry surfaces as the work progresses and before it tenaciously adheres to the faces of the masonry. Remove mortar protrusions and smears as masonry units are laid and tooled, as scaffolds are raised, and at the start of the next day's work, leaving the surface of the masonry clean and finished. Use calcimine brushes, stiff fiber brushes, other similar masonry units, burlap, rags, carpet remnants, rubber floats, or other approved means. (Cleaning of masonry the morning after laying by the same masons who laid the masonry the previous day, using stiff fiber brushes with or without water and sand, and concentrating on cleaning the field of the masonry units has also been successfully used to achieve an appearance matching or exceeding the cleanliness of the approved sample panel.) Use of chemical cleaning or harsh physical cleaning will not be permitted. Included as chemical cleaners and prohibited are most manufactured masonry cleaning solutions or compounds. Equipment or methods and techniques utilized, reduced productivity, as well as weather conditions experienced will not relieve this Section contractor of required compliance.

Protection shall be provided to prevent mortar spattering and maintain masonry in a clean condition so that the masonry is satisfactory for acceptance when masonry work is completed. This may require covering portions of finished masonry which is below new work in progress with polyethylene, canvas, or other approved means. Extend covering a minimum of 24 inches down both sides of wall, and hold covering securely in place. Hair-pin type devices frequently spaced have been successfully used in the past. When practical, lay masonry from the top floor down.

No final washdown is required unless removal of earthy construction dirt or dust is necessitated by extremely unusual site conditions.

**MASONRY WASTE DISPOSAL**

Excess masonry materials are this Section contractor's property and shall be removed from the Project site upon completion of unit masonry work.

**END OF SECTION**

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Interior Wall framing.
2. Ceiling joist framing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: Per code requirements.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

    a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..
    b. Ceiling Joist Framing: Vertical deflection of 1/240 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

## 2.2 COLD-FORMED STEEL FRAMING, GENERAL

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H.
2. Coating: G60.

## 2.3 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.033”.
2. Flange Width: 1 3/8”.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.033”.
2. Flange Width: 1 ¼”.

## 2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.043”.
2. Flange Width: 1 3/8”

## 2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Welding Electrodes: Comply with AWS standards.

## 2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.

B. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

C. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.8 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

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

### 3.2 PREPARATION

### 3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

## 3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches.
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches from abutting walls, and as follows:

D. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated.

1. Install web stiffeners to transfer axial loads of walls above.

E. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:

1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

## 3.5 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

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

## 3.6 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Steel Angles, Channels.

B. Metal accessories.
   1. Including, but not limited to, anchors, bolts, screws, joist hangers, and fasteners.

C. Misc. Metal Brackets, supports, blocking etc. as indicated on drawings and on A700 to support magnetic hold opens.

1.03 RELATED WORK

A. Door Hardware: Section 08 71 00.

B. Painting: Section 09 90 00.

1.04 REFERENCES

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

1.05 SUBMITTALS

A. Submit in accord with the General Conditions of the Contract.
   1. Shop drawings required for all items. Show all work to be fabricated with all construction details shown in appropriate scale, methods of attachments to other materials, finished dimensions, shop welds and grinding of welds, field assembly joints, etc.
   2. Coordinate work with other suppliers and subcontractors; obtain their approved shop drawing where necessary, or obtain any necessary additional detail information regarding mounting conditions or other aspects of related work.

1.06 QUALITY ASSURANCE

A. Take field measurements prior to shop drawing preparation and fabrication.

B. Comply with the provisions of the following except as otherwise indicated:
   1. AISC "Code of Standard Practice for Steel Buildings and Bridges".
   2. AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", including the "Commentary" and Supplements thereto as issued.
   3. AISC "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.
   4. AWS D1.1 "Structural Welding Code".

C. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.07 DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store at the job site in a manner that will avoid damage or deformation. Damaged material will be rejected.

B. Items to be built into concrete, masonry, etc. shall be furnished by the respective contractor and the contractor shall build this into the work as the work progresses.

1.08 PROJECT CONDITIONS

A. Verify dimensions in field for pre-cut or prefabricated items.

B. Examine job conditions and adjoining construction which may affect the acceptability of the work.

C. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing embedments and other items that are to be embedded in concrete. Deliver such items to Project site in time for installation.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
   1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.
   2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints", Second Edition, January 7, 1997. For applications on ferrous metal substrates.
   3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

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

PART 2 - PRODUCTS

2.01 METAL FOR FABRICATIONS

A. Cold-rolled carbon steel sheets: ASTM A336.

B. Structural Steel Sheet: Hot rolled ASTM A570, or cold-rolled ASTM A611, of grade required for design loading, minimum of Grade C.

C. Galvanized carbon steel sheets: ASTM A446, with G90 zinc coating.

D. Shop coat primer: FS-TT-P-32, for shop application and field touch-up.

E. Touch-up primer for galvanized surfaces.
1. Steel shapes and fasteners, in general, for exterior use and where built into exterior wall: zinc coated.

## 2.02 GALVANIZED STEEL

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

## 2.03 ACCESSORIES

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

B. Fasteners: Including, but not limited to the following;
1. Provide zinc-coated fasteners for exterior use where built into exterior walls or where shown on drawings. Select fasteners for the type, grade and class required.
a. Provide hot-dipped galvanized coating for fasteners less than 1/2" diameter that are in contact with pressure-treated wood.
2. Bolts and Nuts: Regular hexhead type, ASTM A 307, Grade A or Type 304 stainless steel, ASTM A 320. High Strength bolts and nuts, ASTM A 325.
3. Lag Bolts: Type, FS FF-B-561.
4. Machine Screws: Cadmium plated steel, FS FF-S-92, Security Screw
5. Wood Screws: Carbon steel, FS FF-S-111.
6. Plain Washers: Round, carbon steel, FS FF-W-92.
7. Concrete Anchorage Devices: Wedge-type expansion bolts, FS FF-S-325, Group II, Type 4, Class 1, zinc coated or stainless steel as shown on the drawings and installed in accordance with manufacturer's recommendations.
a. "Kwik-bolt", Hilti Corporation.
b. "Wej-it", Wej-it Corporation.
8. Masonry Sleeve Anchors: zinc coated or stainless as shown on the drawings.
a. Rawl "Lok/Bolt".
b. HILTI - Sleeve anchor.
9. Toggle Bolts: Spring-wing type, FS FF-B-558, Type I, Class I and Style 1 zinc coated or stainless steel as shown on the drawings.
10. Lock Washers: Helical spring type carbon steel, FS FF-W-84.

C. Electrodes for Welding: Comply with AWS code.

## 2.04 FABRICATION

A. Weld permanent connections wherever possible; use continuous welds where exposed. Grind smooth all welds where exposed; straighten members after welding.
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

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

C. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished product for use intended. Work to dimensions on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

E. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of type indicated or, if not indicated, security (countersunk) screws or bolts.

F. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

2.05 STEEL FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
1. ASTM A 123/A 123M, for galvanizing steel products.
2. ASTM A 153/A 153M, for galvanizing steel hardware.
3. Except for items indicated to be fabricated of stainless steel, exterior metal fabrication items shall be hot-dip galvanized.

B. Preparation for Shop Painting: Clean steel items free of mill scale, rust and foreign matter, grease, oil, dust, and dirt in accordance with SSPC SP-2, SP-3, or SP-7.

C. Shop Priming: Apply one shop coat of metal primer using manufacturer's standard primer, except stainless steel, galvanized steel, and other non-ferrous items.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchorage to masonry with expansion bolts, sleeves, toggle bolts or approved similar. Do not use wood plugs for anchorage.

B. Bolts, screws, and similar fastenings for field connections shall be of the same material and finish as the parts being fastened.

C. Immediately after erection, repaint field connections, weld burns, abraded surfaces. Scrape and wire brush loose and scaling paint to sound metal, follow with spot priming.

D. Install manufactured units and specialty products in accordance with the manufacturer's instructions and approved shop drawings.

E. Do not proceed with installation until conditions are satisfactory.

F. Install in accordance with approved shop drawings.

G. Corrosion Protection: Coat concealed metal surfaces that will come into contact with grout, concrete, or dissimilar metals with a heavy coat of bituminous paint.

## 3.02 ADJUSTING AND CLEANING

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

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE

A. Perform all Work required to complete the Rough Carpentry indicated by the Construction Documents, and furnish all items necessary for its proper installation.

1.03 WORK INCLUDED

A. Wood Blocking, Cants and Nailers.

B. Plywood Backing Panels.

1.04 RELATED WORK

A. Unit Masonry, Section 04 20 00.

B. Metal Fabrications, Section 05 50 00.

1.05 SUBMITTALS

A. Submit in accordance to the General Conditions of the contract.

B. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses indicated on the documents. Indicate species and grade selected for each use, and design values approved by American Lumber Standards Committee.

C. Schedule for completion of rough framing for coordination of templating for shop fabrication of architectural woodwork.

D. Wood treatment data as follows, including chemical treatment manufacturer's warranty and instructions for handling, storing, installing, and finishing treated materials:
1. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standard.

1.06 REFERENCES

A. American Institute of Timber (AITC)
1. AITC, Timber Construction Manual

B. American Forest and Paper Association (AFPA)
1. AFPA, National Design Specification for Wood Construction.
2. AFPA, Design Values for Wood Construction, NDS Supplement.

C. American Plywood Association (APA)
1. APA, Plywood Design Specification.

D. American National Standards Institute (ANSI)
1. ANSI A190.1, Structural Glued Laminated Wood.
2. ANSI A208.1, Material Formed Wood Particle Board.

E. American Society for Testing and Materials (ASTM)
1. ASTM E84, Test for Surface Burning Characteristics of Building Materials.

F. American Wood Preservers Association (AWPA)
1. AWPA C-20, Structural Lumber - Fire Retardant Treatment by Pressure Processes.

G. American Wood Preservers Bureau (AWPB)
1. AWPB LP-2, Pressure Treatment with Water-Borne Preservatives.

H. National Bureau of Standards (NBS)
1. NBS PS 1, Voluntary Product Standard for Construction and Industrial Plywood.
2. NBS PS 20, Voluntary Product Standard for Lumber.

## 1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site dry and store above ground on level wood blocking, cover from rain, allowing drainage of water from all parts. Handle with care to avoid damage.

## 1.08 COORDINATION

A. Correlate location of all framing, furring, blocking, grounds and similar items with all trades.

B. Verify all dimensions and shop drawing requirements prior to proceeding with work.

C. Avoid delay of work of other trades dependent on or affected by carpentry work.

## 1.09 ENVIRONMENTAL REQUIREMENTS

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

B. Low- Emitting Materials, Composite Wood & Agrifiber Products: Composite wood and agrifiber products used inside the weatherproofing system shall contain no added urea-formaldehyde resins.
1. Laminating Adhesives used to fabricate on-site and shop applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins.

# PART 2 - PRODUCTS

## 2.01 MATERIALS

A. Wood for nailers, blocking, furring, sleepers and other miscellaneous boards: Construction grade, S4S, dried, 19 percent maximum moisture content. Pressure preservative treat items in contact with flashing, waterproofing, masonry, concrete or the ground.

B. Exterior plywood, thickness as indicated on drawings, 7-ply, CDX APA Rated, un-sanded with a minimum 16/0 span rating. Refer to drawings for sizes.

C. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
   1. Treat wood materials subject to insect attack. Moisture content after treatment shall be 19 percent for lumber and 15 percent for plywood.
   2. Preservative Chemicals: Water-borne, alkaline copper quaternary (ACQ) preservatives.
      a. Acceptable to authorities having jurisdiction and containing no arsenic or chromium.

D. Fire-retardant treated wood products shall be pressure-impregnate wood materials to comply with ASTM E84, Class A and with AWPA C-20 and C-27. Each piece shall bear UL label "FR-S" for 25 maximum flame spread. Moisture content after treatment shall be 19 percent for lumber and 15 percent for plywood.
   1. Treated materials shall be "Dricon" as manufactured by Koppers Company, Inc.
   2. Application: Treat all rough carpentry, unless otherwise indicated.
      a. Concealed blocking.
      b. Plywood backing panels.

E. Rough hardware shall include all nails, spikes, screws, bolts and similar items of types and sizes sufficient to draw and rigidly secure members for which they are used. Fasteners shall be galvanized plated at exterior locations and at all treated wood applications.

F. Adhesive shall be of proper design and characteristics to rigidly secure materials for which they are used. Adhesive shall be "Titebond VOC-Compliant Heavy Duty Construction Adhesive”conforming with ASTM C557, as manufactured by Franklin International; or approved equal.
   1. Provide construction adhesive with a VOC content of less than 70 g/l.

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

## PART 3 - EXECUTION

### 3.01 PREPARATION

A. Examine all adjoining work, verify all governing dimensions, and report any unsatisfactory conditions.

B. Provide temporary enclosures, partitions, or stairs to properly protect and facilitate the work.

### 3.02 GENERAL INSTALLATION

A. Install materials and systems in accordance with manufacturer's published instructions and requirements. Install materials with uniform appearance and in proper relation with adjacent construction.

B. Cut and frame all lumber into the respective locations, true to line, grade, plumb and level. Form nailers, blockings and bucks to the shape and dimension indicated. Cut and frame all rough carpentry work required by the other sections.

C. Use only sound, thoroughly seasoned materials of longest practical lengths and sizes to minimize jointing. Use materials free from warp which cannot be easily corrected by anchoring and attachment.

D. Treat all wood nailers, sleepers, blocking, furring, other wood in contact with concrete, masonry adjacent to grade or exterior which shall be inaccessible in finished work.

E. Provide blocking, bucks and framing for all trades as required.
   1. Blocking to be provided at the following locations:
      a. All wall hung casework, cabinetry, countertops and shelving.
      b. All wall hung/mounted equipment, brackets, etc.
      c. And as indicated on drawings.

F. Include 2 inch nominal blocking in metal stud partitions required for backing of all accessories, cabinetry, and other surface or recessed items.

G. Where finish trim is applied directly to framing members or blocking, such members shall be perfectly straight, clear and well seasoned. Warp or other poor characteristics not allowed.

H. Provide solid surfaces at least 1 1/2 inches wide in both directions at all corners for securing finishes.

## 3.03 HARDWARE

A. Secure permanently and in proper position all materials with the necessary fastenings to provide the strength and rigidity required to complete the work. Provide washers under bolt heads and nuts in contact with wood.

B. Bolt nailers and blocking to steel, masonry or concrete members with bolts of proportionate strength of members attached, length required, spaced 2 feet 0 inches on center and 4 inches from each end, except as otherwise indicated. Unless otherwise indicated, anchor bolts shall be 3/8 inch diameter by length required or comparable power actuated fasteners.

C. Nail plywood in accord with APA recommendations.

## 3.04 TEMPORARY ENCLOSURES

A. The Subcontractor shall furnish, erect, keep in good repair and remove all necessary temporary guard rails, barricades, pedestrian walkways, temporary ladders, building enclosures and partitions (including temporary wood doors hung on temporary wood bucks at exterior door entrances, doors to allow emergency egress by building occupants) and all other necessary temporary enclosures as required as the work progresses.

## 3.05 CLEANING

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

END OF SECTION 06 10 00

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Carpentry work which is exposed to view, non-structural, and not specified as part of other sections.

B. The types of finish carpentry include, but are not necessarily limited to the following:
1. Wood trim to allow sealant installation to prevent the migration of gas.

1.03 RELATED WORK

A. Related Sections: The following sections contain requirements that relate to this section:

B. Joint Sealants: Section 07 92 00.

C. Painting: Section 09 90 00.

1.04 SUBMITTALS

A. General: Submit each item in this article according to the General Conditions of the Contract.
1. Shop drawings for all millwork; receive approval prior to fabrication; draw in related or dimensional position with sections shown either full size or 3-inch scale.

B. Product Data: For each type of component required. Include but not limited to the following:
1. Manufacturer's data on hardware, accessories, and finishes.

1.05 QUALITY ASSURANCE

A. Quality Standards: Architectural Woodwork Quality Standards, Guide Specification and Quality Control Program as set forth by the Architectural Woodwork Institute (AWI).

B. Architectural Woodwork Manufacturer: Experienced in this type of work; successfully completed comparable work.

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

1.06 DELIVERY, STORAGE AND HANDLING

A. Protect finish carpentry materials during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver finish carpentry materials until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed.

C. If finish carpentry materials must be stored in other than installation areas, store only in areas meeting requirements specified for installation areas.

1. Conditioning: Installer shall advise Contractor of temperature and humidity requirements for finish carpentry installation areas. Do not install finish carpentry until required temperature and relative humidity have been stabilized and will be maintained in installation areas.
2. Maintain temperature and humidity in installation area as required to maintain moisture content of installed finish carpentry within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period. The fabricator of woodwork shall determine optimum moisture content and required temperature and humidity conditions.

## PART 2 - PRODUCTS

### 2.010 MATERIALS, GENERAL

A. Lumber standards: Comply with DOC PS 20, "American Softwood Lumber Standard," for lumber and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Inspection Agencies: Inspection agencies, and the abbreviations used to reference them, include the following:
1. NELMA – Northeastern Lumber Manufacturers Association.
2. NHLA – National Hardwood Lumber Association.
3. NLGA – National Lumber Grades Authority.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB – West Coast Lumber Inspection Bureau.
6. WWPA – Western Wood Products Association.

C. Grade Stamps: Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. For exposed lumber, furnish pieces with grade stamps applied to ends of back of each piece, or omit grade stamps entirely and provide certificates of grade compliance issued by inspection agency.

### 2.02 SOLID STOCK

A. Interior Trim for Transparent Finish
1. Interior: AWI 300 Custom Grade.
1. Species: White Oak, quarter-sawn.
2. Texture: S2S2E, (smooth).

### 2.03 ACCESSORIES

A. Provide nails, screws and other anchoring devices of the proper type, size, material and finish for application to provide secure attachment, concealed where possible, and complying with applicable Federal Specifications.
1. Nails, Wire, Brads and Staples: FS FF-N-105.
2. Power-Driven Fasteners: CABO NER-272.
3. Cedar to be fastened with 304 (18-8) or better stainless steel fasteners only.

B. Where interior finish carpentry materials are exposed in areas of high humidity, provide fasteners and anchorages with hot-dip galvanized coating complying with ASTM A 153 or No. 304 stainless steel.

C. Glue: Aliphatic- or phenolic-resin wood glue recommended by manufacturer for general carpentry use. Exterior rated for exterior use.

D. Sealants: Comply with requirements of Division 7 Section "Joint Sealants" for materials required for sealing work.

2.04 FABRICATION

A. Wood Moisture Content: Comply with requirements of specified inspection agencies and manufacturer's recommendations for moisture content of finish carpentry on relative humidity conditions existing during time of fabrication and in installation areas.

B. Field Dimensions
1. Millwork Manufacturer: Responsible for details, dimensions not controlled by job conditions; show on shop drawing all field measurements beyond his control. Contractor, Woodwork Manufacturer: Cooperate to establish, maintain these field dimensions.

C. Leave all surfaces clean and true and all exposed wood surfaces sanded parallel with grain, free of discernible marks and ready for work under Division 9 Section "Painting".

D. Cutouts: Make those required for mechanical and electrical items.

E. Back out or kerf backs of the following members, except members with ends exposed in finished work:
1. Standing and running trim wider than 5 inches.

F. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius.

G. Ease edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.01 EXAMINATION

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

3.02 PREPARATION

A. Condition wood materials to average prevailing humidity conditions in installation areas prior to installing.

B. Examine substrate before installation. Verify that substrate is sound and plumb/level. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Wood frame walls shall be dry, clean, sound, well-nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces. Leave no hammer or automated fastener dents or scuffs.

D. Coordinate woodwork installation with wall flashings and other built-in components.

E. Prime and backprime exterior wood, including cut ends, for painted, stained and oil finish exposed on the exterior. Comply with requirements for surface preparation and application in Division 9 Section "Painting".

3.03 INSTALLATION

A. Do not use finish carpentry materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
   1. Do not use manufactured units with defective surfaces, sizes or patterns.

B. Install finish carpentry plumb, level, true and aligned with adjacent materials. Use concealed shims where required for alignment.

C. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
   1. Countersink nails; fill surface flush and sand where face nailing is unavoidable.

D. Install to tolerance of 1/8 inch in 96 inches for plumb and level. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.

E. Coordinate finish carpentry with materials and systems in or adjacent to standing and running trim and rails.
   1. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of trim and rails.

F. Finish according to specified requirements.
   1. Refer to Division 9 Sections for final finishing of finish carpentry.

## 3.04 STANDING AND RUNNING TRIM INSTALLATION

A. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.
   1. Stagger joints in adjacent and related standing and running trim.
      a. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint.
      b. Use scarf joints for end-to-end joints. Plane backs of casings to provide uniform thickness across joints, if required.

B. Match color and grain pattern across joints.

C. Drill pilot holes in wood before fastening as required to prevent splitting.
   1. Fasten to prevent movement or warping.
      a. Countersink fastener heads on exposed carpentry work and fill holes.
      b. Stagger nails along the length of long pieces of trim.

## 3.05 ADJUSTING

A. Repair damaged or defective work as directed.

B. Adjust and lubricate hardware for proper operation.

## 3.06 CLEANING

A. Clean exposed surfaces.

B. Clean shop-finished woodwork, touch-up finish as required and remove and refinish damaged or soiled areas of finish.

C. Protect finish carpentry and maintain conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Exposed-fastener, lap-seam metal wall panels in vertical installation.

B. Related Sections:

1. Cold Formed Metal Framing, 05 40 00

2. Sealants, Section 07 92 00

1.03 DEFINITION

A. Metal Wall Panel Assembly: Metal wall panels, attachment system components, miscellaneous metal framing, and accessories necessary for a complete wall system providing an air barrier to prevent the migration of gases.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Metal wall panel assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.

B. Delegated Design: Design metal wall panel assembly, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Air Infiltration: Air Infiltration: ASTM E1680

D. Fire Rating: Class A

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

1.05 SUBMITTALS

A. Submit in accord with the general requirements of this contract.

B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings: Show fabrication and installation layouts of metal wall panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. Distinguish among factory-, shop-, and field-assembled work.

1. Accessories: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:
   a. Trim.
   b. Anchorage systems.

D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.
2. Include manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each sealant exposed to view.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: Minimum 10 x 10 inches.
2. Trim and Closures: 10 inches long. Include fasteners and other exposed accessories.
3. Accessories: 10-inch- long Samples for each type of accessory.
4. Exposed Sealants: For each type and color of joint sealant required. Install joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of metal-faced composite wall panels adjacent to joint sealants.

F. Delegated-Design Submittal: For metal wall panel assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

G. Coordination Drawings: Exterior elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Wall panels and attachments.
2. Girts or sub-framing.
3. Wall-mounted items including doors, windows, louvers, and lighting fixtures.
4. Penetrations of wall by pipes and utilities.

H. Qualification Data: For Installer and professional engineer.

I. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

J. Maintenance Data: For metal wall panels to include in maintenance manuals.

K. Warranties: Samples of special warranties.

## 1.06 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of metal-faced composite wall panel from single source from single manufacturer.

C. Fire-Resistance Ratings: Where indicated, provide metal-faced composite wall panels identical to those of assemblies tested for fire resistance per ASTM E 119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

D. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, testing and inspecting agency representative, metal wall panel Installer, metal wall panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal wall panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to metal wall panel installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that will affect metal wall panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal wall panel assembly during and after installation.
8. Review wall panel observation and repair procedures after metal wall panel installation.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, metal wall panels, and other manufactured items so as not to be damaged or deformed. Package metal-faced composite wall panels for protection during transportation and handling.

B. Unload, store, and erect metal-faced composite wall panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Store metal wall panels horizontally vertically on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal wall panels to ensure dryness, with positive slope for drainage of water. Do not store metal wall panels in contact with other materials that might cause staining, denting, or other surface damage. Do not allow storage space to exceed 120 deg F.

D. Retain strippable protective covering on metal-faced composite wall panel for period of panel installation.

## 1.08 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal wall panels to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions by field measurements before metal wall panel fabrication and indicate measurements on Shop Drawings.

1.09 COORDINATION

A. Coordinate metal wall panel assemblies with rain drainage work, flashing, trim, and construction of studs, soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.010 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal wall panel assemblies that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures, including rupturing, cracking, or puncturing.
   b. Deterioration of metals and other materials beyond normal weathering.
2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
   a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
   b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
   c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

1.011 ENVIRONMENTAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 PANEL MATERIALS

A. Aluminum Sheet: Coil-coated sheet, ASTM B 209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required

1. Surface: Smooth, flat finish.
2. Exposed Coil-Coated Finish:
   a. 3-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

B. Panel Sealants:

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; elastomeric polyurethane, polysulfide, or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal wall panels and remain weathertight; and as recommended in writing by metal wall panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

## 2.02 MISCELLANEOUS METAL FRAMING

A. Miscellaneous Metal Framing, General: ASTM C 645, cold-formed metallic-coated steel sheet, ASTM A 653/A 653M, G60 hot-dip galvanized or coating with equivalent corrosion resistance unless otherwise indicated.

B. Subgirts: Manufacturer's standard C- or Z-shaped sections 0.064-inch nominal thickness.

C. Zee Clips: 0.079-inch nominal thickness.

D. Base or Sill Angles and Channels: 0.079-inch nominal thickness.

E. Hat-Shaped, Rigid Furring Channels:

1. Nominal Thickness: As required to meet performance requirements.
2. Depth: As indicated or required for a complete installation.

F. Cold-Rolled Furring Channels: Minimum 1/2-inch- wide flange.

1. Nominal Thickness: As required to meet performance requirements, or as indicated.
2. Depth:
   a. As indicated or required for a complete installation.
   b. Custom sizes are required.
3. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with nominal thickness of 0.040 inch.
4. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

G. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, and depth required to fit insulation thickness indicated.

1. Nominal Thickness: As required to meet performance requirements.

H. Fasteners for Miscellaneous Metal Framing: Of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous metal framing members to substrates.

## 2.03 MISCELLANEOUS MATERIALS

A. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide exposed fasteners with heads matching color of metal-faced composite wall panels by means of plastic caps or factory-applied coating. Provide EPDM, PVC, or neoprene sealing washers.

## 2.04 EXPOSED-FASTENER LAP-SEAM METAL WALL PANELS

A. General: Provide factory-formed, metal wall panels designed to be field assembled by lapping side edges of adjacent panels and mechanically attaching panels to supports using exposed fasteners in side laps. Include accessories required for complete installation.

B. Exposed-Fastener Metal Wall Panels: Corrugated

1. Basis-of-Design Product: McElroy Multi-Rib, galvalume steel, 26 gauge.

2. Subject to compliance with the requirements, comparable products by one of the following may be provided; submit for approval:
   a. AEP-Span.
   b. Architectural Metal Systems.
   c. Berridge Manufacturing Company.
   d. Butler Manufacturing Company
   e. Centria
   f. Copper Sales, Inc.
   g. Englert, Inc.
   h. Fabral.
   i. McElroy Metal, Inc.
   j. Metal Sales Manufacturing Corporation.
   k. Metecno-Morin.
   l. Petersen Aluminum Corporation.

3. Material: Galvalume sheet, 26 gauge; smooth.
   a. Exterior Finish: 70 percent; 3-coat fluoropolymer.
   b. Panel Color: To be selected from manufacturer’s standard colors.
   c. Trim Color: Match panel color.
   d. Interior Finish: Manufacturer's standard.

4. Ribs: Major longitudinal ribs 1 3/16” deep, spaced 12” on center; minor longitudinal ribs centered between major ribs, spaced 3” on center panel.

5. Panel Width: 36” cover width, lengths indicated on drawings.

## 2.05 ACCESSORIES

A. Wall Panel Accessories: Provide components required for a complete metal wall panel assembly including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal-faced composite wall panels unless otherwise indicated.
   1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal wall panels.
   2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
   3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Provide integral drainage system and manufactures standard extrusions at termination of dissimilar materials.

C. Flashing and Trim: Formed from 0.032-inch- thick zinc coated (galvanized) steel sheet or aluminum- zinc alloy-coated steel sheet prepainted with coil coating. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae,

parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal wall panels.

D. Panel Sealants:
   1. Joint Sealant: ASTM C 920; silicone sealant; of type, grade, class, and use classifications required to seal joints in metal-faced composite wall panels and remain weathertight; and as recommended in writing by panel manufacturer.
      a. Non-staining type meeting ASTM C-1248.
   2. Color: Custom color to match composite wall panel finish as selected by A/E.

E. Sub-girts and/or Z-furring:
   1. Galvanized steel, minimum 20 gage, dimensions as indicated on drawings. Furring Channel: Provide Hat, C, U or Z type as recommended by manufacturer.
   2. Flat Strap: At least 14 gage thick

F. Panel Fasteners: Stainless steel fasteners suitable for attaching to specified substrate. Minimum 3/4 inch length, with heads/integral washers a minimum of 7/16 inch diameter.

G. Pre-finished Moldings: Manufacturer’s standard line of extrusions; finish to match panel, to profile required on Drawings.

## 2.06 FINISHES

A. Comply with NAAMM's - Metal Finishes Manual for Architectural and Metal Products, for recommendations of designating finishes.

B. Superior Performance Organic Coating System: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) resin system.
   1. Three-Coat Fluoropolymer: AAMA 2605, fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' installation instructions.
   2. Custom color as selected by Architect.

C. Field Touch-Up Materials: As recommended by coating manufacturer for field application.

## 2.07 FABRICATION

A. General: Fabricate and finish metal wall panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Fabricate metal wall panels in a manner that eliminates condensation on interior side of panel and with joints between panels designed to form weathertight seals.

C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

D. As applicable, fabricate metal wall panel joints with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, and that will minimize noise from movements within panel assembly.

E. Sheet Metal Accessories: Fabricate flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate non-moving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended by meta wall panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal-faced composite wall panel manufacturer for application, but not less than thickness of metal being secured.

2.08 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal-faced composite wall panel supports, and other conditions affecting performance of the Work.
1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal-faced composite wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal-faced composite wall panel manufacturer.
3. Verify that weather-resistant sheathing paper has been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
4. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Examine roughing-in for components and systems penetrating metal wall panels to verify actual locations of penetrations relative to seam locations of panels before panel installation.

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

3.02 PREPARATION

A. Miscellaneous Framing: Install subgirts, base angles, sills, furring, and other miscellaneous wall panel support members and anchorage according to ASTM C 754 and metal-faced composite wall panel manufacturer's written instructions.

3.03 METAL WALL PANEL INSTALLATION

A. General: Install metal wall panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to girts and subgirts unless otherwise indicated. Anchor panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Commence metal wall panel installation and install minimum of 300 sq. ft. in presence of factory-authorized representative.
2. Shim or otherwise plumb substrates receiving metal wall panels.
3. Flash and seal metal-faced composite wall panels at perimeter of all openings. Do not begin installation until weather barrier and flashings that will be concealed by panels are installed.
4. Install screw fasteners in predrilled holes.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal wall panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete, and elsewhere as indicated or, if not indicated, as necessary for waterproofing or to provide an air barrier to prevent the migration of gases.
9. Align bottom of metal wall panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
10. Provide weathertight escutcheons for pipe and conduit penetrating walls. Seal to provide an air barrier and prevent the migration of gases.

B. Fasteners:

1. Aluminum Wall Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior and aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action as recommended by metal-faced composite wall panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

E. Lap-Seam Metal Wall Panels: Fasten metal wall panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
1. Lap ribbed or fluted sheets one full rib corrugation. Apply panels and associated items for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.

2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal wall panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.
5. Provide sealant tape at lapped joints of metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to weather-side surface of fastenings on end laps; on side laps of nesting-type panels; on side laps of corrugated nesting-type, ribbed, or fluted panels; and elsewhere as needed to make panels weathertight.
7. At panel splices, nest panels with minimum 6-inch end lap, sealed with butyl-rubber sealant and fastened together by interlocking clamping plates.

F. Zee Clips: Provide Zee clips of size indicated or, if not indicated, as required to act as standoff from subgirts for thickness of insulation indicated. Attach to subgirts with fasteners.

## 3.04 ACCESSORY INSTALLATION

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

1. Install components required for a complete metal wall panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

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

1. Install exposed flashing and trim that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

## 3.05 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
B. Water-Spray Test: After completing the installation of 75-foot- by-2-story minimum area of metal wall panel assembly, test assembly for water penetration according to AAMA 501.2 in a 2-bay area directed by Architect.
C. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect and test completed metal wall panel installation, including accessories.
D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements. Additional tests and inspections, at Contractor's expense,

will be performed to determine compliance of replaced or additional work with specified requirements.

## 3.06 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal-faced composite wall panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal-faced composite wall panel installation, clean finished surfaces as recommended by panel manufacturer. Maintain in a clean condition during construction.

B. After metal wall panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal wall panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

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SECTION 07 92 00

JOINT SEALANTS

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

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

### 1.02 WORK INCLUDED

A. Miscellaneous Joints.

### 1.03 RELATED WORK

A. Section 06 20 00, Finish Carpentry.

B. Section 07 42 13, Metal Wall Panels.

C. Section 08 11 13, Steel Doors and Frames.

### 1.04 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for initial selection: Manufacturer’s color charts.

C. Samples for final selection: Custom color range of actual material for selection.

D. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

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

F. Warranties: Sample of special warranties.

### 1.05 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit quantity required by joint sealant manufacturer of each kind of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
1. Locate test joints where indicated on Project or, if not indicated, as directed by A/E.
2. Conduct field tests for each application indicated below:
a. Each kind of sealant and joint substrate indicated.
1) Existing concrete and masonry.
2) Where new work abuts materials listed above.

3. Notify A/E seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

1.07 PROJECT CONDITIONS

A. Examine the joint surfaces and backing, and their anchorage to the structure, and the conditions under which the joint sealer work is to be performed. Do not proceed with the joint sealer work until unsatisfactory conditions have been corrected.

B. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed with the work only when forecasted weather conditions are favorable for proper cure and development of high early bond strength. Wherever joint width is affected by ambient

temperature variations, install sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range.

1.08 WARRANTY

A. Special Installer's Warranty: Manufacturer's standard form in which Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
   1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
   2. Disintegration of joint substrates from natural causes exceeding design specifications.
   3. Mechanical damage caused by individuals, tools, or other outside agents.
   4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

1.09 ENVIRONMENTAL REQUIREMENTS

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

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

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Colors of Exposed Joint Sealants: As selected by A/E from manufacturer's full range, or custom colors where indicated.

2.02 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Corning Corporation; 790.
    b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
    c. May National Associates, Inc.; Bondaflex Sil 290.
    d. Pecora Corporation; 301 NS.
    e. Sika Corporation, Construction Products Division; SikaSil-C990.
    f. Tremco Incorporated; Spectrem 1.

B. Single-Component, Nonsag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Corning Corporation; NS Parking Structure Sealant.
    b. May National Associates, Inc.; Bondaflex Sil 728 NS.
    c. Pecora Corporation; 311 NS.
    d. Tremco Incorporated; Spectrem 800.

C. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Dow Corning Corporation; 799.
    b. GE Advanced Materials - Silicones; UltraGlaze SSG4000 or UltraGlaze SSG4000AC.
    c. May National Associates, Inc.; Bondaflex Sil 200 GPN or Bondaflex Sil 201 FC.
    d. Polymeric Systems, Inc.; PSI-631.
    e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
    f. Tremco Incorporated; Proglaze SSG or Tremsil 600.

D. Multicomponent, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type M, Grade NS, Class 50, for Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Tremco Incorporated; Spectrem 4TS.

E. Mildew-Resistant, Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. Pecora Corporation; 898.

## 2.03 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    a. BASF Building Systems; Sonolac.
    b. Bostik, Inc. Chem-Chal 600.
    c. Pecora Corporation; AC-20+.
    d. Tremco Incorporated; Tremflex 834.

## 2.04 PREFORMED JOINT SEALANTS

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

2.05 SEALANT ACCESSORIES

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

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

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

D. Joint Sealant Backing:

1. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
2. Closed Cell Back-up (Backer Rod): ASTM C 1330, Type C.
   a. Tremco "Closed Cell Backer Rod".
   b. Sonneborn "Sonofoam".
   c. W.R. Meadows "Kool-Rod".

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

PART 3 - EXECUTION

3.01 EXAMINATION

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

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

3.02 JOINT PREPARATION

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

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

3.03 SEALANT APPLICATION, GENERAL

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

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Set joint filler units at proper depth or position in the joint to coordinate with other work, including the installation of bond breakers, backer rods and sealants.

1. Do not leave voids or gaps between the ends of joint filler units.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond breaker tape wherever shown and wherever required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Apply compound with a gun having proper size nozzle or with a knife, as required. Use sufficient pressure to fill all voids and joints solid. Remove excess sealant and leave surfaces smooth, neat and clean. Upon completion sealant shall have a smooth, even finish and all joints shall be weathertight. All work shall be in accordance with manufacturer's printed instructions.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

G. Acoustical Sealant Installation: At sound-rated assemblies and elsewhere as indicated, seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations. Refer to Section 09 29 00 for product.

H. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into the voids of adjoining surfaces. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

## 3.04 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed and cured sealant joints as follows:
    a. Perform 5 tests for the first 1000 feet of joint length for each kind of exterior sealant and joint substrate.
    b. Perform 1 test for each 1000 feet of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect tested joints and report on the following:
   a. Whether sealants filled joint cavities and are free of voids.
   b. Whether sealant dimensions and configurations comply with specified requirements.
   c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field-Adhesion Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.05 PROTECTION

A. Cure sealants in compliance with manufacturer's instructions and recommendations. Advise the Contractor of procedures required for the cure and protection of joint sealers during the construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at the time of Substantial Completion.

## 3.06 JOINT-SEALANT COLOR SCHEDULE

1. Provide different sealant colors, as selected by A/E from manufacturer's full range of colors, at the following joint locations, and as specified in related Sections:
   a. Metal Panels.
   b. Wood Trim.

END OF SECTION 07 92 00

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SECTION 08 11 13

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Hollow Metal Doors.

B. Hollow Metal Frames.

1.03 RELATED WORK

A. Joint Sealants: Section 07 92 00.

B. Door Hardware: Section 08 71 00.

C. Painting: Section 09 90 00.

1.04 REFERENCES

A. Comply with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. ANSI A250.3 Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames

C. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings

D. ANSI A250.5 Accelerated Physical Endurance Test Procedure for Steel Doors, Frames, and Frame Anchors

E. ANSI A250.6 Hardware on Steel Doors (Reinforcement --Application)

F. ANSI A250.8 Nomenclature for Standard Steel Doors and Steel Door Frames

G. ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames

H. ANSI/DHI A115 Specifications for Hardware Preparations in Standard Steel Doors and Frames

I. ANSI/DHI A115.1G Installation Guide for Doors and Hardware

J. SDI-Steel Door Institute

K. ASTM E119 Methods for Fire Tests of Building Construction and Materials.

L. ASTM A240/A240M Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel

M. ASTM A366 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality

N. ASTM A568 Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements

O. ASTM A569 Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality

P. ASTM A591 Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for light Coating Mass Applications

Q. ASTM A620 Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Drawing Quality, Special Killed

R. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process

S. ASTM A924 Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

T. NFPA 80: Fire Doors and Windows.

U. NFPA-101-94: Life Safety Code.

V. American Welding Society

## 1.05 SUBMITTALS

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

## 1.06 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

## 1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage.

1. Provide additional protection to prevent damage to finish of factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Construction Manager; otherwise, remove and replace damaged items as directed.

D. Store doors and frames at building site under cover. Place units on minimum 4 inch high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create a humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4 inch spaces between stacked doors to promote air circulation.

1.08 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.01 MANUFACTURERS, HOLLOW METAL

A. Amweld Building Products

B. Ceco Door Products

C. Curries Company

D. Kewaunee Corporation

E. Mesker Door, Inc.

F. Steelcraft

G. Or approved equal.

2.02 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008 or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flamespread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Glazing: Comply with requirements in Division 08 Section "Glazing."

I. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

J. Steel: Commercial quality, level, cold-rolled steel conforming to ASTM A366, free of scale and surface defects. Commercial quality hot rolled and pickled steel conforming to ASTM A569 may be used as option for interior frames. Standard hollow metal frame gauges are as follows (Bullet Resistant must meet specified resistance level):
1. Interior Frames: 16-gage.
2. Exterior Frames: 14-gage.
3. Flush Doors: 16-gage (exterior), 18-gage (interior).
4. Rough Bucks and Stiffeners: 12-gage.
5. Miscellaneous Trim: 16 gage.

2.03 FABRICATION, GENERAL

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

B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.

C. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Fabricate doors to a maximum tolerance of 1/16 inch from a straight edge when laid on face of door in any direction, including diagonal.

E. Provide proper Underwriters' Laboratory (UL) labels. Labeled doors shall have equal labeled frames.

F. Clearances
1. Edge clearances shall be provided as follows:
   a. Between doors and frame, at head and jambs - 1/8 inch.
   b. At door sills:
      1) Where no threshold is used - 3/8 minimum.
      2) Where threshold is used - 1/4 inch maximum between door & threshold.

G. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.

3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

H. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
3. Provide loose stops and moldings on inside of hollow metal work. Coordinate rabbet width between fixed and removable stops with type of glazing and type installation indicated.

## 2.04 HOLLOW METAL FRAME FABRICATION

A. Provide metal frames of the types and styles indicated on the drawings or schedules and complying with SDI for materials and construction requirements.

B. Provide metal frames for doors, transoms, sidelights, borrowed lites, and other openings, as shown on drawings.

C. Provide integral channel frames, sub frames and stiffeners to structure where indicated or required for fastening and stiffening frames.

D. Provide steel spreader temporarily attached to feet of both jambs for welded frames.

E. Completely clean all frames by degreasing process, followed by one coat rust inhibitive primer equal to withstand a salt spray test (5% solution) of 70 hours. Thoroughly prime all surfaces without runs, smears, or bare spots, and under and inside all removable stops.

F. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. Sidelight Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
6. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    b. Compression Type: Not less than two anchors in each jamb.
    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.

7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

## 2.05 HOLLOW METAL DOOR FABRICATION

A. Top and bottom edges of all doors shall be closed with a continuous recessed steel channel not less than 16-gauge, full width spot welded to both faces.

B. All doors to be flush with seamless edges i.e., provide continuous flush end closures, continuously welded in place and ground smooth.

C. Hardware location per manufacturer recommended heights to meet ADA requirements.

D. Completely clean all doors of impurities and pressure sand to a smooth surface and correct all irregularities with metallic putty sanded smooth. Provide one spray coat of primer, baked on. Thoroughly paint unexposed inside surfaces of exterior doors, fire doors, and other doors occurring in excessive moisture area.

E. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

F. Glazed Lites: Factory cut openings in doors.

## 2.06 STANDARD HOLLOW METAL DOORS

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

B. Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
    1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush).

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

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

## 2.07 STANDARD HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Frames: Fabricated from metallic-coated steel sheet.
1. Fabricate frames with mitered or coped corners.
2. Fabricate frames as face welded unless otherwise indicated.
Frames for Level 2 Steel Doors: 0.053-inch- thick steel sheet.

C. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

## 2.08 FRAME ANCHORS

A. Jamb Anchors:
1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inchdiameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

## 2.09 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.

D. Cut-Off Stops:
1. Angled stop terminates 6-inches above the floor, closed at a 45 degree angle.
2. See Door Schedule for locations.

## 2.010 STEEL FINISHES

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

2. Ensure primer is compatible with finish coats scheduled.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.

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

### 3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.03 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    b. Install frames with removable glazing stops located on secure side of opening.
    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 plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    f. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
   a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Completely fill jambs and head of hollow metal door frames in masonry walls with grout.
6. 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.
7. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
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. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
   1. Non-Fire-Rated Standard Steel 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 ¾ inch.

D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions\.
   1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

E. Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated.
   1. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
   2. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels.
   3. At in-place concrete or masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.
   4. Install fire-rated frames in accordance with NFPA Std. No. 80.
   5. In metal stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In open steel stud partitions, place studs in wall anchor notches and wire tie. In closed steel stud partitions, attach wall anchors to studs with self-tapping screws.

6. Fill heads of fasteners with body putty, grind smooth and touch-up prime.

F. Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

G. Install glazing in strict accordance with fire resistant glazing material manufacturer's specifications. Field cutting or tampering is not permissible.

3.04 ADJUSTING AND CLEANING

A. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

END OF SECTION 08 11 13

SECTION 08 36 13

SECTIONAL OVERHEAD DOORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following types of sectional overhead doors:
   1. Doors with steel-framed steel panels, polystyrene insulated.
   2. Track, verify configuration for reuse of existing masonry rough opening.
   3. Electric door operators.

1.03 RELATED SECTIONS

A. Section 05 50 00 Metal fabrications.
B. Section 06 10 00 Rough Carpentry.
C. Division 26 sections: electrical service and connections for powered operators.

1.04 DEFINITIONS

A. Operation Cycle: Detection installing contractor will control doors operation on detection of CNG, as specified in section 23 09 93. Coordinate operation with CO2 sensors.

1.05 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide sectional overhead doors capable of withstanding the effects of gravity loads and the following loads and stresses without evidencing permanent deformation of door components:
   1. Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.

B. Operation-Cycle Requirements: Design sectional overhead door components and operator to operate for not less than 10,000 cycles.

1.06 SUBMITTALS

A. Product Data: For each type and size of sectional overhead door, operator and accessory. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes. Provide roughing-in diagrams, operating instructions, and maintenance information. Include the following:
   1. Setting drawings, templates, and installation instructions for built-in or embedded anchor devices.
   2. Summary of forces and loads on walls and jambs.
   3. Motors: Show nameplate data and ratings; characteristics; mounting arrangements; size and location of winding termination lugs, conduit entry, and grounding lug; and coatings.

B. Shop Drawings: For special components and installations not dimensioned or detailed in manufacturer's data sheets.
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems. Differentiate between manufacturer-installed and field-installed wiring and between components provided by door manufacturer and those provided by others.

C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied finishes.

D. Samples for Verification: Of each type of exposed finish required, prepared on Samples of size indicated below and of same thickness and material indicated for Work. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
   1. Panel: 6 inches square.

E. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

F. Manufacturers' Certificates: Signed by manufacturers certifying that they comply with requirements specified in "Quality Assurance" Article. On request, submit evidence of manufacturing experience.

1.07 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who is an authorized representative of the sectional overhead door manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: Engage a firm experienced in manufacturing sectional overhead doors similar to those indicated for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain sectional overhead doors through one source from a single manufacturer.
   1. Obtain operators and controls from the sectional overhead door manufacturer.

D. Product Options: Drawings indicate size, profiles, and dimensional requirements of sectional overhead doors and accessories and are based on the specific system indicated. Other manufacturers' systems with equal performance and dimensional characteristics may be considered. Refer to Division 1 Section "Substitutions."

E. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Basis of Design: Clopay Industrial Series Ribbed Steel Door Series 524S
   2. Or equal product from Overhead Door, C.H.I Overhead Door, Distributor: Geise Building Products, Brookfield WI, 262.784.4250.
   3. Or approved equal.

2.02 STEEL SECTIONS

A. Construct 2 inch thick door sections from galvanized, structural-quality carbon-steel sheets complying with ASTM A 653 commercial quality, with a minimum yield strength of 33,000 psi and a minimum G60 zinc coating. Sections and frame construction and installation to create an airtight barrier to prevent the migration of gas.
   1. Exterior Sheet Thickness: 24 ga.
   2. Exterior Section Face: Ribbed.

B. Fabricate door panels from a single sheet to provide sections not more than 24 inches high and nominally 2 inches deep. Roll horizontal meeting edges to a continuous, interlocking, keyed, rabbeted, shiplap, or tongue-in-groove weathertight, airtight seal, with a reinforcing flange return.

C. Enclose open section with not less than 0.064-inch galvanized steel channel end stiles welded in place. Provide not less than 0.064-inch galvanized intermediate stiles, cut to door section profile, spaced at not more than 48 inches o.c., and welded in place.

D. Reinforce sections with continuous horizontal and diagonal reinforcement, as required to stiffen door and for wind loading. Provide galvanized steel bars, struts, trusses or strip steel, formed to depth and bolted or welded in place.

E. 1 3/8 inch thick polystyrene insulation with fire retardant additive to meet UL R-1894A.

F. Provide reinforcement for hardware attachment.

G. Fabricate sections so finished door assembly is rigid and aligned, with tight hairline joints, and free of warp, twist, and deformation.

H. Finish galvanized steel door sections as follows:
   1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   2. Provide system with 10 year warranty against rust through.
   3. Surface Preparation: Clean galvanized surfaces with nonpetroleum solvent so surfaces are free of oil and surface contaminants.
   4. Pretreat zinc-coated steel, after cleaning, with a conversion coating of type suited to organic coating applied over it.
   5. Apply manufacturer's standard primer to both door faces after forming, according to coating manufacturer's written instructions for application and minimum dry film thickness.
   6. Apply manufacturer's standard primer and powder-coat-applied finish coats to interior and exterior door faces after forming, according to coating manufacturer's written instructions for application, thermosetting, and minimum dry film thickness.
      a. Color and Gloss: prefinished with a 3-coat process of baked-on-polyester top coat over primer on a phosphate coating. Color to be selected from manufacturer’s standard colors. Interior to have baked-on polyester over primer. One full mil exterior, one-half mil interior.

## 2.03 TRACKS, SUPPORTS, AND ACCESSORIES

A. Tracks: Provide manufacturer's low headroom track with rear mount trolley operator, galvanized steel track system, sized for door size and weight, designed for lift type indicated and clearances shown, and complying with ASTM A 653, for minimum G60 zinc coating. Provide complete track assembly including brackets, bracing, and reinforcement for rigid support of ball-bearing roller guides for required door type and size. Slot vertical sections of track at 2 inches o.c. for door-drop safety device. Slope tracks at proper angle from vertical or otherwise design to ensure tight closure at jambs when door unit is closed. Weld or bolt to track supports.

B. Track Reinforcement and Supports: Provide galvanized steel track reinforcement and support members, complying with ASTM A 36 and ASTM A 123. Secure, reinforce, and support tracks as required for door size and weight to provide strength and rigidity without sag, sway, and vibration during opening and closing of doors.

C. Support and attach tracks to opening jambs with continuous angle welded to tracks and attached to wall. Support horizontal (ceiling) tracks with continuous angle welded to track and supported by laterally braced attachments to overhead structural members at curve and end of tracks.

D. Weatherseals: Provide replaceable, adjustable, continuous, compressible weather-stripping gaskets of flexible vinyl, rubber, or neoprene fitted to bottom and at top of overhead door.
   1. Provide motor-operated doors with combination bottom weatherseal and sensor edge.
   2. In addition, provide continuous flexible seals at door head and jambs for an airtight installation.
   3. Provide all seals to create an air barrier in the closed position to prevent the migration of gases.

E. Spring Counterbalance: Torsion sprung counterbalance mechanism sized to weight of the door, with a helically wound, oil tempered torsion spring mounted on a steel shaft; cable drum of die cast aluminum with high strength galvanized aircraft cable with minimum 7 to 1 safety factor. Standard Cycle Spring: 10,000 cycle.

F. Windows: NA

## 2.04 HARDWARE

A. General: Provide heavy-duty, corrosion-resistant hardware, with hot-dip galvanized, stainless-steel, or other corrosion-resistant fasteners, to suit door type.

B. Hinges: Provide heavy-duty galvanized steel hinges, of not less than 0.0747-inch- thick uncoated steel, at each end stile and at each intermediate stile, per manufacturer's written recommendations for door size. Attach hinges to door sections through stiles and rails with bolts and lock nuts or lock washers and nuts. Use rivets or self-tapping fasteners where access to nuts is not possible. Provide double-end hinges, where required, for doors exceeding 16 feet in width, unless otherwise recommended by door manufacturer.

C. Rollers: Provide heavy-duty rollers, with steel ball bearings in case-hardened steel races, mounted with varying projections to suit slope of track. Extend roller shaft through both hinges where double hinges are required. Provide 3-inch- diameter roller tires for 3-inch track, 2-inch- diameter roller tires for 2-inch track, and as follows:
   1. Case-hardened steel tires.

D. Push/Pull Handles: For push-up-operated or emergency-operated doors, provide galvanized steel lifting handles on each side of door.

E. Slide Bolt: Fabricate with side locking bolts to engage through slots in tracks for locking by padlock, located on single-jamb side, operable from inside only.

F. Fabricate locking device assembly with lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bar to engage through slots in tracks.
   1. Locking Bars: Single-jamb side, operable from inside and outside.

G. Chain Lock Keeper: Suitable for padlock. Confirm side of door to be secured prior to shop drawing submittals for Owner approval.

H. Where door unit is power operated, provide safety interlock switch to disengage power supply when door is locked.

## 2.05 ELECTRIC DOOR OPERATORS

A. General: Provide electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operational life specified, complete with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking door, and accessories required for proper operation.

B. All openers and accessories must be explosion proof, unless located in Cold Storage at Door OHD S-4.

C. Comply with NFPA 70.

D. Disconnect Device: Provide hand-operated disconnect or mechanism for automatically engaging sprocket-chain operator and releasing brake for emergency manual operation while disconnecting motor, without affecting timing of limit switch. Mount disconnect and operator so they are accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

E. Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency auxiliary operator.

F. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V, ac or dc.

G. Door-Operator Type: Provide explosion proof unit consisting of electric motor and the following:
1. Product: LiftMaster Elite Series (Or approved equal) Electric door operator selection depends on size and weight of door and type of operation. Field verify all doors.
2. 1 HP 408V, 3 phase. 125 Ft. Lbs/Second rating for 12 Cycles per hour.
3. 1 HP motor, UL listed.
4. Internal electronic load sensor.
5. V-Belt primary reduction and chain drive secondary reduction.
6. One radio controlled operator per door.
7. Provide 3 button transmitter to provide remote open, close, stop functionality.

H. Obstruction Detection Device: Provide each motorized door with indicated external automatic safety sensor able to protect full width of door opening. Activation of sensor immediately stops and reverses downward door travel.
1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
a. Self-Monitoring Type: Provide self-monitoring sensor designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door operates to close only with constant pressure on close button.

2. Sensor Edge: Provide each motorized door with an automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor immediately stops and reverses downward door travel. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
a. Provide electrically actuated automatic bottom bar.
1) Self-Monitoring Type: Provide self-monitoring, 4-wire configured device.

I. Limit Switches: Provide adjustable switches, interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Examine wall and overhead areas, including opening framing and blocking, with Installer present, for compliance with requirements for installation tolerances, clearances, and other conditions affecting performance of Work of this Section.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

A. General: Install door, track, and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports according to Shop Drawings, manufacturer's written instructions, and as specified.

B. Fasten vertical track assembly to framing at not less than 24 inches o.c. Hang horizontal track from structural overhead framing with angle or channel hangers welded and bolt fastened in place. Provide sway bracing, diagonal bracing, and reinforcement as required for rigid installation of track and door-operating equipment.

## 3.03 ADJUSTING

A. Lubricate bearings and sliding parts; adjust doors to operate easily, free from warp, twist, or distortion and fitting weathertight for entire perimeter.

B. Adjust belt-driven motors as follows:
   1. Use adjustable motor-mounting bases for belt-driven motors.
   2. Align pulleys and install belts.
   3. Tension belt according to manufacturer's written instructions.

## 3.04 DEMONSTRATION

A. Startup Services: Engage a factory-authorized service representative to perform startup services and to train Owner's maintenance personnel as specified below:
   1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
   3. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."
   4. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
   5. Schedule training with Owner with at least 7 days' advance notice.

END OF SECTION 08 36 13

SECTION 08 71 00

DOOR HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Door Hardware and verification of existing hardware for coordination of specified components.

1.03 RELATED SECTIONS

A. Metal Fabrications: Section 05 50 00.
B. Hollow Metal Doors and Frames: Section 08 11 13.

1.04 REFERENCES

A. Federal Specifications (FS)
   1. FF-H-106a Hardware, Builders'; Locks and Door Trim-Standard Finishes for Builders Hardware.

B. National Fire Protection Association, Inc. (NFPA), Battery March Park, Quincy, MA 02269.
   1. NFPA 80 - Standard for fire doors and windows.
   2. NFPA 101 - Code for safety to life from fire in buildings and structures.

C. Underwriter's Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062.
   1. Building Materials Directory.

D. Hardware shall be in strict accord with Wisconsin Administrative Code Chapter Comm. 69 - "Barrier Free Design".

1.05 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract.
   1. Five (5) copies of a detailed, vertical type hardware schedule for approval.
      a. List and describe each opening separately. Include doors with identical hardware, except hand, in a single heading. Include door number, room designations, degree of swing, and hand.
      b. List related details. Include dimensions, door and frame material, and other conditions affecting hardware.
      c. List all hardware items. Include manufacturer's name, quantity, product name, catalog number, size, finish, attachments, and related details.
      d. Resubmit four (4) copies of the corrected schedule when required.
      e. Determine keying requirements, as directed by the Owner's Representative and submit five (5) copies of a detailed keying schedule for approval; resubmit four copies (4) of the corrected schedule when required. Confirm side of door to be secured prior to shop drawing submittals for Owner approval. Maintain all egress routes and provide free egress.
      f. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.

2. Samples of hardware items as may be required. Identify each sample and indicate the location of subsequent installation in the project.
3. A copy of the approved hardware schedule and all pertinent templates or template information to each fabricator of material factory-prepared for the installation of hardware.

1.06 QUALITY ASSURANCE

A. Manufacturers and product numbers listed herein establish a standard of quality. Similar items by other manufacturers may be accepted by prior written approval by the architect in accord with the General Conditions of the Contract. Except where specified in the hardware schedule, furnish products of only one manufacturer for each type of hardware.

B. Supplier: Hardware Supplier: The hardware supplier shall be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI's continuing education program (CEP).

C. Items of hardware not definitely specified herein but necessary for completion of the Work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required. Include such nuances as strike type, strike lip, raised barrel hinges, mounting brackets, fasteners, shims, and coordination between conflicting products. All doors shall be provided with a stop.

1.07 REGULATORY REQUIREMENTS

A. Furnish UL listed hardware for all UL labeled openings in conformance with requirements for the class of opening scheduled.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware to the job site in the manufacturer's original containers marked to correspond with the approved hardware schedule for installation location.

B. Store hardware in dry surroundings and protect against loss and damage.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Refer to the Hardware Schedule at the end of this Section.

2.02 ACCESSORIES

A. Furnish all necessary hardware accessories such as wood or machine screws, bolts, nuts, anchors, toggle bolts, and other fasteners, each of the type, size, material and finish for its intended purpose and each according to the material to which the hardware is being applied.

B. Keying system will be determined by the Owner's Representative.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install hardware in accordance with manufacturer's recommendations and instructions.

B. Install hardware on UL labeled openings in accordance with manufacturer's requirements to maintain the fire rating.

C. Mortise and cut to close tolerance and conceal evidence of cutting in the finished work.

D. Remove, cover or protect hardware after fitting until paint or other finish is applied. Permanently install hardware after finishing operations are complete.

E. Deliver one complete set of installation and adjustment instructions, and tools with the hardware.

F. Coordinate all Owner Furnished Contractor Installed hardware.

3.02 ADJUSTING

A. At final completion, adjust and test all hardware for function and performance and leave in good operating condition.

3.03 CLEANING

A. Clean all hardware to restore the original finish.

3.04 PROTECTION

A. Protect the finished installation until acceptance of the project.

3.05 HARDWARE SCHEDULE

A. Manufacturers

| | | |
|---|---|---|
| 1. Hinges | Hager Hinge Co. | HAG |
| a. Approved Equals: | Stanley | |
| | McKinney | |
| 2. Lockset | Best | |
| 3. Door Closers | LCN | LCN |
| a. Approved Equals: | No substitutions. | |
| 4. Electromagnetic Holder | Rixson | RF |

B. Hardware Sets:

**SET 01, modify existing door**

Provide an air seal to prevent the migration of gases. All existing openings have closers, notify architect of any discrepancy. Field verify the ability to reuse of any existing seals, closers or thresholds. Provide adjustments required for the reuse of existing to provide an air seal. Review existing conditions and provide appropriate products.

| | | | | | |
|---|---|---|---|---|---|
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |

**SET 02, modify existing door**

Provide an air seal to prevent the migration of gases. All existing openings have closers, notify architect of any discrepancy. Field verify the ability to reuse of any existing seals, closers or thresholds. Provide adjustments required for the reuse of existing to provide an air seal. Review existing conditions and provide appropriate products.

| | | | | | |
|---|---|---|---|---|---|
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |

**SET 03**

| | | | | | |
|---|---|---|---|---|---|
| | EA | HINGES | BB1191 NRP | 652 | HAG |
| 1 | EA | STOREROOM LOCK | 93K D x 14D | 626 | BES |
| 1 | EA | CLOSER | 4110 | 689 | LCN |
| 1 | EA | ELECTROMAG HOLDER | 998M 24 VDC | 689 | RF |
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |

Provide an air seal to prevent the migration of gases.

Notes: Door normally held open by magnetic holders, tied to fire alarm. Doors release, close, and latch upon fire alarm or loss of power.

**SET 04, modify existing door**

Provide an air seal to prevent the migration of gases. All existing openings have closers, notify architect of any discrepancy. Field verify the ability to reuse of any existing seals, closers or thresholds. Provide adjustments required for the reuse of existing to provide an air seal. Review existing conditions and provide appropriate products.

| | | | | | |
|---|---|---|---|---|---|
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |
| 1 | EA | ELECTROMAG HOLDER | 998M 24 VDC | 689 | RF |
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |

Bracket for Electromagnetic holder Division 05 50 00

Notes: Door normally held open by magnetic holders, tied to fire alarm. Doors release, close, and latch upon fire alarm or loss of power.

**SET 05**

| | | | | | |
|---|---|---|---|---|---|
| | EA | HINGES | BB1191 NRP | 652 | HAG |
| 1 | EA | STOREROOM LOCK | 93K D x 14D | 626 | BES |
| 1 | EA | CLOSER | 4110 | 689 | LCN |
| 1 | EA | ELECTROMAG HOLDER | 998M 24 VDC | 689 | RF |
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |

Bracket for Electromagnetic holder Division 05 50 00

Provide an air seal to prevent the migration of gases.

Notes: Door normally held open by magnetic holders, tied to fire alarm. Doors release, close, and latch upon fire alarm or loss of power.

**SET 06**

| | | | | | | |
|---|---|---|---|---|---|---|
| | EA | HINGES | BB1191 NRP | 652 | HAG | |
| 1 | EA | STOREROOM LOCK | 93K D x 14D | 626 | BES | |
| 1 | EA | CLOSER | 4110 | 689 | LCN | |
| 1 | SET | PERIMETER SEAL | 5020 | CLR | | NGP |
| 1 | SET | SEALS | 155S | MIL | | NGP |
| 1 | EA | SWEEP | 200N | CLR | | NGP |
| 1 | EA | WALL STOP | WS407 | 630 | | IVE |

Provide an air seal to prevent the migration of gases.

**SET 07**

| | | | | | |
|---|---|---|---|---|---|
| | EA | HINGES | BB1191 NRP | 652 | HAG |
| 1 | EA | STOREROOM LOCK | 93K D x 14D | 626 | BES |
| 1 | EA | CLOSER | 4110 | 689 | LCN |
| 1 | SET | PERIMETER SEAL | 5020 | CLR | NGP |
| 1 | SET | SEALS | 155S | MIL | NGP |
| 1 | EA | SWEEP | 200N | CLR | NGP |
| 1 | EA | OVERHEAD STOP | 100S | 630 | GLY |

Provide an air seal to prevent the migration of gases.

END OF SECTION 08 71 00

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. Glass in Steel and Doors.

B. Glass in Wood Frames.

C. All Glass Display Door

1.03 RELATED WORK

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

B. Finish Carpentry 06 20 00.

1.04 REFERENCES

A. Reference Specification: "Glazing Manual", by Flat Glass Marketing Association.

B. Materials: Conform in all respects to the "Safety Standard for Architectural Glazing Materials", 16CFR 1201, issued by the Consumer Product Safety Commission.

C. AMA WSG.1 Window Selection Guide.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications for Insulating-Glass Units with Sputter-Coated, Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

B. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Laminated Glazing Reference Manual" and GANA's "Glazing Manual."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

D. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

E. All materials used for this project shall be from the same batch run and manufacturer.

F. Water Penetration Resistance, nor uncontrolled water leakage; tested as per ASTM E331

G. Thermal Transmittance Resistance: Maximum "U" factor in accordance with Wisconsin Enrolled Commercial Code; as tested by AAMA 1503.1

H. Condensation Resistance; Condensation Resistance Factor (CRF) to be minimum 56/frame and 50/glass, with 30 percent inside relative humidity, and 68 degree F temperature.; as tested by AAMA 1530.1.

I. Sound Transmission Resistance; Sound Transmission Class (STC) for typical application to be minimum of 32; AS tested by ASTM E4134.

J. Fenestration must comply with a minimum testing performance requirements for an AAMA/NWWDA 101/1.S.2 HC-40 rating. The recognized standard for performance ratings of windows is AAMA/NWWDA 101/1.S.2.

K. All performance testing must be conducted by an independent, impartial, third party, AAMA certified testing laboratory.

L. Polyurethane thermal barriers shall be tested as per AAMA TIR A8-90 and AAMA Draft #13 of AAMA's Dry Shrinkage & Composite Performance Thermal Cycling Procedure for validation testing at differential temperatures. At the conclusion of the tests, the shrinkage shall be equal to or less than the prescribed 0.10%.

M. Use of poured and de-bridged polyurethane thermal beak assemblies will require window manufacturer's prior adoption and continued use of the procedures and quality control features outlined in AAMA's Quality Assurance processing guide For Poured and De-bridged Polyurethane Thermal Barriers.

## 1.06 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

## 1.07 INSULATED GLASS WARRANTY

A. Provide insulating glass manufacturer's written guarantee.

## 1.08 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract
   1. Manufacturer's product data.
      a. Provide data for visible light transmittance, reflectance, U-value, shading coefficient, solar heat gain coefficient and light to solar gain.
   2. Two samples of each type glass specified.

## 1.09 DELIVERY, STORAGE AND HANDLING

A. Package, handle, deliver and store to avoid damage. Scratched glass will be rejected.

1.010 PROJECT CONDITIONS

A. Do not proceed with installation of liquid sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation.

1.011 ENVIRONMENTAL REQUIREMENTS

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

PART 2 - PRODUCTS

2.01 GLASS PRODUCTS, GENERAL

A. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass lites in thicknesses as needed to comply with requirements indicated.

B. Strength: Where float glass is indicated, provide annealed float glass, Kind HS heat-treated float glass, or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass or Kind FT heat-treated float glass as needed to comply with "Performance Requirements" Article. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

   1. Provide safety glazing labeling.

C. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

   1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
   2. For laminated-glass lites, properties are based on products of construction indicated.
   3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
   4. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
   5. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
   6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

2.02 GLASS PRODUCTS

A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 1 (clear) unless otherwise indicated.

B. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.
   1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated and free of tong marks.

2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).
4. Comply with requirements for safety glass in the International Building Code.

C. Uncoated Tinted Float Glass: Class 2, complying with other requirements specified.

## 2.03 INSULATING GLASS

A. Glass Type GLT-13: Low-E Clear + Clear insulating glass PPG Industries, Inc.; Solar Control, Low-E, Solarban 60:
1. Overall Unit Thickness: 1 inch.
2. Thickness of Each Glass Lite: 6.0 mm.
3. Outdoor Lite: Clear float glass, heat-strengthened float glass or fully tempered float glass as required by conditions and codes.
   a. Outdoor lite: Clear Solarban 60 Low-E Coating: Sputtered on second surface.
4. Interspace Content: Air.
5. Indoor Lite: Clear float glass, heat-strengthened float glass or fully tempered float glass as required by conditions and codes.
6. Visible Light Transmittance: 70 percent minimum.
7. Winter Nighttime U-Factor: 0.29 maximum.
8. Summer Daytime U-Factor: 0.27 maximum.
9. Solar Heat Gain Coefficient: 0.39 maximum.
10. Shading Coefficient: 0.45
11. Outdoor Visible Light Reflectance: 11 percent.
12. Provide safety glazing labeling.
13. Glass: Clear float.

B. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.
1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Manufacturer's standard spacer material and construction.
3. Desiccant: Molecular sieve or silica gel, or blend of both.
4. Dehydrated Interspace Content: Air.
5. Thickness: 1 inch typical; provide 5/8 inch thick unit at storefront entrance.

## 2.04 GLASS TYPE SCHEDULE

A. Glass Products indicated below are based on proprietary products of Viracon, PPG, SAFTI FIRST Serious Materials and Bendheim. Products from any of the above listed manufacturers that meet the design criteria of the glass specified below are acceptable.

1. GLT 4: Tempered, clear float glass.
   a. Thickness: 1/4".

2. GLT 13: Refer to above.

## 2.05 GLAZING ACCESSORIES

A. Glazing Sealant: One-part silicone similar to Pecora 860, Sonneborn Omniplus or Tremco Spectrum 2.
1. Comparable means both quality and color options.

B. Setting Blocks: 70-90 Shore "A" durometer, sized to accommodate size of glass used, compatible with glazing sealant.

C. Spacers: Compatible with sealant used.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until conditions are satisfactory.

### 3.02 PREPARATION

A. Field Measurement
   1. Measure size of frame to receive glass.
   2. Compute actual glass size, allowing for edge clearances.

B. Preparation of Surfaces
   1. Remove protective coatings from surfaces to be glazed.
   2. Clean glass and glazing surfaces to remove dust, oil and contaminants.

### 3.03 INSTALLATION

A. Install glass in accordance with glass manufacturer's recommended instructions.

B. Provide weathertight installation.

### 3.04 CLEANING

A. Remove excess glazing compound from installed glass.

B. Remove labels from glass surface as soon as installed.

C. Wash and polish both faces of glass.

D. Remove debris from work site.

### 3.05 PROTECTION

A. Attach crossed streamers away from glass face.

B. Do not apply markers to glass surface.

C. Replace damaged glass.

END OF SECTION 08 80 00

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SECTION 09 90 00

PAINTING

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

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

### 1.02 WORK INCLUDED

A. Painting and finishing of interior exposed items and surfaces throughout Project.

B. Field painting of exposed bare and covered pipes and ducts and hangers, conduits, uni-strut, exposed steel and iron work, all metal fabricated Section 05 50 00 items, and primed metal surfaces including but not limited to, hollow metal work, equipment installed under mechanical and electrical work.

C. "Paint" as used herein means all coating systems materials including primers, emulsions, enamels, stains, sealers and fillers, and other applied material whether used as prime, intermediate or finish coats.

D. Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces. Where items or surfaces are not specifically mentioned, paint the same as similar adjacent materials or areas.

1. Refer to A100 Finish Notes for existing work to be protected and not painted.

E. Following categories are not included as part of field-applied finish work.
1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified.
2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces in concealed areas and generally inaccessible areas.
3. Finished Metal Surfaces.
4. Operating Parts.

### 1.03 RELATED WORK

A. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

B. Examine the Contract Documents and be familiar with all their provisions regarding painting. All surfaces that are left unfinished by the requirements of other Sections shall be painted or finished as part of this Section.

### 1.04 SUBMITTALS

A. Submit in accordance with the General Conditions of the Contract:
1. Paint: Submit a list of specified products with corresponding name of manufacturer, identifying name and number of proposed products along with manufacturer's written instructions for use of each product.

2. If manufacturer to be used is different from that of color chips furnished, prepare and submit two approximately 6 inch square, properly labeled samples of each color and sheen required on properly prepared paint-out cards or hardboard.

1.05 QUALITY ASSURANCE

A. MPI Standards:
1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."

2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not deliver materials to site until having received all written approvals of submitted information and samples.

B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label.

C. Store materials not in actual use in tightly covered containers.

D. Take all precautions to ensure that workers and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

E. Remove rags and waste from storage areas daily.

1.07 PROJECT CONDITIONS

A. Apply water-base paints only when temperatures of surfaces to be painted and surrounding air temperatures are between 50 and 95 degrees F.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F. and 95 degrees F.

C. Do not apply paint when relative humidity exceeds 85%; at temperatures less than 5 degrees F. above the dew point; or to damp or wet surfaces.

1.08 SEQUENCING AND SCHEDULING

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

1.09 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional 5 percent, but not less than 1 new and unopened gal. of each material and color applied.

1.010 SUSTAINABLE DESIGN REQUIREMENTS

A. Low-Emitting Materials, Field applied Paints and Coatings: Interior paints and coatings applied on-site must meet the limitations and restrictions concerning chemical components set by the following standards:
1. Topcoat Paints, Green Seal Standard GS-11, Paints: First Edition, May 20, 1993.

2. Anti-Corrosive and Anti-Rust Paints: Green Seal Standard GS-03, Anti-Corrosive Paints", Second Edition, January 7, 1997. For applications on ferrous metal substrates.
3. "All Other Architectural Coatings, Primers and Undercoats: South Coast Air Quality Management District (SCAQMD) Rule #1113, Architectural Coatings", rules in effect on January 1, 2004.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURERS

A. Provide products from the following manufacturers:

1. AFM Safecoat
2. Benjamin Moore & Co.
3. Cabot
4. ICI/Dulux.
5. Mythic Paint, Southern Diversified Products
6. PPG Architectural Finishes, Inc.
7. Rymar, LLC
8. Sherwin-Williams Company
9. Sikkens
10. Target Coatings

### 2.02 MATERIALS

A. Use the materials of the same manufacturer for each system.

B. Sherwin-Williams systems are called out in the system schedules to establish quality and dry mil thickness of finished installation for all systems. A different manufacturer may be used for color selection. Any manufacturer noted above may be used as long as quality and color requirements are met.

1. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.

D. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

E. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Primer or Undercoat: VOC content of not more than 100 g/L (150 g/L with colorant added at point-of-sale).
2. Flat Paints and Coatings: VOC content of not more than 50 g/L (100 g/L with colorant added at point-of-sale).
3. Non-flat Paints and Coatings: VOC content of not more than 100 g/L (150 g/L with colorant added at point-of-sale).
4. Floor Paint: VOC content of not more than 100 g/L (150 g/L with colorant added at point-of-sale).
5. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
6. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

F. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

## 2.03 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

## 2.04 METAL PRIMERS

A. Rust-Inhibitive Primer (Water Based): MPI #107.

2.05 LATEX PAINTS

A. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).

B. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).

C. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).

D. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).

2.06 EQUIPMENT

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

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates:
1. Concrete: Must be cured a minimum of 45 days.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.02 PREPARATION

A. Perform preparation and cleaning procedures in accord with paint manufacturer's instructions and as specified for each particular substrate condition.

1. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations.
   a. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   b. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

2. All paint removal work performed on-site must use a non-caustic, citrus-based stripping product. The Owner will only accept a citrus-based product for stripping the paint. The use of sodium hydroxide or methylane chloride removers will NOT be permitted. Dry scraping, sanding or other abrading of the existing paint that would create dust or chips is not permitted.
   a. Use of a drop cloth below the work area and disposal of paint debris at the end of each day will be mandatory.

3. Follow manufacturer’s instructions for use of stripping solutions to avoid raising grain of wood.

4. Do not dip fabricated units (doors, etc.) in stripping solution to avoid saturating wood or damaging glued connections.
5. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning.
6. Remove dirt, rust, scale, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

B. Ferrous Metal

1. Remove dirt and grease with mineral spirits or solvent recommended by paint manufacturer and clean cloths.
2. Where not galvanized, shop coat of primer will exist on surface. If prime coat is not smooth, sand to bare metal and re-prime.

C. Concrete

1. Surfaces must be clean and free of grease, wax, and mildew. Remove any chalk and loose scaling. Wash with a detergent and rinse with water from a hose.

## 3.03 APPLICATION

A. Provide adequate forced ventilation of enclosed areas for curing of installed materials, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors or gases.

B. Do work under adequate illumination and dust-free conditions.

C. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

D. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

E. Materials

1. Do not open containers until required for use.
2. Stir materials thoroughly and keep at uniform consistency during application.

F. Coats

1. Number specified is minimum.
2. Touch up suction spots between coats.
3. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
4. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
5. Refinish surfaces affected by refitting work.

## 3.04 COLOR SEPARATION

A. Not applicable.

## 3.05 CLEANING

A. During the progress of this work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

3.06 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct damage by cleaning, repairing or replacing.

B. Provide "wet paint" signs to protect newly-painted finishes. Remove temporary protective wrappings, after completion of painting operations.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 SCHEDULE OF WORK

A. In addition to obvious surfaces, the following do not require painting or finishing.
1. Do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) acoustic materials, finished mechanical and electrical equipment including light fixtures and distribution cabinets.
2. Painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, utility tunnels, pipe spaces, duct shafts and elevator shafts.
3. Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.
4. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting, unless otherwise indicated.
5. Do not paint over any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plate.
6. Paint all steel.
7. Do not apply next coat until previous is thoroughly dry.
8. Provide final coat which is solid and even in color, free from runs, laps, sags, brush marks, air bubbles and excessive roller stipple and worked into crevices, joints and similar areas.

B. Electrical Panel Box Covers and Doors
1. Remove, paint and reinstall after paint is dry.

C. Other Unfinished and Primed Surfaces

1. Provide specified finish on exposed surfaces. This includes prime coated mechanical units, piping, pipe covering, conduit, and interior duct surfaces visible behind grilles.

D. General
1. Paint or finish other new, unfinished and primed surfaces noted on drawings.
2. Provide aggregate in quantity as recommended by manufacturer and mix according to manufacturer’s written instructions.

E. Interior Paint Schedule

| System | Material | Type/Sheen | Number and Type of Coating |
|---|---|---|---|
| IPS-1 | Wood | Latex-Eggshell | One coat "Harmony Interior Latex Primer", |

| | | | |
|---|---|---|---|
| | | Zero VOC | Two coats "Harmony Interior Latex Eggshell". |
| IPS-6 | Gypsum Board | Epoxy-Gloss | One coat “ProMar Primer”<br>Two coats “Water based Catalyzed Epoxy” |
| IPS-7 | Gypsum Board | Latex-Eggshell<br>Zero VOC | One coat "Harmony Interior Latex Primer",<br>Two coats "Harmony Interior Latex Eggshell". |
| IPS-9 | Concrete Masonry | Latex/Eggshell | One coat “Loxon Block Surfacer”;<br>Two coats “Pro Industrial Zero VOC Acrylic Gloss finish B66W611” |
| IPS-13 | Ferrous Metal (Unprimed) | Latex/Semi-gloss | One coat "Pro-Cryl Universal Primer";<br>Two coats "ProClassic Waterborne” |
| IPS-14 | Ferrous Metal (Primed) | Latex/Semi-gloss | One coat “Pro-Cryl Universal Primer”;<br>Two coats “ProClassic Waterborne" |
| IPS-15 | Copper/Aluminum (finished rooms only) | Latex/Flat | One coat "DTM Acrylic Primer;<br>Finish";<br>Two coats "ProMar 200 Interior Latex Flat" |
| IPS-16 | Galvanized Metal (finished rooms only) | Latex/Flat | One coat "DTM Acrylic Primer Finish”;<br>Two coats "ProMar 200 Interior Latex Flat" |

## 3.08 PAINT COLOR SCHEDULE (GENERIC)

A. PT-1: Hollow Metal Doors, Frames, Steel brackets for hardware: Color to be selected by architect.
B. PT-2: Ceiling, walls above where ACT grid is removed.
C. PT-3: Concrete block.

END OF SECTION

# SECTION 23 05 00
# COMMON WORK RESULTS FOR HV

## P A R T 1 - G E N E R A L

### SCOPE

This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections.

### RELATED WORK

| | |
|---|---|
| 23 05 13 | Common Motor Requirements for HV Equipment |
| 23 05 23 | Valves and Piping for Fuel Gas |
| 23 05 29 | Hangers and Supports for HV Piping and Equipment |
| 23 05 93 | Testing, Adjusting, and Balancing for HV |
| 23 07 00 | HVAC Insulation |
| 23 09 14 | Electric Control Devices for HV |
| 23 09 26 | Gas Detection System |
| 23 09 93 | Sequence of Operation for HV Controls |
| 23 31 00 | HV Ducts |
| 23 33 00 | Air Duct Accessories |
| 23 34 00 | HV Fans |
| 23 37 13 | Diffusers, Registers & Grilles |
| 23 55 00 | Fuel Fired Heaters (Radiant Heaters and Makeup Air Units) |
| Division 26 00 00 – Electrical Sections | |
| 28 31 00 | Fire Detection and Alarm |

### REFERENCE

Applicable provisions of Division 1 govern work under this section.

### REFERENCE STANDARDS

Abbreviations of standards organizations referenced in other sections are as follows:

| | |
|---|---|
| AABC | Associated Air Balance Council |
| ADC | Air Diffusion Council |
| AGA | American Gas Association |
| AMCA | Air Movement and Control Association |
| ANSI | American National Standards Institute |
| ASHRAE | American Society of Heating, Refrigerating and Air Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| EPA | Environmental Protection Agency |
| GAMA | Gas Appliance Manufacturers Association |
| IEEE | Institute of Electrical and Electronics Engineers |
| ISA | Instrument Society of America |
| MCA | Mechanical Contractors Association |
| MICA | Midwest Insulation Contractors Association |
| NBS | National Bureau of Standards |
| NEBB | National Environmental Balancing Bureau |
| NEC | National Electric Code |
| NEMA | National Electrical Manufacturers Association |
| NFPA | National Fire Protection Association |
| SMACNA | Sheet Metal and Air Conditioning Contractors' National Association. Inc. |
| UL | Underwriters Laboratories Inc. |
| ASTM E814 | Standard Test Method for Fire Tests of Through-Penetration Fire Stops |
| ASTM E84 | Standard Test Method for Surface Burning Characteristics of Building Materials |
| UL1479 | Fire Tests of Through-Penetration Firestops |
| UL723 | Surface Burning Characteristics of Building Materials |

## QUALITY ASSURANCE

Refer to Division 1, Basic Requirements, Equals and Substitutions.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

## CONTINUITY OF EXISTING SERVICES

Dane County Highway Department will continue to occupy the facility during construction. Work of this project will be phased to allow Highway Department operations to continue, in some areas of the facility.

Do not interrupt or change existing services without prior written approval from the Dane County Project Manager. When interruption is required, coordinate the down-time with the user to minimize disruption to their activities. Unless specifically stated, all work involved in interrupting or changing existing services is to be done during normal working hours.

## SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between ductwork, piping, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. The contractor responsible shall hire individuals skilled in such work to do the sealing and fireproofing. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

**Penetrations of walls by piping (heating or plumbing) or ductwork shall be sealed to limit migration of methane from the CNG detection zones to adjacent areas of the facility.**

## SUBMITTALS

Refer to Division 1, Basic Requirements, Submittals.

Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the engineer that the equipment submitted and the motor starter schedule are in agreement or indicate any discrepancies. See related comments in Section 23 05 13 in Part 1 under Electrical Coordination.

Include wiring diagrams of electrically powered equipment.

Submit sufficient quantities of shop drawings to allow the following distribution:

- Operating and Maintenance Manuals 2 copies
- Testing, Adjusting and Balancing Contractor 1 copy
- Dane County Public Works 1 copy
- Engineer 1 copy

    - Electronic submittals are acceptable in PDF format. Submittals shall clearly identify the specific item being submitted for review.
    - Electronic submittals may not be returned or partially returned as required to identify conditions of the review.
    - A Submittal Review Form will be returned with conditions of the approval or rejection to the submittal
    - When electronic submittals are provided the contractor shall provide a minimum on one hard copy to be retained at the project and three additional copies on CD or Flash Drive to be distributed to Dane County Public Works, Dane County Highway Department and the Engineer. Refer to paragraph which follows in Operation and Maintenance Instructions.

## CERTIFICATES AND INSPECTIONS

Refer also to Division 1, Basic Requirements, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer in accordance with City of Madison requirements or Wis Adm Code. Deliver originals of these certificates to the Dane County Project Manager. Include copies of the certificates in the Operating and Maintenance Instructions.

## OPERATING AND MAINTENANCE INSTRUCTIONS

Refer to Division 1, Basic Requirements, Operating and Maintenance Instructions.

Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:

- Copies of all approved shop drawings.
- Manufacturer's wiring diagrams for electrically powered equipment
- Records of tests performed to certify compliance with system requirements
- Certificates of inspection by regulatory agencies
- Control record drawings and control sequences
- Parts lists for manufactured equipment
- Lubrication instructions, including list/frequency of lubrication done during construction
- Warranties
- Additional information as indicated in the technical specification sections

When electronic Operation and Maintenance Instructions are provided the contractor shall provide a minimum on one hard copy as described above to be retained at the project and three additional copies on CD or Flash Drive to be distributed to Dane County Public Works, Dane County Highway Department and the Engineer.

## COMMISSIONING

Each assembly, component, equipment, system and interface to be commissioned shall be verified by the installer at the site while work is underway and documented. The contractor is responsible for successfully completing installations, and correcting all deficiencies prior to functional performance test.

The installing contractors shall complete the functional performance tests. Coordinate with Dane County Highway Department, Dane County Public Works and the Consulting Engineers so they may witness and document test results.

Contractors are responsible for completion and coordination of their work with all trades prior to testing, performing preliminary functional performance testing, insuring necessary staff and resources are on hand and expediting testing. This includes completion of testing and balancing by the HV contractor required for successful functional performance testing. Failure to complete or coordinate work, preplan or have staff and resources available to carry out testing will result in retesting.

All contractors involved with specific assemblies, components, equipment, systems and interfaces shall have qualified installers and technicians present at the same time working together to perform testing and demonstrate correct performance through all operating and failure modes and compliance with contract documents and manufacturer’s recommendations.

Correct minor deficiencies during testing. Deficiencies that cannot be corrected during testing will be documented and subject to retest. Retesting will continue until no deficiencies remain.

**RECORD DRAWINGS**

Refer to Division 1, Basic Requirements, Record Drawings.

In addition to the data indicated in the Basic Requirements, maintain control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

## P A R T 2 - P R O D U C T S

**IDENTIFICATION**

STENCILS:
Not less than 1 inch high letters/numbers for marking pipe and equipment.

ENGRAVED NAME PLATES:
White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

**SEALING**

Manufacturers:
3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

Submittals:
Contractor shall submit product data for each system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

Product:
Fire stop systems shall be UL listed or tested by an independent testing laboratory approved by the Department of Commerce.

Use a product that has a rating not less than the rating of the wall or floor being penetrated. Reference architectural drawings for identification of fire and/or smoke rated walls and floors.

Contractor shall use firestop putty, caulk sealant, intumescent wrapstrips, intumescent firestop collars, firestop blocks, firestop mortar or a combination of these products to provide a UL listed system for each application required for this project. Provide mineral wool backing where specified in manufacturer's application detail.

NON-RATED PENETRATIONS:

Pipe Penetrations:
At pipe penetrations of non-rated interior walls, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood walls where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

Duct Penetrations:
Annular space between duct (with or without insulation) and the non-rated walls or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

## PART 3 - EXECUTION

### DEMOLITION

Refer to Continuity of Existing Services paragraph included in the specification section.

Owner will be moving existing materials and equipment necessary for completion of work required by this project. The contractor shall coordinate with the Dane County Highway Department Project Representative and Dane County Public Works Project Manager for scheduling the work.

Perform all demolition as indicated on the drawings to accomplish new work. Coordinate work with the user to minimize disruption to the existing building occupants.

Coordinate with Dane County Highway Department Project Representative any equipment that the County may want to retain for potential reuse.

All indicated to be removed shall be disposed of by the removing contractor.
Refer to section 01 74 19 – Construction Waste Management, Disposal and Recycling.

All pipe, wiring and associated conduit, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor.

### CUTTING AND PATCHING

Refer to Division 1, Basic Requirements, Cutting and Patching.

### COORDINATION

Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency with controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

### IDENTIFICATION

Identify equipment new or existing modified or newly controlled in this project by stenciling equipment number on or near the equipment item.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

### LUBRICATION

Lubricate all bearings with lubricant as recommended by the manufacturer before the equipment is operated for any reason. Once the equipment has been run, maintain lubrication in accordance with the manufacturer's instructions until the work is accepted by the owner. Maintain a log of all lubricants used and frequency of lubrication; include this information in the Operating and Maintenance Manuals at the completion of the project.

### SLEEVES

SLEEVES:
Provide galvanized sheet metal or conduit sleeves for penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction.

Sleeves are not required in interior non-rated drywall, plaster or wood partitions.

**SEALING AND FIRESTOPPING**

FIRE AND/OR SMOKE RATED PENETRATIONS:
Install approved product in accordance with the manufacturer's instructions where pipes penetrate a fire/smoke rated surface. When pipe is insulated, use a product which maintains the integrity of the insulation and vapor barrier.

Where firestop mortar is used to infill large fire-rated floor openings that could be required to support weight, provide permanent structural forming. Firestop mortar alone is not adequate to support any substantial weight.

NON-RATED PARTITIONS:
At all interior partitions penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the sleeve or cored opening.

**COMMISSIONING**

Refer to Part 1 – General for Commissioning required for Heating and Ventilation work on this project.

**TRAINING OF OWNER PERSONNEL**

Provide Owner training using final O&M data. Training sessions to include site presentations to instruct user personnel in the proper operation and maintenance of systems and equipment provided as part of this project. Include 2 hours of instruction, using the manuals during this instruction. Demonstrate startup and shutdown procedures for all new of newly controlled equipment. All training to be during normal working hours.

The Owner may videotape training sessions to provide final record.

END OF SECTION

# SECTION 23 05 13
# COMMON MOTOR REQUIREMENTS FOR HV EQUIPMENT

## P A R T 1 - G E N E R A L

### SCOPE
This sections includes requirements for single phase motors that are used with equipment specified in other sections.

### RELATED WORK
Section 23 09 14 - Electric Control Devices for HV
Section 23 09 26 - Gas Detection System
Section 23 09 93 - Sequence of Operation for HV Controls
Section 23 34 00 - HV Fans
Section 23 55 00 - Fuel Fired Heaters (Makeup Air Units)
Division 26 00 00 – Electrical Sections

### REFERENCE
Applicable provisions of Division 1 govern work under this section.

### REFERENCE STANDARDS
| | |
|---|---|
| ANSI/IEEE 112 | Test Procedure for Polyphase Induction Motors and Generators |
| ANSI/NEMA MG-1 | Motors and Generators |
| ANSI/NFPA 70 | National Electrical Code |

### QUALITY ASSURANCE
Refer to Division 1, Basic Requirements, Equals and Substitutions.

### SHOP DRAWINGS
Refer to Division 1, Basic Requirements, Submittals.

Include with the equipment which the motor drives the following motor information: motor manufacturer, horsepower, voltage, phase, hertz, rpm, full load efficiency. Include project wiring diagrams prepared by the contractor specifically for this work.

### OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section Basic Requirements.

### ELECTRICAL COORDINATION
All starters, overload relay heater coils, disconnect switches and fuses, relays, wire, conduit, pushbuttons, pilot lights, and other devices required for the control of motors or electrical equipment are furnished and installed by the Electrical Contractor, except as specifically noted elsewhere in this division of specifications or on equipment schedules.

Electrical drawings and/or specifications show number and horsepower rating of all motors furnished by this Contractor, together with their actuating devices if these devices are furnished by the Electrical Contractor. Should any discrepancy in size, horsepower rating, electrical characteristics or means of control be found for any motor or other electrical equipment after contracts are awarded, Contractor is to immediately notify the architect/engineer of such discrepancy. Costs involved in any changes required due to equipment substitutions initiated by this contractor will be the responsibility of this contractor. See related comments in Section 23 05 00 - Common Work Results for HVAC, under Shop Drawings.

Electrical Contractor will provide all power wiring, control wiring to be provided by this Division.

### PRODUCT CRITERIA
Motors to conform to all applicable requirements of NEMA, IEEE, ANSI, and NEC standards and shall be listed by U.L. for the service specified.

Select motors for conditions in which they will be required to perform; i.e., general purpose, splashproof, explosion proof, standard duty, high torque or any other special type as required by the equipment or motor manufacturer's recommendations.

Furnish motors for starting in accordance with utility requirements and compatible with starters as specified.

## P A R T 2 - P R O D U C T S

**THREE PHASE, SINGLE SPEED MOTORS**

Use NEMA rated 208 volt, three phase, 60 hertz motors for all motors 1/2 HP and larger unless specifically indicated.

Use NEMA general purpose, continuous duty, Design B , normal starting torque, T-frame or U-frame motors with Class B or better insulation unless the manufacturer of the equipment on which the motor is being used has different requirements. Use open drip-proof motors unless totally enclosed fan-cooled, totally enclosed non-ventilated, explosion-proof, or encapsulated motors are specified in the equipment sections.

Use grease lubricated anti-friction ball bearings with housings equipped with plugged/capped provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at the end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

All open drip-proof motors to have a 1.15 service factor. Other motor types may have minimum 1.0 service factors.

All motors 1 HP and larger, except specially wound motors and inline pump motors 56 frame and smaller, to be high efficiency design with full load efficiencies which meet or exceed the values listed below when tested in accordance with NEMA MG 1.

FULL LOAD NOMINAL MOTOR EFFICIENCY BY MOTOR SIZE AND SPEED

| | -----Open Drip-Proof Motors------ | | |
|---|---|---|---|
| MOTOR | -------Nominal Motor Speed------- | | |
| HP | 1200 rpm | 1800 rpm | 3600 rpm |
| 1 | 82.5 | 85.5 | 77.0 |
| 1-1/2 | 86.5 | 86.5 | 84.0 |
| 2 | 87.5 | 86.5 | 85.5 |
| 3 | 88.5 | 89.5 | 85.5 |
| 5 | 89.5 | 89.5 | 86.5 |
| 7-1/2 | 90.2 | 91.0 | 88.5 |
| 10 | 91.7 | 91.7 | 89.5 |
| 15 | 91.7 | 93.0 | 90.2 |
| 20 | 92.4 | 93.0 | 91.0 |

**SINGLE PHASE, SINGLE SPEED MOTORS**

Use NEMA rated 115 volt, or 230 volt single phase, 60 hertz motors as scheduled.

Use permanent split capacitor or capacitor start, induction run motors equipped with permanently lubricated and sealed ball or sleeve bearings and Class A insulation. Service factor to be not less than 1.35.

Use open drip-proof motors unless totally enclosed fan-cooled, totally enclosed non-ventilated, explosion-proof, or encapsulated motors are specified in the equipment sections.

## P A R T 3 - E X E C U T I O N

**INSTALLATION**

When motor will be connected to the driven device by means of a belt drive, mount sheaves on the appropriate shafts in accordance with the manufacturer's instructions. Use a straight edge to check alignment of the sheaves; reposition sheaves as necessary so that the straight edge contacts both sheave

faces squarely. After sheaves are aligned, loosen the adjustable motor base so that the belt(s) can be added and tighten the base so that the belt tension is in accordance with the drive manufacturer's recommendations. Frequently recheck belt tension and adjust if necessary during the first day of operation and again after 80 hours of operation.

Lubricate all motors requiring lubrication. Record lubrication material used and the frequency of use. Include this information in the maintenance manuals.

END OF SECTION

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# SECTION 23 05 23
# VALVES AND PIPING FOR FUEL GAS

## PART 1 - GENERAL

**SCOPE**
This section includes valve specifications for all HV.

**RELATED WORK**
Section 23 09 14 - Electric Control Devices for HVAC
Section 23 09 93 - Sequence of Operation for HV Controls

**REFERENCE**
Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

| | |
|---|---|
| ANSI B16.3 | Malleable Iron Threaded Fittings |
| ASTM A53 | Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless |
| ASTM A234 | Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures |

**QUALITY ASSURANCE**
Refer to division 1, Basic Requirements, Equals and Substitutions.

**SUBMITTALS**
Refer to division 1, Basic Requirements, Submittals.

Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section Basic Requirements.

**WELDER QUALIFICATIONS**
Contractor to submit his Standard Welding Procedure Specification together with the Procedure Qualification Record as required by Section IX of the ASME Boiler and Pressure Vessel Code and/or the National Certified Pipe Welding Bureau. Contractor to submit certification that the welders to be used on this project have successfully demonstrated proper welding procedures in accordance with the Code of Federal Regulations, Title 49, Part 192, Section 192.285.

## P A R T 2 - P R O D U C T S

**NATURAL GAS PIPING**
2-1/2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

**UNIONS AND FLANGES**
2-1/2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

**NATURAL GAS SYSTEMS VALVES**

SHUT OFF VALVES:

2" and smaller: Ball valve, bronze body, threaded ends, chrome-plated bronze or stainless steel ball, full or conventional port, teflon seat, blowout-proof stem, two-piece construction, suitable for 150 psig working pressure, U.L. listed for use as natural gas shut-off.

2-1/2" through 4": Cast iron body, flanged ends, bronze bearings, electroless nickel plated cast iron plug with Hycar resilient plug seal, Buna-N stem seal packing, lever actuator, 175 psi W.O.G., U.L. listed for use as natural gas shut-off.

**GAS PRESSURE REGULATORS:**

2" and smaller: Cast iron body, aluminum spring and diaphragm, Nitrile diaphragm, threaded ends, 150 psi W.O.G., -20°F to 150°F.

**FLEXIBLE GAS CONNECTOR**

Based on product by Brass Craft ProCoat connector. Equivalent connectors are acceptable when approved by the engineer or owner.

Stainless steel flexible connector with polymer coating, with FIPand MIP connectors

**GAS SOLENOID VALVES**

Based on ASCO fuel gas solenoid valve. Prior approved valves by Honeywell or equivalent.

Solenoid valve, combustion gas, 2 way, 2 position, normally closed configuration, aluminum body,
3 pipe size , 3 inch orifice diameter, Cv Flow Factor 138, 7,4300,000 Btu/hr fuel gas capacity.
Operating pressure differential range: 0 to 5 PSI, max. fluid temp 125°F., 28.2 watts, 120 volts, 60 Hz, coil enclosure NEMA Type 4X.
Unit to be suitable for Exterior installation.
Agency Compliance UL, CSA. Approvals Z21.21 (6.5), Standard C22.2, electrically operated valves.

## P A R T 3 - E X E C U T I O N

**GENERAL**

Properly align piping before installation of valves in an upright position; operators installed below the valves will not be accepted.

Install valves in strict accordance with valve manufacturer's installation recommendations. Do not support weight of piping system on valve ends.

Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position
Install stem extensions when shipped loose from valve.

**THREADED PIPE JOINTS**

Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed

**FLEXIBLE GAS CONNECTOR**

Make gas connection to gas fired heating equipment with flexible connectors as indicated on drawings and/or details.

**GAS PRESSURE REGULATORS**

When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes.

**GAS SOLENOID VALVES**

Install gas solenoid valve where indicated on the drawings.
Install in accordance with the manufacturers requirements.
Control valve operation as specified in the Control Sequences.

END OF SECTION

# SECTION 23 05 29
# HANGERS AND SUPPORTS FOR HV PIPING AND EQUIPMENT

## P A R T 1 - G E N E R A L

**SCOPE**
This section includes hangers and supports for HV piping and equipment.

**RELATED WORK**
Section 23 05 29 - Valves and Piping for Fuel Gas
Section 23 34 00 – HV Fans
Section 23 55 00 - Fuel Fired Heaters

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

**REFERENCE STANDARDS**
MSS SP-58 Pipe Hangers and Supports - Materials, Design and Manufacture.
MSS SP-59 Pipe Hangers and Supports - Selection and Application.

**QUALITY ASSURANCE**
Refer to Division 1, General Conditions, Equals and Substitutions.

**DESCRIPTION**
Provide all supporting devices as required for the installation of mechanical piping. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction. Do not hang any mechanical item directly from a metal deck.

**SHOP DRAWINGS**
Refer to division 1, General Conditions, Submittals.

**DESIGN CRITERIA**
Materials and application of pipe hangers and supports shall be in accordance with MSS Standard Practice SP-58 and SP-69 unless noted otherwise.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, maintenance, etc.

## P A R T 2 - P R O D U C T S

**PIPE HANGER AND SUPPORT MANUFACTURERS**
Anvil, B-Line, Fee and Mason, Kindorf, Michigan Hanger, Unistrut, or approved equal. Anvil figure numbers are listed below; equivalent material by other manufacturers is acceptable.

**STRUCTURAL SUPPORTS**
Provide all supporting steel required for the installation of mechanical equipment and materials, whether or not it is specifically indicated or sized, including angles, channels, beams, etc. to suspend or floor support tanks and equipment.

**PIPE HANGERS AND SUPPORTS**
HANGERS FOR STEEL PIPE SIZES 1/2” THROUGH 2”:
Carbon steel, adjustable, clevis, black finish. Anvil figure 65 or 260.

HANGERS FOR STEEL PIPE SIZES 2-1/2” AND OVER:
Carbon steel, adjustable, clevis, black finish. Anvil figure 260.

WALL SUPPORT:
Welded steel bracket with hanger. B-Line 3068 Series, Anvil 194 Series.

Perforated epoxy painted finish, 16-12 gauge min., steel channels securely anchored to wall structure with interlocking, split type, bolt secured, galvanized pipe clamps. B-Line type S channel with B-2000 series clamps, Anvil type AS200 H with AS 1200 clamps.

STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, black finish.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

| Maximum Load (Lbs.) (650°F Maximum Temp.) | Rod Diameter (inches) |
|---|---|
| 610 | 3/8 |
| 1130 | 1/2 |

**BEAM CLAMPS**
MSS SP-69 Type 23 malleable black iron clamp for attachment to beam flange to 0.62 inches thick for single threaded rods of 3/8, 1/2, and 5/8 inch diameter, for use with pipe sizes 4 inch and less. Furnish with a hardened steel cup point set screw. Anvil figure 86.

MSS SP-69 Type 28 or Type 29 forged steel jaw type clamp with a tie rod to lock clamp in place, suitable for rod sizes to 1-1/2 inch diameter but limited in application to pipe sizes 8 inch and less without prior approval. Anvil figure 228.

**EQUIPMENT CURBS**
Custom built curbs to adapt existing fan curbs to new power roof exhaust fan base. Constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load.

Field verify existing conditions and fabrication requirements.

Wood Build Sleeper Curb:
Constructed of wood blocking anchored to the deck. The curb must be structurally capable of supporting the intended load with no penetrations through the curb flashing. Galvanized steel counter flashing with metal receiver cap for mounting utility fan isolation base. Do not use built-in metal base flashings or cants.

## P A R T 3 - E X E C U T I O N

**INSTALLATION**
Install supports to provide for free expansion of the piping and duct system. Support all piping from the structure using beam clamps.

**HANGER AND SUPPORT SPACING**
Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

| Pipe Material | Pipe Size | Max. Spacing |
|---|---|---|
| Steel | 1/2" through 1-1/4" | 6'-6" |
| Steel | 1-1/2" through 6" | 10'-0" |

**EQUIPMENT CURBS**
Install new adaptor curbs on existing curbs. Provide reinforcement at existing curbs as indicated on the drawings. Fasten new curbs to existing.

Utility Fan sleeper curbs shall be installed into existing roof. Provide two rails of length required and spaced to accommodate the fan isolation base.

END OF SECTION

**SECTION 23 05 93**
**TESTING, ADJUSTING, AND BALANCING FOR HV**

## P A R T 1 - G E N E R A L

### SCOPE

An independent test and balance agency shall perform all testing, adjusting, and balancing of air systems for this project. The test and balance agency shall be a subcontractor of the HV contractor.

This project is balancing of the new makeup air units and new exhaust systems as indicated on the drawings and specified in this specification section.

The extent of test-adjust-balance (TAB) work is indicated by the requirements of this section and noted on the project drawings and schedules and is defined to include the balance of supply air distribution, and verification of performance of mechanical exhaust air and make-up supply air equipment, all in accordance with standards published by AABC or NEBB. The work consists of setting speed and volume (flow) adjusting apparatus provided for the systems, recording data, conducting tests, preparing and submitting reports and recommending modifications to the work as required by the Contract Documents.

The scope of this project is to balance the air systems to the contract document requirements.
This includes

- Air Systems:
    1. New Make-up Air Units.
    2. New Exhaust Fans
    3. New Supply Grilles.

Refer to project drawings equipment schedules for air flow requirements.

Refer to project drawings for mechanical and control Key Notes applicable to balancing this project.

If problems are found, handle as specified in Part 3 under Deficiencies.

### CONDITIONS OF THE CONTRACT

The Conditions of the Contract (General, Supplementary, and other Conditions) and the Basic Requirements (Sections of Division 1) are hereby made a part of this Section.

### RELATED WORK

| | |
|---|---|
| Section 23 05 00 | Common Work Results for HV |
| Section 23 09 14 | Electric Control Devices for HV |
| Section 23 09 93 | Sequences of Operation for HV Controls |
| Section 23 31 00 | HV Ducts |
| Section 23 33 00 | Air Duct Accessories |
| Section 23 31 00 | HV Fans |
| Section 23 55 00 | Fuel Fired Heaters (Makeup Air Units) |

### REFERENCE

Applicable provisions of the General Conditions, Supplementary General Conditions and General Requirements in Division 1 govern work under this section.

### REFERENCE STANDARDS

| | |
|---|---|
| AABC | National Standards for Total System Balance, Sixth Edition, 2002. |
| ASHRAE | ASHRAE Handbook, 2007 HVAC Applications, Chapter 37, Testing Adjusting and Balancing. |
| NEBB | Procedural Standards for Testing Adjusting Balancing of Environmental Systems, Seventh Edition, 2005. |

### QUALITY ASSURANCE

Qualifications
An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally

related to HV work other then that specifically related to installing Testing and Balancing components necessary for work in this section such as, but not limited to sheaves, pulleys, and balancing dampers.

A certified member of AABC or certified by NEBB in the specific area of work performed. Maintain certification for the entire duration of the project.

**SUBMITTALS**
See also Related Work in this section.

Submit testing, adjusting and balancing reports bearing the seal and signature of the NEBB or AABC Certified Test and Balance Supervisor. The reports certify that the systems have been tested, adjusted and balanced in accordance with the referenced standards; are an accurate representation of how the systems have been installed and are operating; and are an accurate record of all final quantities measured to establish normal operating values of the systems.

Contents: Provide the following minimum information, forms and data:

General Information: Inside cover sheet identifying Test and Balance Agency, Contractor, Architect, Engineer, Project Name and Project Number. Include addresses, contact names and telephone numbers. Also include a certification sheet containing the seal and signature of the Test and Balance Supervisor.

Summary: Provide summary sheet describing mechanical system deficiencies. Describe objectionable noise or drafts found during testing, adjusting and balancing. Provide recommendations for correcting unsatisfactory performances and indicate whether modifications required are within the scope of the contract, are design related or installation related. List instrumentation used during testing, adjusting and balancing procedures.

The remainder of the report to contain the appropriate standard NEBB or AABC forms for each respective item and system. Fill out forms completely. Where information cannot be obtained or is not applicable indicate same.

## P A R T 2 - P R O D U C T S

**INSTRUMENTATION**
Provide all required instrumentation to obtain proper measurements. Application of instruments and accuracy of instruments and measurements to be in accordance with the requirements of NEBB or AABC Standards and instrument manufacturer's specifications.

All instruments used for measurements shall be accurate, and calibration histories for each instrument to be available for examination by Owner or Engineer upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards

## PART 3 - EXECUTION

### PRELIMINARY PROCEDURES

Review applicable construction documents, applicable change orders. A limited amount of original project shop drawings of equipment, outlets/inlets are available for review.

Check equipment for proper rotation and belt tension, temperature controls for completion of installation.

Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

### PERFORMING TESTING, ADJUSTING AND BALANCING

Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday. Refer to requirements for coordinating access to selected areas of the building.

In areas containing ceilings, remove ceiling tile to accomplish balancing work; replace tile when work is complete and provide new tile for any tile that are damaged by this procedure. If the ceiling construction is such that access panels are required for the work of this section and the panels have not been provided, inform the owner's project representative.

Cut insulation, ductwork and piping for installation of test probes to the minimum extent necessary for adequate performance of procedures. Patch using materials identical to those removed, maintaining vapor barrier integrity and pressure rating of systems.

Measure and record system measurements at the fan to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

Measure and record static air pressure conditions across fans. Spot check static air pressure conditions directly ahead of terminal units.

Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data.

Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the system.

Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

Final air system measurements to be within the following range of specified cfm:

| | |
|---|---|
| Make-up Air Units | 0% to +10% |
| Fans | 0% to +10% |
| Supply grilles, | 0% to +10% |

Contact the Control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control and CNG exhaust system operation and any deficiencies found.

Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

**DEFICIENCIES**

Test and balance agency will notify the Owners Project Representative and Engineer of these items and instructions will be issued to the Division 23 contractor for correction. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

END OF SECTION

# SECTION 23 07 00
# HVAC INSULATION

## P A R T 1 - G E N E R A L

### SCOPE
This section includes insulation specifications for piping and ductwork.

### REFERENCE STANDARDS

| | |
|---|---|
| ASTM B209 | Aluminum and Aluminum Alloy Sheet and Plate |
| ASTM C165 | Test Method for Compressive Properties of Thermal Insulations |
| ASTM C177 | Heat Flux and Thermal Transmission Properties |
| ASTM C195 | Mineral Fiber Thermal Insulation Cement |
| ASTM C302 | Density of Preformed Pipe Insulation |
| ASTM C355 | Test Methods for Test for Water Vapor Transmission of Thick Materials |
| ASTM C449 | Mineral Fiber Hydraulic Setting Thermal Insulation Cement |
| ASTM C518 | Heat Flux and Thermal Transmission Properties |
| ASTM C534 | Preformed Flexible Elastomeric Thermal Insulation |
| ASTM C547 | Mineral Fiber Preformed Pipe Insulation |
| ASTM C612 | Mineral Fiber Block and Board Thermal Insulation |
| ASTM C921 | Properties of Jacketing Materials for Thermal Insulation |
| ASTM C1136 | Flexible Low Permeance Vapor Retarders for Thermal Insulation |
| ASTM D412 | Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension |
| ASTM D1000 | Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications |
| ASTM D2240 | Standard Test Method for Rubber Property—Durometer Hardness |
| ASTM E84 | Surface Burning Characteristics of Building Materials |
| MICA | National Commercial & Industrial Insulation Standards |
| NFPA 225 | Surface Burning Characteristics of Building Materials |
| UL 723 | Surface Burning Characteristics of Building Materials |

### QUALITY ASSURANCE

Label all insulating products delivered to the construction site with the manufacturer's name and description of materials.

### DESCRIPTION

Furnish and install all insulating materials and accessories as specified or as required for a complete installation. The following types of insulation are specified in this section:

- Duct Insulation

Install all insulation in accordance with the latest edition of MICA (Midwest Insulation Contractors Association) Standard and manufacturer's installation instructions. Exceptions to these standards will only be accepted where specifically modified in these specifications, or where prior written approval has been obtained from the Dane County Project Manager.

### ENVIRONMENTAL REQUIREMENTS
Do not store insulation materials on grade or where they are at risk of becoming wet. Do not install insulation products that have been exposed to water.

Protect installed insulation work with plastic sheeting to prevent water damage.

## P A R T 2 - P R O D U C T S

### MATERIALS
Manufacturers: Certainteed, Johns Manville, Knauf, Owens-Corning, VentureTape or approved equal.

Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

**INSULATION TYPES**

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

RIGID FIBERGLASS INSULATION:

Minimum nominal density of 3 lbs. per cu. ft., and thermal conductivity of not more than 0.23 at 75 degrees F, minimum compressive strength of 25 PSF at 10% deformation, rated for service to 450 degrees F.

EXTRUDED POLYSTYRENE INSULATION:

Rigid closed cell, minimum nominal density of 1.6 lbs. per cu. ft., thermal conductivity of not more than 0.285 at 75 degrees F, minimum compressive strength of 20 psi, maximum water vapor permeability of 1.5 perm inch, maximum water absorption of .5 % by volume, rated for service range of -290 degrees F to 165 degrees F.

**JACKETS**

FOIL SCRIM ALL SERVICE JACKETS (FSJ):

Glass fiber reinforced foil kraft laminate, factory applied to insulation. Maximum permeance of .02 perms and minimum beach puncture resistance of 25 units.

SELF-ADHERING JACKETS (SAJ):

5-ply, self-adhering multiple laminated waterproofing material with reflective aluminum foil, high density polymer films and cold weather acrylic adhesive providing zero (0.0) permeability. Minimum 6 mils material thickness, 35lb puncture resistance when tested in accordance with ASTM D1000 and flame spread/smoke developed rating of 10/20 when tested in accordance with UL 723.

Vapor retarding tape shall be specifically designed and manufactured for use with the self-adhering jacket specified above. Tape shall be provided by the same manufacturer that provides jacketing. Vapor retarding tapes used with self-adhering jackets shall have a maximum permeance of 0.0 perms.

**ACCESSORIES**

All products shall be compatible with surfaces and materials on which they are applied, and be suitable for use at operating temperatures of the systems to which they are applied.

Adhesives, sealants, and protective finishes shall be as recommended by insulation manufacturer for applications specified.

## P A R T 3 - E X E C U T I O N

**EXAMINATION**

Verify that all piping, equipment, and ductwork are tested and approved prior to installing insulation. Do not insulate systems until testing and inspection procedures are completed.

Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

**INSTALLATION**

All materials shall be installed in strict accordance with manufacturer's recommendations, building codes, and industry standards. Do not install products when the ambient temperature or conditions are not consistent with the manufacturer's recommendations. Surfaces to be insulated must be clean and dry.

Locate insulation and cover seams in the least visible location. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. Provide neatly beveled and coated terminations at all nameplates, uninsulated fittings, or at other locations where insulation terminates.

Install fabric reinforcing without wrinkles. Overlap seams a minimum of 2 inches.

Use full length material (as delivered from manufacturer) wherever possible. Scrap piecing of insulation or pieces cut undersize and stretched to fit will not be accepted.

All pipe and duct insulation shall be continuous through walls, ceiling or floor openings and through sleeves except where firestop or firesafing materials are required. Vapor barriers shall be maintained continuous through all penetrations.

Provide a continuous unbroken moisture vapor barrier on insulation applied to systems noted below. Attachments to cold surfaces shall be insulated and vapor sealed to prevent condensation.

Provide a complete vapor barrier for insulation on the following systems:

- Insulated Duct

**PROTECTIVE JACKET INSTALLATION**

SELF-ADHERING JACKETS (SAJ):

Install according to manufacturer's recommendations. Cut allowing minimum 4" overlap on ends and 6" on longitudinal joints. Align parallel to surface. Remove release paper and press flat to surface to avoid wrinkles. Rub entire surface for full adhesion and sealing at joint overlaps. On exterior applications, provide a bead of compatible caulk along exposed edges.

Piping with self-adhering (SAJ) jackets shall have elbows, fittings, valves and butt joints wrapped with 2 layers of vapor retarding tape. Piping with a PVC jacket (PFJ) installed over the self-adhering (SAJ) jacket may be provided with a single, lapped layer of vapor retarding tape for elbows, fittings and valves under the PVC jacket. Vapor retarding tape shall be compatible with the jacket material used.

**DUCT INSULATION**

GENERAL:

Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins. Space fasteners 18" on center or less as required to prevent sagging.

Secure rigid board insulation to ductwork with weld pins. Apply insulation with joints firmly butted as close as possible to the equipment surface. Pins shall be located a maximum of 3" from each edge and spaced no greater than 12" on center.

Install weld pins without damage to the interior galvanized surface of the duct. Clip pins back to washer and cover penetrations with tape of same material as jacket. Firmly butt seams and joints and cover with 4" tape of same material as jacket. Seal tape with plastic applicator and secure with staples. All joints, seams, edges and penetrations to be fully vapor sealed.

Stop and point insulation around access doors and damper operators to allow operation without disturbing insulation or jacket material.

External supply duct insulation is not required where ductwork contains continuous 1" acoustical liner. Provide 4" overlap of external insulation over ends of acoustically lined sections.

Where insulated ductwork is supported by trapeze hangers, the insulation shall be installed continuous through the hangers. Drop the supporting channels required to facilitate the installation of the insulation. Where rigid board or flexible insulation is specified, install high density inserts to prevent the weight of the ductwork from crushing the insulation.

Where insulated low temperature (below 45ºF) ductwork is supported by steel metal straps or wire ropes that are secured directly to the duct, the straps or ropes shall be completely covered with insulation and sealed to provide a complete vapor barrier.

Where ductwork exposed to the weather is insulated the top surface of the insulation shall be sloped a minimum of ¼" per foot to eliminate ponding and create positive drainage off of insulation.

**DUCT INSULATION SCHEDULE:**

Provide duct insulation on new and existing remodeled ductwork in the following schedule:

| SERVICE | INSULATION TYPE | JACKET | THICKNESS |
|---|---|---|---|
| Outside air ducts | Rigid Fiberglass | FSK | 2" |
| All ducts exposed to weather | Extruded Polystyrene | SAJ | 3” |
| Exhaust and relief ducts downstream of motorized backdraft dampers | Rigid Fiberglass | FSK | 2" |

* Exposed supply ducts located in the space they are serving do not require insulation.

END OF SECTION

# SECTION 23 09 14
# ELECTRIC CONTROL DEVICES FOR HV

## P A R T 1 - G E N E R A L

**SCOPE**
This sections includes control system specifications for HV work of this project.

**RELATED WORK**

| | |
|---|---|
| 23 05 13 | Common Motor Requirements for HV Equipment |
| 23 05 23 | Valves and Piping for Fuel Gas |
| 23 05 93 | Testing, Adjusting, and Balancing for HV |
| 23 09 26 | Gas Detection System |
| 23 09 93 | Sequence of Operation for HV Controls |
| 23 34 00 | HV Fans |
| 23 55 00 | Fuel Fired Heaters (Radiant Heaters and Makeup Air Units) |
| Division 26 00 00 – applicable Electrical Sections | |
| 28 31 00 | Fire Detection and Alarm |

**REFERENCE**
Applicable provisions of Division 1 govern work under this section.

**REFERENCE STANDARDS**

| | |
|---|---|
| ANSI B16.22 | Wrought Copper and Wrought Copper Alloy Solder Joint Pressure Fittings |
| ANSI/ASTM B32 | Specification for Solder Metal |
| ASTM B75 | Seamless Copper Tube |
| ASTM D1693 | Environmental Stress-Cracking of Ethylene Plastics |
| ASTM D 635 | Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position |
| UL 94 | Tests for Flammability of Plastic Materials for Parts in Devices and Appliances |
| AMCA 500-D | Laboratory Method of Testing Dampers for Rating |

**SYSTEM DESCRIPTION**
The scope of this project is the control of make-up air units and exhaust fans for various modes of operation based on normal occupied-unoccupied cycles and on detection of carbon monoxide (CO), Nitrogen Dioxide ($NO_2$, diesel exhaust) or Methane ($CH_4$, natural gas, aka CNG).

Controls also include installation of gas fired radiant heater controls specified with the units and installation of gas fired makeup air unit controls specified with the units.

System is to be electric/electronic.

**SUBMITTALS**
Include the following information:

Manufacturer's data sheets indicating model number, pressure/temperature ratings, capacity, methods and materials of construction, installation instructions, and recommended maintenance. General catalog sheets showing a series of the same device is not acceptable unless the specific model is clearly marked.

Schematic flow diagrams of systems showing fans, dampers, and other control devices. Indicate all wiring, clearly, differentiating between factory and field installed wiring. Wiring should be shown in schematics that detail contact states, relay references, etc. Diagrammatic representations of devices alone are not acceptable.

Details of construction, layout, and location of the temperature control panel within the building, including instruments location in panel and labeling. Also include on drawings equipment number and location of mechanical equipment controlled, horsepower of motorized equipment, locations of all remote sensors and control devices (either by room number or column lines).

Schedule of control dampers indicating size, and size of operators required.

A complete description of each control sequence for mode of operation.

**DEMOLITION**

Where existing control devices, or wiring are discontinued from use, remove and remove from premises. Remove any previously abandoned control devices in a similar manner.

**DESIGN CRITERIA**

Size all control apparatus to properly supply and/or operate and control the apparatus served.

Use only UL labeled products that comply with NEMA Standards. Electrical components and installation to meet all requirements of the electrical sections (Division 26) of project specifications.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. A complete set of record control drawings.

**MATERIAL DELIVERY AND STORAGE**

Provide factory shipping cartons for each piece of equipment and control device. This contractor is responsible for storage of equipment and materials inside and protected from the weather.

## P A R T 2 - P R O D U C T S

**CONTROL DAMPERS**

Provide control dampers shown on the plans and as required to perform the specified functions. Refer to Section 23 34 00, Fans and Section 23 55 00, Fuel Fired Heaters (Makeup Air Units) and associated schedules for dampers provided with equipment.

Dampers in galvanized ductwork shall be constructed of galvanized steel and/or aluminum.

Jack shafts shall be extended outside of the ductwork for external actuator mounting.

All power required for electric actuation shall be provided by this contractor.

**TIME CLOCKS**

UL listed, digital, electric astronomic timing, 12 or 24 hour format, full year programming, automatic daylight savings time adjustment, 10 on/off programs per day, holiday programming, number of circuits required to provide control sequence programming, manual override by disabling automatic operation and using ON/OFF switch. Unit to have minimum of seven-day battery back-up.

Time clocks shall be capable of providing separate Occupied-Unoccupied schedules for each of the three detection zones.

**TEMPERATURE CONTROL PANELS**

Constructed of steel or extruded aluminum, with hinged door, keyed lock, and baked enamel finish. Install controls, relays, transducers and automatic switches inside panels. Label devices with permanent printed labels and provide as-built wiring diagram within enclosure. Provide raceways for wiring within panel for neat appearance. Provide termination blocks for all wiring terminations. Label outside of panel with panel number corresponding to plan tags and as-built control drawings as well as building system(s) served.

Control panels that have devices or terminations that are fed or switch 50V or higher shall enclose the devices, terminations, and wiring so that Personal Protective Equipment (PPE) is not required to service the under 50V devices and terminations within the control panel. As an alternative, a separate panel for only the 50V and higher devices may be provided and mounted adjacent to the under 50V control panel.

For panels that have 120 VAC power feeds provide a resettable circuit breaker. Provide label within the panel indicating circuit number of 120 VAC serving panel

**CURRENT STATUS SWITCHES**

Provide a current sensor with adjustable threshold and digital output with LED display, equal to a Veris model H-708/H-904. Threshold adjustment must be by a multi-turn potentiometer or set by multiprocessor that will automatically compensate for frequency and amperage changes associated with variable frequency drives. When used on variable speed motor applications, use a current sensor that will not change state due to varying speeds.

**POWER SUPPLIES**

Provide all required power supplies for transducers, sensors, transmitters and relays. All low voltage transformers shall have a resettable secondary circuit breaker and be listed as class 2 power supplies.

## P A R T 3 - E X E C U T I O N

**INSTALLATION**

Install all control equipment, accessories, and wiring in a neat and workmanlike manner. All control devices must be installed in accessible locations. This contractor shall verify that all control devices furnished under this Section are functional and operating the mechanical equipment as specified in Section 23 09 93.

All components required to provide the control system sequences specified shall be provided by this section unless specifically specified otherwise. This includes all switches, relays, actuators, dampers.

All cables to the electronic input/output devices, sensors, relays and interlocking wiring shall be supplied and installed under this section of specification

Label all control devices with the exception of dampers, with printed labels that correspond to control drawings. Control junction and pullboxes shall be identified utilizing spray painted green covers. Other electrical system identification shall follow the 26 05 53 specification.

Provide all electrical relays and wiring, line and low voltage, for control systems, devices and components. Install all high voltage and low voltage wiring (includes low voltage cable) in metal conduit, Electrical Non-metallic Tubing (ENT), or Electrical Metallic Tubing (EMT), as scheduled below and hereafter referred to generically as conduit. See Wire Conduit Installation Schedule below for specific conduit or tubing to be used. All conduit must be installed in accordance with electrical sections (Division 26) of this specification and the National Electrical code.

Conduit shall be a minimum of 1/2 " for low voltage control provided the pipe fill does not exceed 40%.

Minimum low voltage wiring gauge to be 18 AWG for outputs and 20 AWG for inputs. All low voltage wiring to be stranded.

Low voltage wiring can be run without conduit above accessible lay-in tile ceilings. All wiring in vehicle garages, above inaccessible hard ceilings, exterior locations, and in any exposed areas, and in all other locations should be in conduit. Wire for wall sensors must be run in conduit.

Wiring shall not be attached to existing cabling, existing tubing, plumbing or gas piping, ductwork, ceiling supports or electrical or communications conduit.

This contractor shall be responsible for all 120 VAC power, not provided in the Division 26 specifications, required for equipment and controls provided under this section.

All wiring in control panels shall be terminated on a terminal strip. Wire nuts are not acceptable. A maximum of two wires shall be terminated under any one terminal.

All electrical wiring is to be permanently tagged or labeled within one inch of terminal strip with a numbering system to correspond with the "Record Drawings".

After completion of installation, test and adjust control equipment. Submit data showing set points and final adjustments of controls.

**WIRE CONDUIT AND TUBING INSTALLATION SCHEDULE**

The following conduit schedule shall apply to wire in conduit where conduit is specified for air tubing or wiring. Conduit and tubing referenced below shall meet specifications in Section 26 05 33 and as defined below.

Conduit other than that specified below for specific applications shall not be used.

Wet Interior Locations: Rigid steel conduit. [Schedule 40 PVC conduit][PVC coated rigid steel conduit].

Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

**TEMPERATURE CONTROL PANELS**

Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. All control panel openings shall be plugged. Conduits and other penetrations on the top of the cabinets shall be sealed on the exterior of the cabinet with silicone caulk to resist water penetration. One cabinet may accommodate more than one system in same equipment room. Provide permanent printed labeling for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

Provide as-built control drawings of all systems served by each local panel in a location adjacent to or inside of panel cover. Provide a protective cover or envelope for drawings.

**TRAINING**

Contractor to provide representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a period of adequate to provide Owner an understanding of the system operation.

Refer to Section 23 05 00 for additional requirements related to Training and Commissioning.

END OF SECTION

**SECTION 23 09 26**
**GAS DETECTION SYSTEM**

## PART 1 - GENERAL

### SCOPE

The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Gas Alarm System as shown on the drawings and as herein specified. Included are the following topics:

### RELATED WORK

The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the following project sections:

Section 23 05 00 – Common Work Results for HV
Section 23 05 93 – Testing, Adjusting and Balancing for HV
Section 23 09 14 – Electric Control Devices for HV
Section 23 09 93 – Sequences of Operation for HV Controls
Section 26 05 00 – Common Work Results for Electrical
Section 26 05 26 – Grounding and Bonding for Electrical Systems
Section 26 05 29 – Hangers and Supports for Electrical Systems
Section 26 05 33 – Raceway and Boxes for Electrical Systems
Section 26 05 53 – Identifications for Electrical Systems
Section 28 31 00 – Fire Detection and Alarm

### DESCRIPTION OF WORK

Furnish and install a complete Multi-Zone Gas Detection System within the Dane County Highway Garage as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition.

Each detection zone shall include CO Gas Transmitters/Sensors, NO2 Gas Transmitters/Sensors and CH4 Gas Transmitters/Sensors and detection control panel as indicated on the drawings

The system shall consist of three detection zones, Detection Zone 1, in building Area C; Detection Zone 2, in building Areas A and B and Detection Zone 3, in building Area A.

Detection of CO, NO2 or CH4 in the respective zone shall be capable of controlling that zones respective ventilation fans, and makeup air intakes (open garage doors and or raise designated garage doors independent of the other zones and provide a signal to the fire alarm system so the fire alarm system provide notification to all areas of the building. Refer to Section 23 09 93, Sequences of Operation for HV Controls for complete control system sequences. Any one sensor in a zone shall enable the ventilation sequence for detection of that gas within that zone.

The Gas Detection System shall be manufactured by Quatrosense Environmental, LTD. (www.QELsafety.com), or Dane County prior approved equivalent, and shall be provided for the monitoring of toxic and combustible gas concentrations, and any other 4-20mA input parameter.

The complete installation shall be done in a neat, workmanlike manner in accordance with all applicable Codes and the manufacturer's recommendations.

### REGULATORY REQUIREMENTS

The complete installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

| | |
|---|---|
| NFPA-70 | National Electrical Code (NEC) |
| NFPA 101 | Life Safety Code |
| IBC | International Building Code |
| IFC | International Fire Code |
| IMC | International Mechanical Code |
| | Wisconsin Administrative Code |

**SUBMITTALS**
Under the provisions of Section 23 05 00 and Division 1, submit all products for approval prior to ordering any equipment in accordance with requirements of Division 1, General Conditions.

**PRODUCT DELIVERY, STORAGE AND HANDLING**
Receive equipment at job site; verify applicable components and quantity delivered.

Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.

Do not install damaged equipment.

Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises

**SPARE PARTS**
Contractor shall provide the following spare parts in quantities shown:

| Quantity: | Type of Device |
|---|---|
| (2) | CO Gas Transmitter/Sensor |
| (2) | NO2 Gas Transmitter/Sensor |
| (2) | CH4 Gas Transmitter/Sensor |

## PART 2 - PRODUCTS

**ENCLOSURES**
All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

**CONTROL PANEL**
Provide QEL Model Q-Controller Panel, 128 input panel with CTS-M-Series Gas Detectors or 4-20mA inputs from gas detectors and/or auxiliary input devices.

Controller requirements:

- Q-Controller Panel 128 input panel.
- Q-CONTROLLER FEATURES:
  - 128 RS-485 Channels through four digital ports
  - Modbus Outputs
  - Seven-inch touch screen graphic display
  - Eight event scheduler for daily, weekday or weekend events
  - Auto-configure feature
  - 24VAC/VDC operation
  - 4 x10Amp DPDT relays on main board up to 124 remote
  - 15 Status LEDs indicates power status and communications RX/TX
  - Conforms to UL2017
  - Digital display and keypad for manual programming.
  - Test Function for microprocessor, lights, relays, audio calibration disable through front keypad.
  - Locking door latch.
  - Non-proprietary configuration software and access password to controller.
  - 2 Year Parts only Warranty from date of substantial completion.
  - Capable of activation of sequences at 2 different level of CH4 concentration.
  - On board and remote annunciation
  - Nema 4X enclosure with clear window

Sequence of Operation:

- Refer to Section 23 09 93 for complete sequence of operation
- Activate fire alarm at low warning, fire alarm at high warning, device fully configurable for either or both.

**TRANSMITTER/SENSORS**

TOXIC GAS TRANSMITTER/SENSOR – NO2

Provide QEL Model CTS-M5150 Series stand-alone, analog and/or networked toxic gas transmitter/sensors.

Toxic Gas Transmitter/Sensor requirements:

- Electrochemical Sensor
- Q5 NO2 Transmitter NEMA4X enclosure with 7,500 sq feet coverage / 50’ Radius.
- Range 0 to 10 ppm.
- Digital display of gas concentration.
- Scalable 4-20 mA or 2-10 VDC linearized output.
- RS-485 digital communication.
- 2 SPDT relay output Form C, 1 amp dry contact and buzzer (optional).
- Time delays (make and break) on relay outputs.
- Outputs, range, relay enable/disable, time delays, digital addressing, configuration adjustable through 3 switches on side of unit.
- Input voltage 24VAC or 24VDC.
- Non-proprietary calibration protocol.
- 2-Wire Twisted pair for 24V out of M-Controller.
- Belden 9841 or equal twisted shielded pair for communication.
- (6) Zone 1, (8) Zone 2, (2) Zone 3

Sequence of Operation:

- Refer to Section 23 09 93 for complete sequence of operation
- Activate fan(s) per zone when the level of gas reaches 1.00 ppm concentration.
- Activate visual alarm at low warning, audible and visual alarm at high warning.

TOXIC GAS TRANSMITTER/SENSOR - CO

Provide QEL Model CTS-M5160 Series stand-alone, analog and/or networked toxic gas transmitter/sensors.

Toxic Gas Transmitter/Sensor requirements:

- Electrochemical Sensor
- Q5 CO Transmitter NEMA4X enclosure with 7,500 sq feet coverage / 50’ Radius.
- Range 0 to 250 ppm.
- Digital display of gas concentration.
- Scalable 4-20 mA or 2-10 VDC linearized output.
- RS-485 digital communication.
- 2 SPDT relay output Form C, 1 amp dry contact and buzzer (optional).
- Time delays (make and break) on relay outputs.
- Outputs, range, relay enable/disable, time delays, digital addressing, configuration adjustable through 3 switches on side of unit.
- Input voltage 24VAC or 24VDC.
- Non-proprietary calibration protocol.
- 2-Wire Twisted pair for 24V out of Controller.
- Belden 9841 or equal twisted shielded pair for communication.
- (6) Zone 1, (8) Zone 2, (2) Zone 3

Sequence of Operation:

- Refer to Section 23 09 93 for complete sequence of operation.
- Activate fan(s) per zone when the level of gas reaches 35.00 ppm concentration.
- Activate visual alarm at low warning, audible and visual alarm at high warning.

COMBUSTIBLE GAS TRANSMITTER/SENSOR – CH4

Provide QEL Model CTS-M1710 Series stand-alone, analog and/or networked combustible gas transmitter/sensor.

Combustible Gas Transmitter/Sensor requirements:

- Catalytic Bead Sensor.
- Q5 CH4 Combustible Gas Transmitter NEMA4X enclosure with 7,500 sq feet coverage / 50’ Radius.
- Range 0 to 100 % LEL
- Digital display of gas concentration
- Scalable 4-20 mA or 2-10 VDC linearized output
- RS-485 digital communication
- 2 SPDT relay output Form C, 1 amp dry contact and buzzer (optional)
- Time delays (make and break) on relay outputs
- Outputs, range, relay enable/disable, time delays, digital addressing, configuration adjustable through 3 switches on side of unit
- Input voltage 24VAC or 24VDC
- Non-proprietary calibration protocol.
- 2-Wire Twisted pair for 24V out of M-Controller.
- Belden 9841 or equal twisted shielded pair for communication.
- (4) Zone 1, (5) Zone 2, (1) Zone 3

Sequence of Operation:

- Refer to Section 23 09 93 for complete sequence of operation.
- Activate fan(s) per zone when the level of gas reaches 1.25% concentration in the zone.
- Activate visual and intermittent audible alarm at Low warning when the level of gas reaches 2.50% concentration in the zone,
- Activate visual and continuous audible alarm at High warning when the level of gas reaches 3.50% concentration in the zone. Alarm shall also be transmitted to the fire alarm system for reporting CH4 detection to central monitoring and voice message to the facility. Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface.

## PART 3 - EXECUTION

### GENERAL

The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 and the manufacturer's recommendations.

Commissioning shall be performed by authorized technician. Refer to Section 23 05 00.

### TESTING

Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.

The manufacturer's authorized representative shall provide on-site supervision of the complete system installation, perform a complete functional test of the system, and submit a written report to the Owner attesting to the proper operation of the completed system prior to final inspection.

The manufacturer's authorized representative shall provide additional testing/demonstration of system operation in conjunction with fire alarm system test with the City of Madison Fire Department.

### WARRANTY

The Contractor shall warrant the completed system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of substantial completion of the project.

**TRAINING**

The 23 09 26 – 23 09 93 Supplier and Installing Contractor through the detection system supplier shall provide, as part of this contract, 2 hours system operation training for Owner, and the Engineer. This training shall be coordinated with the Ventilation Control Contractor to provide training of the detection and control system in the same time period.

END OF SECTION

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# SECTION 23 09 93
# SEQUENCE OF OPERATION FOR HV CONTROLS

## P A R T 1 - G E N E R A L

### SCOPE

This section includes control sequences for HVAC equipment provided or modified by this project.

### RELATED WORK

Applicable provisions of Division 1 govern work under this Section.
Section 23 05 00 - Common Work Results for HV
Section 23 05 23 - Valves and Piping for Fuel Gas
Section 23 05 93 - Testing, Adjusting, and Balancing for HV
Section 23 09 14 - Electric Control Devices for HVAC
Section 23 09 26 - Gas Detection System
Section 23 34 00 - HV Fans
Section 23 55 00 - Fuel Fired Heaters (Makeup Air Units)
Division 26 - Electrical Specification Sections
Section 28 31 00 - Fire Detection and Alarm

### REFERENCE

Section 23 09 14 work includes furnishing and installing all field devices, and all related field wiring, interlocking control wiring between equipment, that is covered in that section.

Motorized control dampers and actuators are also covered in Section 23 09 14 except motor operated dampers included as part of specific equipment.

### DESCRIPTION OF WORK

Control sequences are hereby defined as the manner and method by which automatic controls function.

Requirements for each type of operation are specified in this section.

Operation equipment, devices and system components required to be controlled are specified in other Division 23 control sections of these specifications.

### ELECTRICAL WORK

All electrical work required for heating-ventilating controls and not specifically called out on the electrical drawings shall be completed by the Division 23 Contractor. This includes additional circuits. The division 23 Contractor shall coordinate with the Division 26 Contractor.

### SUBMITTALS

Refer to Division 1, Basic Requirements, Submittals, Section 23 05 00 and Section 23 09 14 for descriptions of what should be included in the submittals.

Shop drawings shall be provided under Sections 23 09 14. The contractor providing the 23 09 14 equipment shall provide a complete narrative of the sequence of operation for equipment that is controlled by this section 23 09 14 and this section or directly from that equipment provided controls. The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect the actual operation as applied by the control section contractor.

### OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

### DESIGN CRITERIA

Reference Section 23 09 14.

### CODE REFERENCES

International Mechanical Code sections 404.1 and 404.2 and

Wisconsin Administrative Code SPS 364.0404 alternative to the requirements in IMC sections 404.1 and 404.2.

## P A R T 2 - P R O D U C T S

Not applicable to this Section – reference Section 23 09 14 for product descriptions.

## P A R T 3 - E X E C U T I O N

**GENERAL**

The scope of this project section is the control of make-up air units, exhaust fans for various modes of operation based on normal occupied-unoccupied cycles and on detection of carbon dioxide (CO), Nitrogen Dioxide ($NO_2$, diesel exhaust) or Methane ($CH_4$, natural gas aka CNG). The installation of the control provided as part of gas fired radiant tube heaters is also included in this section.

The building is divided into three detection zones for controls.
The zone designations are:

Detection Zone 1 (South Garage)
Detection Zone 2 (North Garage)
Detection Zone 3 (West Garage, referred to as the Electrical Shop)

In the sequence descriptions the following are the designated gases detected:

CO is Carbon Monoxide
$NO_2$ is Nitrogen Dioxide
$CH_4$ is Methane, (Natural Gas) (CNG)

The gas detection system will provide a signal on the detection of each specific gas in each of three detection zones. This section shall receive the specific gas detection zone signals from the system to activate the ventilation sequence of operation starting or stopping specific equipment required to execute the code required ventilation.

An alarm signal, as indicate in section 23 09 26, shall also be transmitted to the fire alarm system for reporting $CH_4$ detection to central monitoring and voice message to the facility. Refer to Section 28 31 00 Fire Detection and Alarm for coordination of detection and fire alarm systems interface.

**UPON GAS DETECTION ALARM ALL PERSONNEL SHALL EVACUATE THE BUILDING. NO OCCUPANTS SHALL BE IN THE AREA DURING THE ALARM**.

CLEARING OF GAS DETECTION ALARMS

When the alarm of a detected gas $CH_4$ returns to normal and the alarm is cleared the system shall return to the programmed mode of operation once the gas detection alarm is cleared and the heating and ventilation be activated to maintain the required heating and ventilation. The space can be re-occupied.

CONTROL OF OCCUPIED AND UNOCCUPIED MODES

Each of the three detection zones shall have occupied and unoccupied modes of operation shall be controlled independently from the other zones by the multichannel programmable time clock which shall be located in the new electrical service room adjacent to the building ventilation control panel.

The occupied/unoccupied schedules for each zone shall be developed in consultation with the Highway Department Staff.

**CONTROL SEQUENCES OPERATION**

Any **one** of the specific detectors, CO, $NO_2$ or $CH_4$ in a zone shall activate that zones ventilation mode for tthat specific gas.

**DETECTION ZONE 1 (South Garage)**

OCCUPIED AND UNOCCUPIED MODES

Occupied and unoccupied modes of operation shall be controlled by the multichannel programmable time.

OCCUPIED OPERATION MODE

Make up Air Unit MUA-3 shall be energized and outside air damper shall be open, and unit shall be controlled to provide a discharge air temperature with room override as controlled by manufacturer provided controls, installed by this section.

The CO and $NO_2$ exhaust fans EF-11, EF-13 and EF-14 shall operate.

Provide a manual switch for EF-35C and EF-37C to allow operation during normal occupied mode. Switch shall have a red pilot light to indicate operation. Switch shall be located in Shop Office. Doors OHD S-1, OHD S-2 and OHD S-3, if not open shall open to 18 inches above the floor when fans are in manual operation.

EXHAUST FANS EF-15 and EF-16

Engine exhaust fans EF-15 and EF-16 shall be manually started and stopped by a switch installed at a location to be determined.
EF-15 and 16 shall be interlocked with MUA-3 to change the supply air CFM of MUA-3 by adjusting the fan speed through the variable frequency drive, which is provided as part of the makeup air unit, as follows:

- Only the CO and $NO_2$ EF-11, EF-13 and EF-14 operating: 10,500 CFM
- EF-11, EF-13 and EF-14 and EF-15 OR EF-16 operating: 13,000 CFM
- EF-11, EF-13 and EF-14 and EF-15 and EF-16 operating: 15,500 CFM

UNOCCUPIED OPERATION MODE

Make up Air Unit MUA-3 shall be not operate and outside air damper shall be closed.

Provide a manual override to switch Zone 1 system from unoccupied to occupied for 2 hours.

Interconnect with the switched lighting of the zone to switch from unoccupied to occupied ventilation mode when lights are switched on. When lights are switched off ventilation shall switch to programmed mode.

The CO and NO2 exhaust fans EF-11, EF-13 and EF-14 shall be off.

Detection of CO at 35.00 PPM or $NO_2$ at 1.00 PPM shall activate the Make up Air Unit MUA-3 and CO and $NO_2$ exhaust fans EF-11, EF-13 and EF-14 to operate in the occupied mode.

Once the CO level reaches 10.00 PPM or $NO_2$ level reaches 0.2 PPM the ventilation system shall return to the normal Zone 1 time clock scheduled mode of operation.

DETECTION OF $CH_4$ - OCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal occupied operation, shutting off the CO and $NO_2$ exhaust fans EF-11, EF-13, EF-14, exhaust fans EF-15, EF-166 and makeup air unit MUA-3.
- Detection of $CH_4$ shall open garage doors OHD S-1, OHD S-2, OHD S-3 to 18 inches above the floor. OHD S-4, if open shall close.
- Activate CNG exhaust fans EF-34C, EF-35C, EF-36C and EF-37C when the level of gas reaches 1.25% concentration in the zone. When the level of gas reaches 0.5% concentration in the zone the fans shut off and if the OHD's have opened due to the detection the doors shall close.
- Activate visual and continuous audible alarm at High warning when the level of gas reaches 3.0% concentration in the zone. Alarm shall also be transmitted to the fire alarm system for reporting $CH_4$ detection to central monitoring and voice message to the facility. Refer to Section 28 31 00

Fire Detection and Alarm for coordination of systems interface. When the level of gas reaches 0.0% concentration in the zone the fans shut off, if the OHD's have opened due to the detection the doors shall close.

- Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode.

DETECTION OF $CH_4$ - UNOCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal unoccupied operation. If the CO and $NO_2$ exhaust fans EF-11, EF-13 and EF-14 and makeup air unit MUA-3 should be operating as specified in the CO and $NO_2$ unoccupied mode that mode shall be overridden and these exhaust fans and the MUA shut off.
- Detection of $CH_4$ shall open garage doors OHD S-1, OHD S-2, OHD S-3 to 18 inches above the floor. OHD S-4, if open shall close.
- Activate CNG ventilation system as specified for Detection of $CH_4$ Occupied Operation Mode.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode.

**DETECTION ZONE 2 (North Garage)**

OCCUPIED AND UNOCCUPIED MODES

Occupied and unoccupied modes of operation shall be controlled by the multichannel programmable time.

OCCUPIED OPERATION MODE

Make up Air Unit MUA-1 shall be energized and outside air damper shall be open, and unit shall be controlled to provide a discharge air temperature with room override as controlled by manufacturer provided controls, installed by this section.

The CO and $NO_2$ exhaust fans EF-2, EF-3, EF-4 and EF-5 shall operate.

Provide a manual switch for EF-30C and EF-33C to allow operation during normal occupied mode. Switch shall have a red pilot light to indicate operation. Switch shall be located in Shop Office.
Overhead Door OHD N-2, if not open shall open 25 inches above the floor when fans are in manual operation.

EXHAUST FANS EF-6 and EF-7 and MUA-2 (Paint Booth Makeup Air and Exhaust

Fans EF-6 and EF-7 shall be manually started and stopped by a switch installed at a location to be determined, likely at the existing location.
EF-6 and EF-7 shall be interlocked with MUA-2 to start when the exhaust fans are switched on.

Makeup Air Unit MUA-2 when energized the outside air damper shall be open, and unit shall be controlled to provide a discharge air temperature with room override as controlled by manufacturer provided controls, installed by this section.

UNOCCUPIED OPERATION MODE

Make up Air Unit MUA-1 or MUA-2 shall be not operate and outside air damper shall be closed.

Provide a manual override to switch Zone 2, MUA-1 system from unoccupied to occupied for 2 hours.

Interconnect with the switched lighting of the zone to switch from unoccupied to occupied ventilation mode when lights are switched on. When lights are switched off ventilation shall switch to programmed mode.

The CO and $NO_2$ exhaust fans EF-2, EF-3, EF-4 and EF-5 shall be off.

Detection of CO at 35.00 PPM or $NO_2$ at 1.00 PPM shall activate the Make up Air Unit MUA-1 and CO and $NO_2$ exhaust fans EF-2, EF-3, EF-4 and EF-5 to operate in the occupied mode.

Once the CO level reaches 10.00 PPM or $NO_2$ level reaches 0.2 PPM the ventilation system shall return to the normal Zone 2 time clock scheduled mode of operation.

DETECTION OF $CH_4$ - OCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal occupied operation, shutting off the CO and $NO_2$ exhaust fans EF-2, EF-3, EF-4 and EF-5 and makeup air unit MUA-1.
- Detection of $CH_4$ shall override the operation of EF-6 and EF-7 and if operating shall shut off.
- MUA-2 shall operate providing additional makeup air for $CH_4$ exhaust.
- Detection of $CH_4$ shall open garage door OHD N-2, to 25 inches above the floor.
- Activate CNG exhaust fans EF-30C, EF-31C, EF-32C and EF-33C when the level of gas reaches 1.25% concentration in the zone. When the level of gas reaches 0.00% concentration in the zone the exhaust fans and makeup air unit shut off and if the OHD's have opened due to the detection the doors shall close.
- Activate visual and continuous audible alarm at High warning when the level of gas reaches 3.50% concentration in the zone. Alarm shall also be transmitted to the fire alarm system for reporting $CH_4$ detection to central monitoring and voice message to the facility. Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface. When the level of gas reaches 0.00% concentration in the zone the fans shut off, if the OHD's have opened due to the detection the doors shall close.
- Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode.

DETECTION OF $CH_4$ - UNOCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal unoccupied operation. If the CO and $NO_2$ exhaust fans EF-2, EF-3, EF-4 and EF-5 and makeup air unit MUA-1 should be operating as specified in the CO and $NO_2$ unoccupied mode that mode shall be overridden and these exhaust fans and the MUA shut off.
- Detection of $CH_4$ shall open garage door OHD N-2 to 25 inches above the floor.
- Activate CNG ventilation system as specified for Detection of $CH_4$ Occupied Operation Mode.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode..

**DETECTION ZONE 3 (West Garage, referred to as the Electrical Shop)**

OCCUPIED AND UNOCCUPIED MODES

Occupied and unoccupied modes of operation shall be controlled by the multichannel programmable time.

OCCUPIED OPERATION MODE

Make up Air Unit MUA-4 shall be energized and outside air damper shall be open, and unit shall be controlled to provide a discharge air temperature with room override as controlled by manufacturer provided controls, installed by this section.

The CO and $NO_2$ exhaust fan EF-17 shall operate.

Provide a manual switch for EF-38C to allow operation during normal occupied mode. Switch shall have a red pilot light to indicate operation. Switch shall be located in Electrical Shop Office.
Overhead door OHD E-1 if not open shall open 10 inches above the floor when fan is in manual operation.

UNOCCUPIED OPERATION MODE

Make up Air Unit MUA-4 shall be not operate and outside air damper shall be closed.

Provide a manual override to switch Zone 3 system from unoccupied to occupied for 2 hours.

Interconnect with the switched lighting of the zone to switch from unoccupied to occupied ventilation mode when lights are switched on. When lights are switched off ventilation shall switch to programmed mode.

The CO and NO2 exhaust fans EF-17 shall be off.

Detection of CO at 35.00 PPM or $NO_2$ at 1.00 PPM shall activate the Make up Air Unit MUA-4 and CO and $NO_2$ exhaust fan EF-17 to operate in the occupied mode.

Once the CO level reaches 10.00 PPM or $NO_2$ level reaches 0.20 PPM the ventilation system shall return to the normal Zone 3 time clock scheduled mode of operation.

DETECTION OF $CH_4$ - OCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal occupied operation, shutting off the CO and $NO_2$ exhaust fans EF-17 and makeup air unit MUA-4.
- Detection of $CH_4$ shall open garage door OHD E-1 to 10 inches above the floor.
- Activate CNG exhaust fan EF-39C when the level of gas reaches 1.25% concentration in the zone. When the level of gas reaches 0.2% concentration in the zone the exhaust fan and makeup air unit shut off and if the OHD's have opened due to the detection the door shall close.
- Activate visual and continuous audible alarm at High warning when the level of gas reaches 3.0% concentration in the zone. Alarm shall also be transmitted to the fire alarm system for reporting $CH_4$ detection to central monitoring and voice message to the facility. Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface. When the level of gas reaches 0.00% concentration in the zone the fans shut off, if the OHD's have opened due to the detection the doors shall close.
- Refer to Section 28 31 00 Fire Detection and Alarm for coordination of systems interface.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode.

DETECTION OF $CH_4$ - UNOCCUPIED OPERATION MODE

- Detection of $CH_4$ shall override the normal unoccupied operation. If the CO and $NO_2$ exhaust fan EF-17 and makeup air unit MUA-4 should be operating as specified in the CO and $NO_2$ unoccupied mode that mode shall be overridden and these exhaust fan and the MUA shut off.
- Detection of $CH_4$ shall open garage door OHD E-1 to 10 inches above the floor.
- Activate CNG ventilation system as specified for Detection of $CH_4$ Occupied Operation Mode.
- Upon clearing of $CH_4$ the system shall return to the normally scheduled mode.

**GAS FIRED RADIANT HEATING UNITS**

Unit controls are specified to be provided by the unit manufacturer.

This section shall be installed by this section contractor

Thermostats as indicated on the plan are to be verified and coordinated existing conditions and the owner to determine the final location.

**TRAINING**

The 23 09 26 – 23 09 93 Supplier and Installing Contractor of the detection system shall provide, as part of this contract, 2 hours training on the operation of the ventilation control system to designated user personnel. This training shall be coordinated with the Gas Detection System training to provide training of the detection and control system in the same time period.

END OF SECTION

**SECTION 23 31 00**
**HV DUCTS**

## P A R T 1 - G E N E R A L

**SCOPE**
This section includes specifications for all duct systems used on this project

**RELATED WORK**
Section 23 05 93 - Testing, Adjusting, and Balancing for HV
Section 23 33 00 – Air Duct Accessories

**REFERENCE**
Applicable provisions of Division 1 govern work under this Section.

**REFERENCE STANDARDS**

| | |
|---|---|
| ASTM A90 | Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles |
| ASTM A623 | Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process |
| ASTM A527 | Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality |
| NFPA 90A | Standard for the Installation of Air Conditioning and Ventilating Systems |
| UL 181 | Standard for Safety for Factory Made Air Ducts and Air Connectors. |

**DESIGN CRITERIA**
Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

- HVAC Duct Construction Standards, Metal and Flexible, 3rd Edition, 2005
- HVAC Air Duct Leakage Test Manual, 2nd Edition, 2012
- HVAC Systems - Duct Design, 4th Edition, 2006

Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

**DELIVERY, STORAGE AND HANDLING**
Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

Protect Ductwork against damage.

Storage and protection methods must allow inspection to verify products.

## P A R T 2 - P R O D U C T S

**GENERAL**
All sheet metal used for construction of duct shall be 24 gauge or heavier except for round 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards.

**MATERIALS**
GALVANIZED STEEL SHEET:
Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90.

**LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)**
Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral

ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

**DUCT SEALANT**

Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.

Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

## P A R T 3 - E X E C U T I O N

**INSTALLATION**

Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

Install all motor operated dampers. Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

**DUCTWORK SUPPORT**

Support ductwork in accordance with SMACNA HVAC Duct Construction Standards.

Exterior supply air ductwork leaving makeup air units shall be supported from the unit concrete base with steel angles or strut.

**LOW PRESSURE DUCT (Maximum 2 inch pressure class)**

Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

Install a manual balancing damper in each branch duct and for each diffuser or grille.

END OF SECTION

# SECTION 23 33 00
# AIR DUCT ACCESSORIES

## P A R T 1 - G E N E R A L

**SCOPE**
This sections includes accessories used in the installation of duct systems.

**REFERENCE STANDARDS**

| | |
|---|---|
| NFPA 90A | Standard for Installation of Air Conditioning and Ventilating Systems |
| SMACNA | HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995 |
| UL 214 | |
| UL 555 (6th edition) | Standard for Fire Dampers and Ceiling Dampers |
| UL 555S (4th edition) | Leakage Rated Dampers for Use in Smoke Control Systems |

**SHOP DRAWINGS**
Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

## P A R T 2 - P R O D U C T S

**MANUAL VOLUME DAMPERS**
Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

**TURNING VANES**
Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

**ACCESS DOORS**
Access door to be designed and constructed for the pressure class of the duct in which the door is to be installed. Doors in exposed areas shall be hinged type with cam sash lock. Hinges shall be aluminum or steel full length continuous piano type. Doors in concealed spaces may be secured in place with cam sash latches. For both hinged and non hinged doors provide sufficient number of camp sash latches to provide air tight seal when door is closed. Do not use hinged doors in concealed spaces if this will restrict access. Use minimum 1" deep 24 gauge galvanized steel double wall access doors with minimum 24 gauge galvanized steel frames. For non-galvanized ductwork, use minimum 1" deep double wall access door with frame that shall use materials of construction identical to adjacent ductwork. Provide double neoprene gasket that shall provide seals from the frame to the door and frame to the duct. When access doors are installed in insulated ductwork or equipment provide insulated doors with insulation equivalent to what is provided for adjacent ductwork or equipment. Access doors constructed with sheet metal screw fasteners will not be accepted.

**LOUVERS**
Manufacturers: Greenheck, or approved equivalent by Airolite, Industrial Louvers, American Warming and Ventilating, Construction Specialties, Ruskin.

Provide louvers of model, size and construction as scheduled.

Extruded aluminum alloy and accessories and construction as scheduled. Provide with bird screen of ½" x ½" mesh aluminum in 12 gauge aluminum.

Louver to bear the AMCA certified ratings seal for both air performance and water penetration, having a free area not less than scheduled based on a 48" x 48" section.

## PART 3 - EXECUTION

**MANUAL VOLUME DAMPERS**

Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

**TURNING VANES**

Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

**ACCESS DOORS**

Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated.

**LOUVERS**

Louvers mounted in exterior walls at locations indicated on the drawings. Connect outside air intake duct to the louver, sealing all connections air and water tight.

**FLASHINGS**

Flashing for wall penetrations with ductwork or the installation of louvers and wall mounted fans, shall be sealed water tight to the building wall.

END OF SECTION

**SECTION 23 34 00**
**HV FANS**

## P A R T 1 - G E N E R A L

### SCOPE
This section includes specifications for fans that are not an integral part of a manufactured device.

### RELATED WORK
Section 23 05 13 - Common Motor Requirements for HVAC Equipment
Section 23 05 31 - HVAC Ducts
Section 23 05 33 - Air Duct Accessories

### REFERENCE
Applicable provisions of Division 1 govern work under this Section.

### REFERENCE STANDARDS

| | |
|---|---|
| AMCA 203 | AMCA Fan Application Manual - Troubleshooting |
| AMCA 210 | Laboratory Method of Testing Fans for Rating |
| NFPA 90A | Standard for the Installation of Air Conditioning and Ventilating Systems |
| ANSI/AMCA Standard 99-10, | Standards Handbook |
| ANSI/AMCA Standard 204-05, | Balance Quality and Vibration Levels for Fans |
| AMCA Publication 211-05, | Certified Ratings Program – Product Rating Manual for Fan Air Performance |
| ANSI/AMCA Standard 300-08, | Reverberant Room Method for Sound Testing of Fans" |
| AMCA Publication 311-05, | Certified Ratings Program – Product Rating Manual for Fan Sound Performance |
| AMCA Standard 500-D-12, | Laboratory Methods of Testing Dampers for Rating" |
| OSHA guideline 1910.212 – | General requirements for Machine Guarding. (www.osha.gov) |

### QUALITY ASSURANCE
Refer to division 1, Basic Requirements, Equals and Substitutions.

### SHOP DRAWINGS
Refer to division 1, Basic Requirements, Submittals.

Include dimensions, capacities, fan curves, materials of construction, ratings, weights, motors and drives, sound power levels, appropriate identification and vibration isolation for all equipment. Sound power levels to be based on tests performed in accordance with AMCA Standard 300.

Fan curves shall indicate the relationship of CFM to static or total pressure for various fan speeds. Brake horsepower, recommended selection range, and limits of operation are to also be indicated on the curves. Indicate operating point on the fan curves at design air quantity and indicate the manufacturer's recommended drive loss factor for the specific application. Tabular fan performance data is not acceptable.

### OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

### DESIGN CRITERIA
Tested and certify all fans in accordance with the applicable AMCA test code.

Each fan and motor combination shall be capable of delivering 110% of air quantity scheduled at scheduled static pressure. The motor furnished with the fan shall not operate into the motor service factor when operating under these conditions. Consider drive efficiency in motor selection according to manufacturer's published recommendation or according to AMCA Publication 203, Appendix L.

Where inlet and outlet ductwork at any fan is changed from that shown on the drawings, provide any motor, drive and/or wiring changes required due to increased static.

All roof mounted equipment to be provided with curbs as an accessory to the fan and be compatible with the roof on which the equipment is to be installed .

## PART 2 - PRODUCTS

**GENERAL**
Use fan size, class, type, arrangement, and capacity as scheduled.

Furnish complete with motors, wheels, drive assemblies, bearings, vibration isolation devices, and accessories required for specified performance and proper operation. All single phase motors to have inherent thermal overload protection. Provide variable pitch sheaves for drives 3 hp and smaller, fixed pitch sheaves for drives 5 hp and larger. Design all drives for 150% of motor rating.

Use OSHA approved belt guards that totally enclose the entire drive. Construct guards of expanded metal to allow for ventilation; provide tachometer openings at shaft locations.

Statically and dynamically balance all fans so they operate without objectionable noise or vibration.

Use AMCA Type A spark resistant construction for all fans handling flammable or explosive vapors.

**POWER ROOF EXHAUST FANS**
Manufacturers: Greenheck, Carnes, Penn, Jenn-Air, Cook, ACME or approved equal.

Provide upblast or downblast units, as scheduled, with aluminum housing, non-overloading type centrifugal wheel, inlet cone, factory mounted and wired motor and disconnect switch, and bird screen.

Provide disconnect switches and thermal overload protection for units with three phase motors as scheduled.

Provide accessories and construction as scheduled.

**SINGLE WIDTH UTILITY SET CENTRIFUGAL FANS**
Manufacturers: Greenheck, Carnes, Cook, Penn, Jenn-Air, or approved equal.

Fan housing is to be aerodynamically designed with high-efficiency inlet. Fan shall airtight construction with the welded scroll panel material formed and embedded into the side panels. All interior and exterior surface untreated steel shall be coated with powder coating.
An OSHA compliant belt guard shall be included to completely cover the motor pulley and belt(s).

Fan wheel shall be of the single width backward inclined centrifugal type. Fan wheel shall be statically and dynamically balanced. Wheel and fan inlet shall be carefully matched and shall have running tolerances for maximum performance and operating efficiency.

Motor shall be totally enclosed fan cooled (TEFC).
Drive belts and sheaves shall be sized for 150% of the fan operating brake horsepower.
Fan shaft to be turned and polished steel that is sized so the first critical speed is at least 25% over the maximum operating speed for each pressure class.
Fan shaft bearings shall grease lubricated, roller pillow block type. Bearings shall be selected for a basic rating fatigue life (L-10) of 80,000 hours. Bearings shall have Zerk fittings to allow for lubrication.

Include factory mounted isolation base with isolation springs and powder coating.

## PART 3 - EXECUTION

**INSTALLATION**
Install as shown on the drawings, as detailed, and according to manufacturer's installation instructions.

END OF SECTION

# SECTION 23 37 13
# DIFFUSERS, REGISTERS & GRILLES

## PART 1 - GENERAL

**SCOPE**
This section includes specifications for air terminal equipment.

**RELATED WORK**
Section 23 31 00 - HVAC Ducts
Section 23 33 00 - Air Duct Accessories
Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

**REFERENCE STANDARDS**
NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
UL 181 - Factory-Made Air Ducts and Connectors.
ARI-ADC Standard 880

**SUBMITTALS**
Refer to Division 1, Basic Requirements, Submittals.

Furnish submittal information including, but not limited to, the following:
- Manufacturer's name and model number
- Identification as referenced in the documents
- Capacities/ratings
- Materials of construction
- Sound ratings
- Dimensions
- Finish
- Color selection charts where applicable
- Manufacturer's installation instructions
- All other appropriate data

**DESIGN CRITERIA**
All performance data shall be based on tests conducted in accordance with Air Diffusion Council (ADC) Test Code 1062 GRD 84.

## PART 2 - PRODUCTS

**MANUFACTURERS**
Manufacturers: Carnes, Krueger, Titus, Metal-Aire, and E.H. Price.

**SIDE-WALL REGISTERS AND GRILLES**
Carnes model scheduled. Titus, Metal Aire, Krueger, Price equivalent or prior approved equivalent.

Steel and/or Aluminum unless otherwise indicated, with frame type appropriate to installation.

Double deflection type blade supply registers and supply grilles allow deflection blade adjustment in all direction.

Register and grille sizes as shown on drawings and/or as scheduled.

Baked enamel finish or powder coat finish, as scheduled.

Screw holes on surface counter sunk to accept recessed type screws.

## PART 3 - EXECUTION

### INSTALLATION

Install grilles and registers as shown on drawings and according to manufacturer's instructions.

Seal connections between ductwork drops and grilles airtight.

**END OF SECTION**

## SECTION 23 55 00
## FUEL FIRED HEATERS

## PART 1 - GENERAL

**SCOPE**
This section includes specifications for fuel-fired heaters.

**RELATED WORK**
Section 23 05 13 - Common Motor Requirements for HV Equipment
Section 23 05 23 - Valves and Piping for Fuel Gas
Section 23 05 29 - Hangers and Supports for HV Piping and Equipment
Section 23 05 93 - Testing, Adjusting and Balancing for HV
Section 23 09 14 - Electric Control Devices for HV
Section 23 09 93 - Sequence of Operation for HV Controls
Section 23 31 00 - HVAC Ducts
Section 23 33 00 - Air Duct Accessories

**REFERENCE STANDARDS**

| | |
|---|---|
| AGA | American Gas Association |
| ANSI Z83.4 | Direct Gas Fired Makeup Air Heaters |
| GAMA | Gas Appliance Manufacturers Association |
| NEC | National Electrical Code |

**WARRANTY**
Direct fired make-up air units warranted for 24 months from date of startup.

## PART 2 - PRODUCTS

**DIRECT FIRED MAKE-UP AIR UNITS**
Manufacturers: Greenheck, Hastings, Reznor, Rupp, Sterling, Trane or Weather-Rite.

AGA certified for use with natural gas.

Entire unit shall be ETL Certified per ANSI Z83.4 or ANSI Z83.18 and bear an ETL mark.

Outdoor units cabinet constructed of 18 gauge aluminized steel with enamel finish or 18 gauge galvanized steel. Gasketed access panels and doors for access to all components including blower, burner and electrical components. All seams to be foam taped or caulked to prevent moisture from entering the unit. Provide a weatherhood constructed of 16 gauge galvanized steel with galvanized bird screen. ]

Insulate cabinet with 1" thick foil faced fiberglass downstream of heat source. Comply with NFPA 90A and NFPA 90B and erosion requirements of UL 181

Provide centrifugal forward curved or plenum fan with statically and dynamically balanced wheels and one piece through shaft and heavy duty sealed ball bearings with extended grease fittings. Ratings are to be established in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Rating".
Fan shall be isolated from unit with vibration isolators and flexible connectors to prevent vibration from transmitting to the building.

Motors shall be open drip proof with adjustable belt drives.

Shall be equipped for operation on natural gas with a maximum rated inlet gas pressure of 2 PSI. A gas pressure regulator shall be supplied to provide the required unit gas pressure.

Modulating type direct fired burner shall be constructed of cast iron gas manifold connected to stainless steel mixing plates, turndown ratio of 25:1.

Furnace shall be assembled, piped, and wired direct gas-fired system of 92% efficiency with a draw through design and field adjustable burner baffles with a direct spark ignition system.

AGA certified gas controls, meeting FM requirements and meeting IRI requirements including flame safeguard relay with flame sensor, high & low gas pressure switches, intermittent spark or hot surface ignition system, manual main shut-off valve, electronic modulating gas valve, pilot controls, electric safety shut-off valve, main and pilot gas regulators suitable for inlet pressure indicated on the drawings.

Control panel / connections: Unit shall have an electrical control center where all high and low voltage connections are made. Control center shall be constructed to permit single-point high voltage power supply connections.

Provide complete with the following electric controls as noted in the schedule on the drawings. Factory installed motor starter with auxiliary contacts, control transformer, high temperature limit switch, low outlet temperature shut-off, high and low flow proving switches, automatic mild weather burner lockout. Contain all electrical in a NEMA 1 control box with fused disconnect.

Refer to Sections 23 09 93 for control sequence.

Provide filter section with 2" thick, MERV 8 throwaway filters. Provide dirty filter switch with indicating light. Filter section to be low velocity V-bank type.

Provide units complete with the following accessories:

- Intake shut-off damper with motor and end switch.
- Outside air inlet hood with screened inlet.
- Industrial remote control panel for field installation

**GAS FIRED RADIANT TUBE HEATERS**

Manufacturers: Based on Detroit Radiant (Re-Verber-Ray) Equivalents by Space-Ray, Superior, Roberts-Gordon (Co-Ray-Vac) or Combustion Research Corp (Reflect-O-Ray) are acceptable.

The entire system shall be AGA certified “Gas Infrared Heaters” conforming to ANSI standard Z83.6. All wiring shall comply with the National Electrical Code.

Heaters shall comply with the requirements of NFPA 30A 7.6.6 for natural gas repair garages indicated in the schedule on the drawings.

System configuration, construction, performance and accessories shall be as indicated on the drawings and/or equipment schedules.

Each comprised of burner unit, outside air inlet, combustion pipe, radiant pipe, reflectors, support brackets, exhaust pipe, thermostats and safety controls. Provide gas regulator, automatic gas valves and safety interlocks on gas train.

Unit is to be non-condensing type.

Burner and associated controls shall include, direct spark ignition, electronic flame monitoring, “power on” and “burner on” indicator lights, 100% gas safety shutoff in case of ignition failure, pre purge and post purge of system and air flow switch to prove combustion air flow prior to firing burner.

Provide polished aluminum or polished stainless steel reflectors over all heat exchanger piping including elbows, u-bends and fittings.

Provide single point 115v power connection at burner unit.

Controls:

- Furnish a low voltage wall mounted thermostat. Unit shall be provided with a factory installed control transformer.
- Provide a remote on-off switch

Power wiring, thermostat and control by Division 23 Contractor.

## PART 3 - EXECUTION

### INSTALLATION

**DIRECT FIRED MAKE-UP AIR UNITS**

Install units as shown on plans, as detailed and according to the manufacturer's installation instructions and in compliance with applicable codes.

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Install remote control panel at location inside building as indicated on the drawings. Verify exact location with owners representative.

For exterior units install on owner provided concrete pad, elevated on a steel stand as indicated on the drawings.

Make supply duct connection and run duct to inside building.

**GAS FIRED RADIANT TUBE HEATERS**

Install units as shown on plans, as detailed and according to the manufacturer's installation instructions and in compliance with applicable codes.

END OF SECTION

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# SECTION 26 05 00
# COMMON WORK RESULTS FOR ELECTRICAL

## PART 1 - GENERAL

The electrical work included in all other divisions is the responsibility of the contractor performing the division 26 work unless noted otherwise.

## GENERAL PROVISIONS

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.

The plans show various details indicating the general arrangement of the electrical work, sizes and locations of panels, devices, feeders, service, special systems, etc., the said plans with figures, lettering, etc., shall be considered a part of these Specifications and no charge or alteration shall be made in either case unless ordered by the Engineer.

In addition to the electrical plans, see General Plans of the building, as all electrical work appearing on the latter plans will be part of this contract unless especially specified to be done by other contractors, as well as, the said work detailed on the electrical plans.

## SCOPE

The work under this section includes basic electrical requirements, which are applicable to all Division 26 sections. This section includes information common to two or more technical specification sections or items that are of a general nature, not conveniently fitting into other technical sections. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Regulatory Requirements
- Quality Assurance
- Continuity of Existing Services and Systems
- Protection of Finished Surfaces
- Approved Electrical Testing Laboratories
- Sleeves and Openings
- Sealing and Firestopping
- Provisions for Future Work
- Intent
- Omissions
- Submittals
- Project/Site Conditions
- Work Sequence and Scheduling
- Work by Other Trades
- Salvage Materials
- Certificates and Inspections
- Operating and Maintenance Instructions
- Record Drawings

PART 2 - PRODUCTS
- Access Panels and Doors
- Identification
- Sealing and Firestopping

PART 3 - EXECUTION
- Excavation and Backfill
- Concrete Work
- Cutting and Patching
- Building Access
- Equipment Access

Coordination
Sleeves
Sealing and Firestopping
Housekeeping and Clean Up

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**RELATED WORK**

Applicable provisions of Division 1 govern work under this Section.

**REFERENCE STANDARDS**

Abbreviations of standards organizations referenced in this and other sections are as follows:

| | |
|---|---|
| ANSI | American National Standards Institute |
| ASTM | American Society for Testing and Materials |
| EPA | Environmental Protection Agency |
| ETL | Electrical Testing Laboratories, Inc. |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Illuminating Engineering Society |
| ISA | Instrument Society of America |
| NBS | National Bureau of Standards |
| NEC | National Electric Code |
| NEMA | National Electrical Manufacturers Association |
| NESC | National Electrical Safety Code |
| NFPA | National Fire Protection Association |
| UL | Underwriters Laboratories Inc. |

**REGULATORY REQUIREMENTS**

All work and materials are to conform in every detail to applicable rules and requirements of the City of Milwaukee Electrical Code, Wisconsin Electrical Code, the National Electrical Code (ANSI/NFPA 70), other applicable National Fire Protection Association codes, the National Electrical Safety Code, and present manufacturing standards (including NEMA).

**QUALITY ASSURANCE**

Refer to Division 1 for General Conditions, Product and Substitution requirements.

Manufacturers listed in specifications and drawings are those the design is based upon.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and the assigned space and for obtaining the performance from the system into which these items are placed.

All materials shall be listed by and shall bear the label of an approved electrical testing laboratory. If none of the approved electrical testing laboratories has published standards for a particular item, then other national independent testing standards, subject to approval of the Engineer, shall apply and such items shall bear those labels. Where one of the approved electrical testing laboratories has an applicable system listing and label, the entire system shall be so labeled.

Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

Without additional cost to the Owner, provide such other labor and materials as required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

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.

**PROTECTION OF FINISHED SURFACES**

Furnish one can of touch-up paint for each different color factory finish furnished by the Contractor. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

**APPROVED ELECTRICAL TESTING LABORATORIES**
The following laboratories are approved for providing electrical product safety testing and listing services as required in these specifications:
Underwriters Laboratories Inc.
Electrical Testing Laboratories, Inc.

**FLOOR, WALL, ROOF AND CEILING OPENINGS**
The General Contractor will be required to leave chase type openings in new ceiling, floors, walls, roof, partitions, etc., as required to install the electrical work specified or shown on the Drawings. Openings for individual raceways are the responsibility of the Electrical Contractor. The Electrical Contractor is responsible for correct size and location of his openings.

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.

If the Electrical Contractor should neglect to inform the General Contractor of his opening requirements and that portion of the Building construction has been completed, the Electrical Contractor shall pay the General Contractor for providing these openings.

Make arrangements with various other contractors for all special framing, spacing and chases. Mason will leave chases in mason work, but Electrical Contractor is responsible for correct size and location.

The Electrical 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.

**SEALING AND FIRESTOPPING**
Refer to Architectural Specifications for requirements.

**INTENT**
The Contractor shall furnish and install all the necessary materials, apparatus, and devices to complete the electrical equipment and systems installation herein specified, except such parts as are specifically exempted herein.

If an item is either called for in the specifications or shown on the plans, it shall be considered sufficient for the inclusion of said item in this contract. If a conflict exists within the Specifications or exists within the Drawings, the Contractor shall furnish the item, system, or workmanship which is the highest quality, largest, or most closely fits the Engineers' intent.

It must be understood that the details and drawings are diagrammatic. The Contractor shall verify all dimensions at the site and be responsible for their accuracy.

All sizes as given are minimum except as noted.

Materials and labor shall be new (unless noted or stated otherwise), first class, and workmanlike, and shall be subject at all times to the A/E's inspections, tests and approval from the commencement until the acceptance of the completed work.

Whenever a particular manufacturer's product is named, it is mentioned only to indicate the type, quality and function of the article which will meet the intent of the specifications.

**OMISSIONS**
No later than ten (10) days before bid opening, the Contractor shall call the attention of the Engineer to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

**SUBMITTALS**
Refer to Division 1 for additional submittal requirements.

The Electrical 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 Engineers final approval.

Shop drawings shall include data on physical dimensions, gauges, materials of construction and capacities. Incomplete drawings will be disapproved.

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.

Operating and Maintenance Instructions
Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:

- Copies of all approved submittals.
- Manufacturer's wiring diagrams for electrically powered equipment
- Records of tests performed to certify compliance with system requirements
- Certificates of inspection by regulatory agencies
- Parts lists for manufactured equipment
- Preventive maintenance recommendations
- Warranties
- Additional information as indicated in the technical specification sections.

**PROJECT/SITE CONDITIONS**
Install Work in locations shown on Drawings, unless prevented by Project conditions.

Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections.

Tools, materials and equipment shall be confined to areas designated by the Owner.

**WORK SEQUENCE AND SCHEDULING**
Install work in phases to accommodate Owner's occupancy requirements. During the construction period coordinate electrical schedule and operations with the General Contractor.

**WORK BY OTHER TRADES**
Every attempt has been made to indicate in this trade's specifications and drawings all work required of this Contractor. However, there may be additional specific paragraphs in other trade specifications and addenda, and additional notes on drawings for other trades which pertain to this Trade's work, and thus those additional requirements are hereby made a part of these specifications and drawings.

Electrical details on drawings for equipment to be provided by others is based on preliminary design data only. This Contractor shall lay out the electrical work and shall be responsible for its correctness to match equipment actually provided by others.

**SALVAGE MATERIALS**
No materials removed from this project shall be reused [except as specifically noted below. All materials removed shall become the property of and shall be disposed of by the Contractor.

**CERTIFICATES AND INSPECTIONS**
Deliver originals of these certificates to the Owner’s Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

**OPERATING AND MAINTENANCE INSTRUCTIONS**
Assemble material in three-ring or post binders, using an index at the front of each volume and tabs for each system or type of equipment. In addition to the data indicated in the General Requirements, include the following information:
Copies of all approved submittals.
Manufacturer's wiring diagrams for electrically powered equipment
Records of tests performed to certify compliance with system requirements

Certificates of inspection by regulatory agencies
Parts lists for manufactured equipment
Preventive maintenance recommendations
Warranties
Additional information as indicated in the technical specification sections

**RECORD DRAWINGS**
The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

Contractor shall keep contract drawings on which daily records of changes and deviations from contract shall be recorded. Dimensions and elevations on the record drawings shall locate all buried or concealed piping, conduit, or similar items.

The daily record of changes shall be the responsibility of Contractor's field superintendent. No arbitrary mark-ups will be permitted.

At completion of the project, the Contractor shall submit the marked-up record drawings to the general contractor prior to final payment.

## PART 2 - PRODUCTS

**ACCESS PANELS AND DOORS**
Lay-in Ceilings:
Removable lay-in ceiling tiles in 2 x 2 foot or 2 x 4 foot configuration provided under other divisions are sufficient; no additional access provisions are required unless specifically indicated.

Concealed Spline Ceilings:
Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under other divisions.

Metal Pan Ceilings:
Removable sections of ceiling tile held in position by pressure fit will be provided under other divisions.

Plaster Walls and Ceilings:
16 gauge frame with not less than a 20 gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers and similar wet areas, concealed hinges, screwdriver operated cam latch for general application, key lock for use in public areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the equipment needed service; minimum size is 12" by 12".

**IDENTIFICATION**
See Electrical section 26 25 53 – Identification for Electrical Systems.

**SEALING AND FIREPROOFING**
Refer to Architectural Specification Section 07 8400 for requirements.

## PART 3 - EXECUTION

**EXCAVATION AND BACKFILL**
Contractor shall file written “notification of excavation” with all utility companies at least 3 days prior to excavation.

Perform all excavation and backfill work necessary to accomplish indicated electrical systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

Sheeting, Shoring and Bracing:
Provide shoring, sheet piling and bracing in conformance with the OSHA and local regulations to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

Dewatering:
Provide, operate and maintain all pumps and other equipment necessary to drain and keep all excavation pits, trenches and the entire subgrade area free from water under all circumstances. Obtain general permit when required.

Depth of Cover:
trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown:

| | |
|---|---|
| 3’-0” minimum cover: | Main Power Service Entrance |
| 1’-6” minimum cover: | Branch Circuits |
| 2’-0” minimum cover: | Telephone Service |

**CONCRETE WORK**
The Division 3 Contractor will perform all cast-in-place concrete unless noted otherwise elsewhere. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for the support of electrical equipment.

**CUTTING AND PATCHING**
Refer to Division 1, General Requirements, Cutting and Patching.

**BUILDING ACCESS**
Arrange for the necessary openings in the building to allow for admittance of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

**EQUIPMENT ACCESS**
Install all piping, conduit, ductwork, and accessories to permit access to equipment for maintenance. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making

sure that access is available for all equipment and specialties. Where access is required in plaster or drywall walls or ceilings, furnish the access doors to the General Contractor and reimburse the General Contractor for installation of those access doors.

**COORDINATION**

The Contractor shall cooperate with other trades in locating work in a proper manner. Should it be necessary to raise or lower or move longitudinally any part of the electrical work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

The Contractor shall verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to light fixtures, panelboards, devices, etc. and recessed or semi-recessed heating units installed in/on architectural surfaces.

Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Cooperate with the testing consultant in ensuring specification Section 26 05 04 compliance. Verify system completion to the testing consultant. Demonstrate the starting, interlocking and control features of each system so the testing contractor can perform its work.

**SLEEVES**

Pipe sleeves for conduits 6" in diameter and smaller, in new poured concrete construction, shall be schedule 40 steel pipe, plastic removable sleeve or sheet metal sleeve, all cast in place.

In wet area floor penetrations, top of sleeve to be 2 inches above the adjacent floor. In existing wet area floor penetrations, core drill sleeve openings large enough to insert schedule 40 sleeve and grout the area around the sleeve. If a pipe clamp resting on the sleeve supports the pipe penetrating the sleeve, weld a collar or struts to the sleeve that will transfer weight to the existing floor structure. Wet areas for this paragraph are rooms or spaces containing air handling unit coils, converters, pumps, chillers, boilers, and similar waterside equipment.

Pipe penetrations in existing concrete floors that are not in wet areas may omit the use of schedule 40 sleeve and use the core drilled opening as the sleeve.

**SEALING AND FIRESTOPPING**

Fire and/or Smoke Penetrations:
Sealing and fire stopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the sleeve, structural or partition opening shall be the responsibility of the contractor whose work penetrates the opening. Refer to Architectural Specification Sections for requirements.

**HOUSEKEEPING AND CLEAN UP**

The Contractor shall clean up and remove from the premises, on a daily basis, all debris and rubbish resulting from its work and shall repair all damage to new and existing equipment resulting from its work. When job is complete, this Contractor shall remove all tools, excess material and equipment, etc., from the site.

**END OF SECTION**

# SECTION 26 05 02
# ELECTRICAL DEMOLITION FOR REMODELING

## PART 1 - GENERAL

**SCOPE**
The work under this section includes:
- Revising Electrical provisions to accommodate HVAC systems to provide for CNG detection and Exhaust
- Replacing Lighting in Maintenance Areas

PART 1 - GENERAL
Scope
Related Work
PART 2 - PRODUCTS
Materials and Equipment
PART 3 - EXECUTION
Examination
Preparation
Demolition and Extension of the Existing Electrical Work
PCB Ballast Handling
Lamp and PCB Ballast Disposal

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

## PART 2 - PRODUCTS

**MATERIALS AND EQUIPMENT**
Materials and equipment for patching and extending work as specified in the individual Sections.

## PART 3 - EXECUTION

**EXAMINATION**
Verify field measurements and circuiting arrangements as shown on Drawings.

Verify that abandoned wiring and equipment serve only abandoned facilities.

Verify whether or not PCB ballasts exist in light fixtures which will be disposed of. If PCB light fixture ballasts exist, then follow requirements in **PCB BALLAST HANDLING** and **LAMP AND PCB BALLAST DISPOSAL** below.

Demolition Drawings are based on casual field observation and/or existing record documents. Report discrepancies to the User Agency, Architect/Engineer and Dane County Field Representative before disturbing existing installation.

Beginning of demolition means installer accepts existing conditions.

**PREPARATION**
Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.

Coordinate utility service outages with the User Agency, Dane County Field Representative, and Architect/Engineer. Also, if applicable, coordinate utility service outages with the local Utility Company.

Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations and follow the safe working practice requirements of NFPA 70E.

Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from the User at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from the User at least 48 hours before partially or completely disabling system. Minimize outage duration. If required, make temporary connections to maintain service in areas adjacent to work area.

Existing Communication/Data System: Maintain existing system in service. If required, make temporary connections to maintain service in areas adjacent to work area.

**DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK**

Remove, relocate, and extend existing installations as necessary, to accommodate new construction and to meet all requirements of these specifications. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

Remove abandoned wiring to source of supply.

Remove exposed abandoned conduit and abandoned conduit above accessible ceiling finishes, unless noted otherwise on drawings. Cut conduit flush with walls and floors, and patch surfaces. If certain conduits and boxes are abandoned but not scheduled for removal, they shall be shown on the "As Built Drawings".

Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit and wiring servicing them is abandoned and removed. Provide blank cover for abandoned outlets which are not removed.

Disconnect and remove abandoned panelboards and distribution equipment.

Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

Provide revised typed circuit directory in panelboards that have circuits removed.

Repair adjacent construction and finishes damaged during demolition and extension work.

Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.

Provide supplemental support for conduits that are routed through demolition area, and are to remain. Supplemental support shall be added so that the conduit meets the support requirements of electrical specification section 26 05 33.

**PCB BALLAST HANDLING**

Generally, all high power factor fluorescent light ballasts manufactured before 1978 and some HID ballasts contain polychlorinated biphenyl (PCB) compounds in their capacitors. The Contractor shall inspect all ballasts in all light fixtures and take the actions described below.

The disposal of all ballasts labeled as "NON-PCBs" or "NO PCBs" shall become the responsibility of the Contractor. If the PCB content is <u>not</u> stated on the ballast label, the ballast shall be handled as a PCB ballast.

All PCB ballasts shall be removed from the light fixtures and shall have the wires clipped off. However, before removal, all PCB ballasts shall be carefully inspected for leaks. <u>If a ballast appears to be leaking (evidenced by potting compound leaking out or by an oily film on the ballast surface) the ballast must be handled per EPA and DNR PCB regulations.</u> Basically, this means the ballast is to be carefully removed from the fixture and placed in an approved drum. See paragraph below for the drum specifications. The person removing the ballast from the fixture shall wear protective gloves, eye protection, and protective clothing as necessary.

If the fixture has also been contaminated, it must be cleaned to less than 10 micrograms/100 square centimeters contamination before disposal. This cleaning must be done by an approved PCB

contractor and is not considered a part of this contract. Contact Dane County for contractor approval before commencing with the cleanup.

PCB disposal drums shall be placed in storage with the cover that came with the barrels, in a location within a building, as designated by the Building Manager. The drums are not to be placed outside where they are exposed to weather.

THESE PCB BALLASTS ARE NOT TO BE REMOVED FROM THE WORK SITE BY THE CONTRACTOR. To do so would be a violation of DNR and DOT hazardous waste regulations and may result in a fine to the Contractor.

The Contractor shall label and mark the PCB storage drums with EPA approved PCB labels and the storage area with signs, marks and lines to meet the regulations of Wisconsin Code NR 157 – Management of PCBs and Products Containing PCBs.

The Contractor shall also provide approved PCB absorbent materials to be stored immediately adjacent to the drum storage area. Do not place loose absorbent material in the drums.

The Contractor shall provide to the Dane County Field Representative, in written form, a total count of these ballasts (or their total weight by drum) and where they are stored.

See Lamp and PCB Ballast Disposal instructions below.

**LAMP AND PCB BALLAST DISPOSAL**

All lamps (fluorescent, incandescent, and HID) contain mercury and/or lead (in the base) as well as other heavy metals and compounds which are regulated by the EPA and DNR during the disposal process. As a result, regulations have been issued covering the handling and disposal of all lamps. Lamps which have been removed from service for disposal shall be handled as follows by the Contractor:

The Contractor shall very carefully remove all lamps (fluorescent, incandescent, and HID) from light fixtures before removal of the fixture from its mounted position. This is to reduce the likelihood that the lamp(s) will be broken. The Contractor will be charged the cost difference between disposal of broken and unbroken lamps, for all lamps broken in excess of 1% of the total lamps removed in the project.

The contractor shall contact an accredited Disposal Company to coordinate the storage and pickup of disposed lamps and PCB ballasts. The contractor may furnish their own containers or obtain them from the Disposal Company. Removed lamps and PCB ballasts shall be placed in containers by the contractor, marked with the number and type of lamp and PCB ballast, and placed in storage at a location on the user property. The contractor shall label the area as “Hazardous Material Storage”. The contractor shall make arrangements for pickup of the lamps and PCB ballasts.

END OF SECTION

# SECTION 26 05 04
# CLEANING, INSPECTION, AND TESTING OF ELECTRICAL EQUIPMENT

## PART 1 - GENERAL

**SCOPE**

The work under this section includes the required cleaning, repair, adjustment, calibration, maintenance and testing of electrical equipment, as specified herein. This applies only to new electrical and existing electrical equipment being furnished, modified, worked on or serviced by this contractor for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work

PART 2 - PRODUCTS
- Not Used

PART 3 - EXECUTION
- General Inspection and Cleaning of All Equipment
- Grounding Systems
- Metering and Instrumentation
- Battery Systems
- Mechanical and Electrical Interlock System
- Panelboards
- Motor Starters and Motor Control Centers
- Cables
- Occupancy Sensors
- Battery Pack Emergency Lighting
- Generators
- Automatic Transfer Switches

**RELATED WORK**

Applicable provisions of Division 1 govern work under this Section.

## PART 2 - PRODUCTS

Not Used.

## PART 3 - EXECUTION

**GENERAL INSPECTION AND CLEANING OF ALL ELECTRICAL EQUIPMENT**

Inspect for physical damage and abnormal mechanical and electrical conditions.

Any item found to be out of tolerance, or in any other way defective as a result of the required inspection or testing, shall be reported. Procedure for repair and/or replacement will be outlined. After appropriate corrective action is completed the item shall be re-tested.

Compare equipment nameplate information with the latest single line diagram and report any discrepancies.

Verify proper auxiliary device operation and indicators.

Check tightness of accessible bolted electrical joints. Use torque wrench method.

Make a close examination of equipment and remove any shipping brackets, insulation, packing, etc. that may not have been removed during original installation.

Make a close examination of equipment and remove any dirt or other forms of debris that may have collected in existing equipment or in new equipment during installation.

Clean All Equipment:
- Vacuum inside of panelboards, switchboards, switchgear, transformer core and coils, bus ducts, MCC's, fire alarm panels, communication/data panels, security panels, etc.
- Loosen attached particles and vacuum them away.
- Wipe all insulators with a clean, dry, lint free rag.

Clean insulator grooves.

Inspect equipment anchorage.

Inspect equipment and bus alignment.

Check all heater elements for operation and control.

Lubricate nonelectrical equipment per manufacturer's recommendations.

**GROUNDING SYSTEMS**
Inspect the ground system for adequate termination at all devices.

**METERING AND INSTRUMENTATION**
Examine all devices for broken parts, damage and wire connection tightness.

Verify the electronic meter is connected properly and displaying proper voltage and power quantities.

Inspect nameplate information for compatibility with one-line drawings.

Verify the instrument transformer connections with the system requirements.

Verify tightness of all bolted connections and assure adequate clearances exist from primary circuits to secondary circuit wiring and to grounds.

Verify that all required grounding and shorting connections exist and that those connections make good contact; i.e. sufficient surface area, good cleanliness, and proper pressure.

Verify proper primary and secondary fuses and required sizes.

**BATTERY SYSTEMS**
Inspect for physical damage and evidence of corrosion. Clean units.

Measure system charging voltage and each individual cell voltage.

Measure the electrolyte specific gravity and level.

Verify and compare measured values with manufacturer's specifications.

**MECHANICAL AND ELECTRICAL INTERLOCK SYSTEM**
Physically test each system to insure proper function, operation and sequencing.

Closure attempt shall be made on locked open devices.

Opening attempt shall be made on locked closed devices.

Key exchange shall be made with devices operated in off normal positions.

**PANELBOARDS**
Torque all the connections per the manufacturers spec. Verify phase wires, color coding, separate neutral and mechanical bonding. Verify circuit breaker operation. Verify the directory.

**MOTOR STARTERS AND MOTOR CONTROL CENTERS**
Verify the control circuits. Confirm the fusing and the grounding of the control transformers. Torque all of the connections. Confirm the overload elements and the circuit breakers (fuse) for proper sizing. Verify all grounding. Operate and test each motor starter for proper operation.

**CABLES**
600 Volt cable:

Visually inspect cables, lugs, connectors and all other components for physical damage and proper connections.

Check all cable connectors for tightness (with a torque wrench) and clearances. Torque test conductor terminations to manufacturer's recommendations.

Perform a 1000 Vdc megger test on all secondary cables from the substation transformers to the secondary switchboards and on all switchboard feeders.

**LIGHT FIXTURES**
Check the bonding and proper lamping. Confirm operation of the fixture with the proper switch or sensor.

**OCCUPANCY SENSORS**
Confirm operation of the sensor per the manufacturers spec.

**BATTERY PACK EMERGENCY LIGHTING**
Verify the operation per the manufacturers spec and run all of the diagnostic steps. Confirm proper grounding and location.

**GENERATORS**
Run the generator through the standard tests as recommended by the manufacturer including the load bank test. Test the automatic start circuits and run the full diagnostic tests. Verify the fuel and the tank. Check for fuel and coolant leaks.

Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.

After the generator has cooled down from the four hour test, shut it down and then simulate a power failure including operation of the transfer switch, automatic cycle, and automatic shutdown and return to normal.

**AUTOMATIC TRANSFER SWITCHES**
Coordinate with the generator and the subsequent tests.

Check the automatic transfer switches and automatic start circuits for proper function.

END OF SECTION

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# SECTION 26 05 19
# LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE

## PART 1 - GENERAL

**SCOPE**
The work under this section includes furnishing and installing required wiring and cabling systems including pulling, terminating and splicing. Included are the following topics:



**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

Section 26 05 33 – Raceway and Boxes for Electrical Systems.
Section 26 05 53 – Identification for Electrical Systems.

**REFERENCES**
NFPA 70 - National Electrical Code.

**SUBMITTALS**
Submit product data: Provide for each cable assembly type.

Submit factory test reports: Indicate procedures and values obtained.

Submit shop drawings for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

Submit manufacturer's installation instructions. Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

**PROJECT CONDITIONS**
Verify that field measurements are as shown on Drawings.

Conductor sizes are based on copper.

Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.

Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

## PART 2 - PRODUCTS

**GENERAL**
All wire shall be new, delivered to the site in unbroken cartons and shall be less than one year old out of manufacturer's stock.

All conductors shall be copper. Aluminum conductors size #1/0 and larger may be substituted for copper. The following requirements shall be met when aluminum conductors are used:

Aluminum alloy conductors shall be compact stranded conductors of a recognized Aluminum Association 8000 Series aluminum alloy conductor material (AA-8000 series alloy).

It is the responsibility of the contractor to increase the size of the conduit, wire gutter, or enclosure, if necessary, to accommodate the aluminum conductors and meet allowable code requirements.

It is the responsibility of the contractor to increase the size of the aluminum conductor to match the ampacity of the copper conductor circuit shown on the Drawings.

The contractor shall submit a feeder schedule to the Engineer for all conductor substitutions indicating the aluminum conductor wire size and the conduit size. The contractor shall not begin the installation until written approval is granted by the Engineer.

All aluminum conductors shall terminate on a compression lug or compression adapter. An oxide-inhibiting joint compound must be applied on the aluminum conductor during termination. The compression connectors shall be installed according to manufacturers' instructions with the compression tool recommended by the manufacturer of the connector.

The contractor shall perform an infrared survey of all aluminum conductor connections after the installation is complete and in normal service. Infrared surveys shall be performed during periods of maximum possible loading with at least 30% of rated load of the equipment being inspected. All connections with elevated temperatures shall be corrected by the contractor.

No copper-to-aluminum transitions permitted when splicing onto existing copper feeders.

Insulation shall have a 600 volt rating.

In mechanical rooms, light fixtures, and other high temperature applications, the insulation shall be rated 90 degrees C. Other areas shall use insulation rated 75 degrees C unless stated otherwise in other parts of these specifications and drawings.

All conductors must be suitable for the application intended. Conductors #10 and larger must be stranded. Conductors #12 and smaller may be solid or stranded with the following requirements or exceptions:

All conductors terminated with crimp type devices must be stranded.

Stranded conductors may only be terminated with UL OR ETL Listed type terminations or methods: e.g. stranded conductors may not be wrapped around a terminal screw but must be terminated with a crimp type device or must be terminated in an approved back wired method.

**BUILDING WIRE**
Description: Single conductor insulated wire.

Insulation: Type THHN/THWN, XHHW-2 insulation for feeders and branch circuits.
Type XHHW-2 insulation for feeders with aluminum conductors.

**UNDERGROUND WIRE FOR EXTERIOR WORK**
Description: Stranded single or multiple conductor insulated wire.

Insulation: Type XHHW-2 or USE.

**WIRING CONNECTORS**
Split Bolt Connectors: Not acceptable.

Solderless Pressure Connectors: High copper alloy terminal. May be used only for cable termination to equipment pads or terminals. Not approved for splicing.

Spring Wire Connectors: Solderless spring type pressure connector with insulating covers for copper wire splices and taps. Use for conductor sizes 10 AWG and smaller.

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.

Mechanical Connectors: Bolted type tin-plated; high conductivity copper alloy; spacer between conductors; beveled cable entrances.

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.

## PART 3 - EXECUTION

### GENERAL WIRING METHODS

All wire and cable shall be installed in conduit.

Do not use wire smaller than 12 AWG for power and lighting circuits.

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).

Make conductor lengths for parallel conductors equal.

Splice only in junction or outlet boxes.

No conductor less than 10 AWG shall be installed in exterior underground conduit.

Identify ALL low voltage, 600v and lower, wire per section 26 05 53.

Neatly train and lace wiring inside boxes, equipment, and panelboards.

### WIRING INSTALLATION IN RACEWAYS

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.

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.

Completely and thoroughly swab raceway system before installing conductors.

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.

### WIRING CONNECTIONS AND TERMINATIONS

Splice only in accessible junction boxes.

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.

All splices shall be so made that they have an electrical resistance not in excess of two feet (600 mm) of the conductor.

Use solderless spring type pressure connectors with insulating covers for wire splices and taps, 10 AWG and smaller.

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.

Thoroughly clean wires before installing lugs and connectors.

At all splices and terminations, leave tails long enough to cut splice out and completely re-splice.

**FIELD QUALITY CONTROL**
Field inspection and testing will be performed under provisions of Section 26 05 04.

Additional testing as follows shall be performed if aluminum conductors are used:

Equipment terminated with aluminum conductors shall be tested with a thermal imager and recorded.

Conductors shall be closely checked for loose or poor connections, and for signs of overheating or corrosion.

Test procedures shall meet NETA guidelines.

Test results and report shall be provided to the engineer.

Contractor shall correct all deficiencies reported in the test report.

**WIRE COLOR**
General:

For wire sizes 10 AWG and smaller - Wire shall be colored as indicated below.

For wire sizes 8 AWG and larger - Identify wire with colored tape at all terminals, splices and boxes. Colors to be as indicated below.

In existing facilities, use existing color scheme.

In new facilities, use black and red for single phase circuits at 120/240 volts, use Phase A black, Phase B red and Phase C blue for circuits at 120/208 volts single or three phase, and use Phase A brown, Phase B orange and Phase C yellow for circuits at 277/480 volts single or three phase. Note: This includes fixture whips except for Listed whips mounted by the fixture manufacturer on the fixture and Listed as a System.

Neutral Conductors: White for 120/208V and 120/240V systems, Gray for 277/480V systems. Where there are two or more neutrals in one conduit, each shall be individually identified with the proper circuit.

Branch Circuit Conductors: Three or four wire home runs shall have each phase uniquely color coded.

Feeder Circuit Conductors: Each phase shall be uniquely color coded.

Ground Conductors: Green for 6 AWG and smaller. For 4 AWG and larger, identify with green tape at both ends and at all access points, such as panelboards, motor starters, disconnects and junction boxes. When isolated grounds are required, contractor shall provide green with yellow tracer.

**BRANCH CIRCUITS**
The use of multi-wire branch circuits with a common neutral feeding loads is not permitted.

All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductor.

**EMERGENCY CIRCUITS**
All emergency system wiring shall be installed in raceways separate from all other systems.

END OF SECTION

# SECTION 26 05 26
# GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### SCOPE
The work under this section includes grounding electrodes and conductors, equipment grounding conductors, and bonding. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Performance Requirements
- Submittals
- Project Record Documents
- Regulatory Requirements

PART 2 - PRODUCTS
- Rod Electrode
- Mechanical Connectors
- Compression Connectors
- Exothermic Connections
- Wire
- Bus

PART 3 - EXECUTION
- Examination
- General
- Less Than 600 Volt System Grounding
- Field Quality Control

### RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

### REFERENCES
NFPA 70 - National Electrical Code.

ANSI/IEEE 142 (Latest edition) - Recommended Practice for Grounding of Industrial and Commercial Power Systems.

### PERFORMANCE REQUIREMENTS
Grounding System Resistance: 2ohms maximum at building service entrance.

### SUBMITTALS
Product Data: Provide data for grounding electrodes and connections.

Test Reports: Indicate overall resistance to ground [and resistance of each electrode].

Manufacturer's Instructions: Include instructions for preparation, installation and examination of exothermic connectors.

### PROJECT RECORD DOCUMENTS
Accurately record actual locations of grounding electrodes.

### REGULATORY REQUIREMENTS
Conform to requirements of NFPA 70.

Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

## PART 2 - PRODUCTS

### ROD ELECTRODE
Material: Copper-clad steel.

Diameter: 3/4 inch (19 mm) minimum.

Length: 10 feet (3.5 m) minimum. Rod shall be driven at least 9' 6" deep.

**MECHANICAL CONNECTORS**
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.

Split bolt connector types are NOT allowed.

The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.

**COMPRESSION CONNECTORS**
The compression connectors shall be manufactured from pure wrought copper. The conductivity of this material shall be no less than 99% by IACS standards.

The connectors shall meet or exceed the performance requirements of IEEE 837, latest revision.

The installation of the connectors shall be made with a compression, tool and die system, as recommended by the manufacturer of the connectors.

The connectors shall be clearly marked with the manufacturer, catalog number, conductor size and the required compression tool settings.

Each connector shall be factory filled with an oxide-inhibiting compound.

**EXOTHERMIC CONNECTIONS**
As manufactured by Cadweld or similar.

**WIRE**
Material: Stranded copper (aluminum not permitted).

Grounding Electrode Conductor: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger.

Foundation Electrodes: As shown on drawings.

Manhole, Main Switchgear room and Vault Bonding: No. 4/0 minimum.

Feeder and Branch Circuit Equipment Ground: Size as required by NFPA 70. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

**BUS**
Material: Copper (aluminum not permitted).

Size: 1/4" X 2" minimum.

## PART 3 - EXECUTION

**EXAMINATION**
Verify that final backfill and compaction has been completed before driving rod electrodes.

**GENERAL**
Install Products in accordance with manufacturer's instructions.

Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.

Ground connection surfaces shall be cleaned and all connections shall be made so that it is impossible to move them.

Attach grounds permanently before permanent building service is energized.

All grounding electrode conductors shall be installed in PVC conduit or rigid galvanized steel conduit bonded at both ends to the grounding electrode conductor with an approved grounding fitting.

**LESS THAN 600 VOLT SYSTEM GROUNDING**

Provide code sized copper grounding electrode conductor from secondary switchboard ground bus, each separately derived system neutral, secondary service system neutral to street side of water meter, building steel, ground rod, and any concrete encased electrodes. Provide bonding jumper around water meter.

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.

Install ground grid under access floors where indicated. Construct grid of #4 AWG bare copper wire installed on 72 inch centers both ways. Bond each access floor support pedestal to grid.

Bond together each metallic raceway, pipe, duct and other metal object entering space under access floors. Bond to underfloor ground grid. Use #4 AWG bare copper conductor.

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.

Provide communications system grounding conductor at point of service entrance and connect to building common grounding electrode system.

Telecommunications and Audio Visual systems shall be installed with an isolated grounding system which has only one ground point. That ground point is to be the common grounding electrode system at the electrical service entrance for the building. Contractor is to provide an isolated grounding conductor from the electrical service entrance of the building to each Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room. Use a minimum No. 2/0 AWG copper conductor, or as indicated on the plans, for the telecommunications service grounding conductor. Leave 10 feet slack grounding conductor at each Telecommunications Room. The grounding conductor MUST NOT be attached to building steel (except as allowed at the main electrical service entrance).

Telecommunications Equipment Rack Grounding: Use a #6 or larger AWG copper conductor from all telecommunications cabinets and racks to the Telecommunications Grounding Bus Bar (TGBB) in each Telecommunication Room.

**FIELD QUALITY CONTROL**

Inspect grounding and bonding system conductors and connections for tightness and proper installation.

END OF SECTION

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# SECTION 26 05 29
# HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

**SCOPE**
The work under this section includes conduit and equipment supports, straps, clamps, steel channel, etc., and fastening hardware for supporting electrical work. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Quality Assurance

PART 2 - PRODUCTS
- Material

PART 3 - EXECUTION
- Installation

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.
Section 26 05 53 – Identification for Electrical Systems

**SUBMITTALS**
Product Data: Provide data for support channel.

**QUALITY ASSURANCE**
Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

## PART 2 - PRODUCTS

**MATERIAL**
Support Channel: Steel, Galvanized, Enameled or other corrosion resistant.

Hardware: Corrosion resistant.

Minimum sized threaded rod for supports shall be 3/8” for trapezes and single conduits 1-1/4” and larger, and ¼” for single conduits 1” and smaller.

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.

## PART 3 - EXECUTION

**INSTALLATION**
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).

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.

Nylon anchor applications:

Nylon anchors shall be designed for the construction material in which they are intended to be installed, and shall be designed for the weight in which the anchors are intended to support.

Nylon wall plug applications may include attaching 4” square boxes or conduit straps to plaster-covered clay tile, drywall, or hollow concrete block. Screws used with nylon wall plugs shall be #10 minimum and shall be longer than the anchor.

Nylon one-piece self-drilling anchor applications may include attaching 4” square boxes or conduit straps to hollow gypsum wallboard for light duty loads. Use No. 8 screws with one-piece self-drilling anchors designed for 3/8” to 1” thick wallboard. Use No. 6 screws with anchors designed for 3/8” to 5/8” wallboard.

**Powder-actuated fasteners are not permitted. Compressed-air power-actuated fasteners may ONLY be used for the installation of separate ceiling wires required for support of conduits and aircraft cable hung light fixtures.**

File and de-bur cut ends of support channel and spray paint with cold galvanized paint to prevent rusting.

Do not fasten supports to piping, ductwork, mechanical equipment, cable tray or conduit. Do not fasten to suspended ceiling grid system.

Support wires that are installed in addition to the ceiling grid support wires to provide secure support for raceways, cables assemblies, boxes, cabinets, and fittings shall be secured at both ends (e.g. the ceiling structure at the top and the ceiling grid at the bottom) per NEC 300.11(A).

Support wires shall be identified per specification section 26 05 53.

Do not drill structural steel members unless approved by The Owner.

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.

In wet locations, mechanical rooms, and electrical rooms, install free-standing electrical equipment on 3.5-inch (89 mm) concrete pads.

Install surface-mounted cabinets and panelboards with a minimum of four anchors. At all cabinet and panelboard locations on concrete or concrete block walls, and at ALL locations below grade, 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). In above-grade equipment rooms that have drywall walls, the cabinets and panelboards may be mounted to the drywall if backing is provided in the stud walls behind the equipment.

Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

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 05 33**
**RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

## PART 1 - GENERAL

### SCOPE
This section describes the products and execution requirements relating to furnishing and installing raceways and boxes and related systems as part of a raceway system for electrical, communications, and other low-voltage systems for the project. Included are the following topics:



### RELATED WORK
Applicable provisions of Division 1 govern work under this section.

Section 26 05 26 – Grounding and Bonding for Electrical Systems
Section 26 05 29 – Hangers and Supports for Electrical Systems.
Section 26 27 02 – Equipment Wiring Systems.
Section 26 27 26 – Wiring Devices.
Section 28 31 00 – Fire Detection and Alarm.

### REFERENCES

Wisconsin Administrative Code SPS 316 - Electrical

**SUBMITTALS**
Surface Raceway System - submit product data and catalog sheets for all components.

Boxes - provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

Conduits in Concrete Slabs Above Grade - provide proposed conduit routing and sizing to Structural Engineer prior to approval of installation to verify structural integrity and fire rating of concrete slab.

## PART 2 - PRODUCTS

**GENERAL**
All steel fittings and conduit bodies shall be galvanized.

No cast metal or split-gland type fittings permitted.

Mogul-type condulets larger than 2 inch (50 mm) not permitted except as approved or detailed.

All condulet covers must be fastened to the condulet body with screws and be of the same manufacture.

C-condulets shall not be used in lieu of pull boxes.

All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

**RIGID METAL CONDUIT (RMC) AND FITTINGS**
Conduit: Heavy wall threaded, galvanized steel, schedule 40.

Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely on external bonding jumpers to maintain grounding continuity between raceway components.

**PVC COATED RIGID METAL CONDUIT**
PVC Externally Coated Conduit: Rigid heavy wall, schedule 40, steel conduit with external 40 mil (0.1 mm) PVC coating. Conduit must be hot dipped galvanized inside and out including threads. The PVC coating bond to the galvanized steel conduit shall be stronger than the tensile strength of the coating itself.

Fittings and Conduit Bodies: Threaded type, material to match conduit. PVC coated fittings and couplings shall have specially formed sleeves to tightly seal to conduit PVC coating. The sleeves shall extend beyond the fitting or coupling a distance equal to the pipe outside steel diameter or two inches (50 mm) whichever is greater.

**INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS**
Conduit: Galvanized steel, threaded.

Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

Expansion Fittings/Expansion Joints: Expansion Fittings shall be Internal Grounding type and shall not rely on external bonding jumpers to maintain grounding continuity between raceway components.

**ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS**
Conduit: Steel, galvanized tubing.

Fittings: All steel, set screw type. No push-on or indenter types permitted.
Conduit Bodies: All steel threaded conduit bodies.

**FLEXIBLE METAL CONDUIT (FMC) AND FITTINGS**
Conduit: steel, galvanized, spiral strip.

Fittings and Conduit Bodies: All steel, galvanized, or malleable iron (except as allowed in specification 26 51 13).

**LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC) AND FITTINGS**
Conduit: flexible, steel, galvanized, spiral strip with an outer Liquidtight, nonmetallic, sunlight-resistant jacket.

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.

**ELECTRICAL NONMETALLIC TUBING (ENT) AND FITTINGS**
Conduit: ENT (smurf tube), UL listed and NEC recognized.

Fittings: One piece quick connect fittings for 1/2 inch to 1 inch size and schedule 40 cemented fittings for larger size. When installed in concrete, fittings shall be suitable for damp locations and shall be concrete–tight, stub-ups and stub-downs kits shall meet manufacturer's recommendations.

**RIGID POLYVINYL CHLORIDE CONDUIT (PVC) AND FITTINGS**
Conduit: Rigid non-metallic conduit, Schedule 40 PVC minimum, Listed, sunlight resistant, rated for $90^0$ C conductors. Schedule 80 for locations exposed to physical damage or as required.

Fittings and Conduit Bodies: NEMA TC 2, Listed.

**FIBERGLASS RESIN CONDUIT (RTRC) AND FITTINGS:**
Conduit: Reinforced Thermosetting Resin Conduit RTRC, Type AG (Above Ground) and XW (Exposed), and UL 2515 AG (Above Ground) or UL 2420 BG (Below Ground) listed.

Fittings, Factory Elbows and Conduit Bodies: Match Conduit.

**HIGH DENSITY POLYETHYLENE CONDUIT (HDPE) AND FITTINGS**
Conduit: Continuous length smooth-wall HDPE conduit for electrical applications produced to ASTM F2160. Conduit shall be listed by a Nationally Recognized Testing Laboratory to UL Standard 651-A for smooth-wall duct to be used as electrical conduit for the installation of Listed electrical cables underground.

The recommended HDPE color is black or black with red stripes. Red identifies the conduit as electrical and black provides UV protection for storage and at points where the conduit may exit the ground.

Fittings: Threaded Mechanical Fittings: Aluminum reverse-threaded conduit couplers designed for use with HDPE conduit. Compression Fittings and Socket Couplings designed for use with HDPE conduit may also be used.

**CONDUIT SUPPORTS**
See section 26 05 29.

**CONDUIT WATER SEALANT**
Description: Conduit sealant used to prevent water from entering buildings via conduits.

Sealant shall seal conduits against water and gas intrusion, such as Polywater® FST™-250 Foam Duct Sealant, Raychem RDSS Rayflate Duct Sealing System, or approved alternate. Sealant shall be re-enterable, shall be compatible with the conduit and conductor types being used, and shall comply with NEC 225.27, 230.8, and 300.5(G).

Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Products manufactured by others may be acceptable provided they meet or exceed the specifications.

**PULL AND JUNCTION BOXES**
Interior Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

Interior 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.

Exterior Boxes and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as rain-tight. PVC box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

Box extensions and adjacent boxes within 48 inches of each other are not allowed for the purpose of creating more wire capacity.

Junction boxes 6 inch-by-6 inch or larger size shall be without stamped knock-outs.

Wireways shall not be used in lieu of junction boxes.

**OUTLET BOXES**
Sheet Metal Outlet Boxes: galvanized steel, with stamped knockouts.

Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

Concrete Ceiling Boxes: Concrete type.

Cast Boxes: Cast ferroalloy or aluminum, deep type, gasketed cover, threaded hubs.

**BOXES FOR AUDIO-VIDEO EQUIPMENT**
Provide floor, wall, and/or ceiling boxes for Audio-Video (AV) Equipment as indicated on the Electrical and/or Audio-Video drawings.

FLAT SCREEN MONITOR BOXES
Provide a recessed wall box for mounting behind flat screen monitors, allowing the screens to sit flush against the wall. These boxes shall provide a neat and secure environment for the audio, video, control and power connections.

The recessed wall box shall install easily between any two standard studs in the wall. Connections and cable entry can be on the top or the bottom depending on installation preference.

The recessed wall box shall be provided with one low-voltage conduit entry box and Nationally Recognized Testing Laboratory (NRTL) listed single gang box for AC power.

The recessed wall box cover shall be provided in white or black and shall be suitable for painting. The cover shall have a cable exit slot for the display connections and the excess cable can easily be hidden inside of the box making the entire installation as clean as possible. The cover screws onto the front of the box once all connections are in place.

The recessed wall box shall be designed for new or existing construction. Brackets shall be included for mounting to studs in new construction as well as surface mount clips for mounting to sheet rock or plywood in existing construction.

**BOXES FOR FIRE ALARM AUDIO-VISUAL NOTIFICATION APPLIANCES**
Recessed boxes for Fire Alarm audio, visual, and audio-visual notification appliances shall be galvanized steel sheet metal with stamped knockouts. Boxes shall be 4 inches square (100 mm) by 2 1/8 inches (54 mm) deep, and shall be painted red.

For surface mounting, use manufacturer supplied back boxes and trim plates, painted red or off white, and shall contain no visible conduit knock-outs. Mark each device with its circuit number.

## PART 3 - EXECUTION

**CONDUIT SIZING, ARRANGEMENT, AND SUPPORT**
EMT is permitted to be used in sizes 4 inch (100 mm) and smaller for power and low-voltage systems. See CONDUIT INSTALLATION SCHEDULE below for other limitations for EMT and other types of conduit.

Size power conductor raceways for conductor type installed. Conduit size shall be 1/2 inch (16 mm) minimum except **all homerun conduits shall be 3/4 inch (21 mm),** or as specified elsewhere. **Caution: Per the NEC, the allowable conductor ampacity is reduced when more than three current-carrying conductors are installed in a raceway. Contractor must take the NEC ampacity adjustment factors into account when sizing the raceway and wiring system.**

Size communications and other low-voltage systems raceways as follows:

Communications, including Outlet Box: 1-1/4 inch minimum. Conduit used for single device locations (e.g. Wireless Access Point, Video Surveillance Camera, and Wall mounted telephone) may be 3/4 inch minimum.

Control, security, signal, video, and other low-voltage applications: 3/4 inch minimum.

Fire Alarm: 1/2 inch minimum.

Floor Box and Poke-Through Assemblies:
Power: 3/4 inch minimum or as indicated on drawings.
Low-voltage: 1 inch minimum or as indicated on drawings.

Provide one raceway from each communications outlet box to above accessible ceiling.

Arrange conduit to maintain 6'-8" clear headroom and present a neat appearance.

Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

Maintain minimum 6 inch (150 mm) clearance between conduit and piping. Maintain 12 inch (300 mm) clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized pipe straps, conduit racks (lay-in adjustable hangers), clevis hangers, or bolted split stamped galvanized hangers.

Group conduit in parallel runs where practical and use conduit rack (lay-in adjustable hangers) constructed of steel channel with conduit straps or clamps. Provide space for 25 percent additional conduit.

Do not fasten conduit with wire or perforated pipe straps. Before conductors are pulled, remove all wire used for temporary conduit support during construction.

Support and fasten metal conduit at a maximum of 8 feet (2.4 m) on center.

Supports shall be independent of the installations of other trades, e.g. ceiling support wires, HVAC pipes, other conduits, etc., unless so approved or detailed.

Conceal all conduits except where noted on the drawings or approved by the Architect/Engineer. Contractor shall verify with Architect/Engineer all surface conduit installations except in mechanical rooms.

Changes in direction shall be made with symmetrical bends, cast steel boxes, stamped metal boxes or cast steel conduit bodies.

For indoor conduits, no continuous conduit run shall exceed 100 feet (30 meters) without a junction box.

All conduits installed in exposed areas shall be installed with a box offset before entering box.

**CONDUIT INSTALLATION**
Cut conduit square; de-burr cut ends.

Conduit shall not be fastened to the corrugated metal roof deck.

Bring conduit to the shoulder of fittings and couplings and fasten securely.

Use conduit hubs for fastening conduit to cast boxes. Use sealing locknuts or conduit hubs for fastening conduit to sheet metal boxes in damp or wet locations.

Terminate all conduit (except for terminations into conduit bodies) using conduit hubs, or connectors with one locknut, or utilize double locknuts (one each side of box wall).

Provide bushings for the ends of all conduit not terminated in box walls. Refer to Section 26 05 26 – Grounding and Bonding for Electrical Systems for grounding bushing requirements.

Provide insulated bushings where raceways contain 4 AWG or larger conductors.

Install no more than the equivalent of:

Three 90 degree bends between boxes for electrical systems.
Two 90 degree bends between boxes for communications and other low voltage systems.
No single bend may exceed 90 degrees.

Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2 inch (50 mm) size unless sweep elbows are required.

Bend conduit according to manufacturer's recommendations. Torches or open flame shall not be used to aid in bending of PVC conduit.

Use suitable conduit caps or other approved seals to protect installed conduit against entrance of dirt and moisture.

Provide 1/8 inch (3 mm) nylon pull string in empty conduit, except sleeves and nipples.

Install expansion-deflection joints where conduit crosses building expansion joints. Note: expansion-deflection joints are not required where conduit crosses building control joints if the control joint does not act as an expansion joint.

**Install expansion joints where direct-buried conduit is subject to Earth Movement by settlement or frost per NEC 300.5(J), especially where conduit exits the ground exposed and enters a box, cabinet, or enclosure attached to a building or structure.**

Install expansion fitting in exterior PVC conduit runs per NEC table 352.44 utilizing a minimum temperature change of 120 degree F.

Avoid moisture traps where possible. Where moisture traps are unavoidable, provide junction boxes with drain fittings at conduit low points.

Where conduit passes between areas of differing temperatures such as into or out of cool rooms, freezers, unheated and heated spaces, buildings, etc., provide condulet or box with duct seal or other means to prevent the passage of moisture and water vapor through the conduit.

Route conduit through roof openings for piping and ductwork where possible.

Where communication cabling is to be installed in conduit to the wiring hub (e.g. Telecom Room), multiple conduits may be consolidated into fewer, larger conduits. Capacity of shared conduits shall equal the capacity of the individual conduits unless otherwise noted.

Use NRTL listed metallic grounding clamps when terminating conduit to cable tray.

Ground and bond conduit under provisions of Section 26 05 26.

Conduit is not permitted in any slab topping of two inches (50 mm) or less.

Conduits in Concrete Slab Above Grade: Provide proposed conduit routing and sizing to Structural Engineer for approval prior to installation to verify structural integrity and fire rating of concrete slab.

Maximum Size Conduit in Concrete Slabs Above Grade: 1 inch (25 mm). Do not route conduits to cross each other in slabs above grade. Minimum conduit spacing shall be 6 inches on center.

PVC conduit in concrete pole bases shall transition to galvanized rigid metal conduit 12 inches before it enters a concrete pole base. Inside the pole base, the elbow shall be galvanized rigid metal conduit. From the elbow, the conduit shall transition back to PVC as it continues up and out the top of the concrete pole base.

PVC conduit shall transition to galvanized rigid metal conduit before it enters a foundation wall or up through a concrete floor.

Identify conduit under provisions of Section 26 05 53.

All conduit installed underground (exterior to building) shall be buried a minimum of 24 inches below finished grade, whether or not the conduit is concrete encased. Install warning tape 12" below finish grade over all buried conduits. Underground warning tape shall be detectable, 2” wide minimum, 5 mil thickness, containing a foil core. Tape color shall be red and labeled with the words "CAUTION-BURIED ELECTRIC LINE BELOW" as manufactured by Presco or similar.

**Conduits penetrating underground foundation walls: Individual conduits or each conduit as part of a ductbank penetrating underground foundation walls (excluding manholes) shall be sealed against water intrusion into the building.**

Clean PVC conduit with solvent, and dry before application of glue. The temperature rating of glue/cement shall match weather conditions. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturer’s recommendations.

**CONDUIT INSTALLATION SCHEDULE**

Conduit other than that specified below for specific applications shall not be used.

- Horizontal Directional Drilling (Directional Boring) Installations: HDPE conduit.
- Underground Installations That Penetrate Foundation Walls: Rigid metal conduit within five feet (1.5 m) of the foundation wall. Conduit may transition to Fiberglass Resin Conduit (BG) or PVC conduit five feet (1.5 m) from the foundation walls.
- Underground Installations That Do Not Penetrate Foundation Walls: Rigid metal conduit, Fiberglass Resin Conduit (BG), or PVC conduit.
- Underground Installations Emerging from Grade: Buried conduit emerging from grade shall be Rigid metal conduit extending from the minimum cover distance of 24 inches below grade to the conduit termination point above grade.
- Underground Installations Under Concrete Slab: Rigid metal conduit or Schedule 40 PVC conduit.
- Underground Installations Emerging through Concrete Slab: Rigid metal conduit.
- Concealed in Poured Concrete Walls: Rigid Metal Conduit, PVC conduit, or Electrical Nonmetallic Tubing (ENT).
- Concealed in Concrete Block Walls: Electrical metallic tubing, PVC conduit. Electrical Nonmetallic Tubing (ENT).
- Within Concrete Slab: Rigid Metal conduit or PVC conduit.
- Emerging from Within Concrete Slab: Rigid metal conduit.
- Exposed Outdoor Locations: Rigid metal conduit, IMC.
- Wet Interior Locations: Exposed:Schedule 80 PVC conduit.
- Concealed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical metallic tubing, and PVC conduit (Ground conductor).
- Interior Building Grounding Electrode Conductor: Schedule 80 PVC.
- Exposed Dry Interior Locations: Rigid metal conduit, Intermediate metal conduit, Electrical metallic tubing.
- Motor and equipment connections: Liquidtight flexible metal conduit (LFMC) (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.
- Light fixtures: Refer to specification section 26 51 13.

**PVC COATED RIGID METAL CONDUIT INSTALLATION**
Installers of PVC Coated Rigid Metal Conduit shall be factory trained and certified in the proper installation methods for this type of conduit. Proof of such certification shall be kept on the project site at all times and shall be produced upon request.

**HIGH DENSITY POLYETHYLENE CONDUIT (HDPE) INSTALLATION**
HDPE conduit may only be used in horizontal directional drilling applications. Installation must be in accordance with NFPA 70National Electrical Code and be direct buried or encased in concrete.

Approved joining methods for HDPE include Threaded Mechanical Fittings, Compression Fittings, and/or Heat Fusion. Heat Fusion joints shall be made using “hot irons” designed specifically for joining HDPE conduit. Any joining method employed shall be manufacturer approved. Glue and/or solvents are NOT approved.

**SURFACE METAL RACEWAY AND MULTI-OUTLET ASSEMBLY INSTALLATION**
Use flat-head screws to fasten channel to surfaces every twenty-four (24) inches. Mount plumb and level.

Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

Fastener Option: Use clips and straps suitable for the purpose.

**NONMETALLIC SURFACE RACEWAY INSTALLATION**
Use flat headed screws with appropriate anchors to fasten channel to surfaces secured every twenty-four (24) inches. Mount plumb and level. All surface mounted devices shall be fastened to the wall utilizing flat head screws along with appropriate anchors. No device shall be adhered to the wall surface using two-faced tape or any means other than as described above.

Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

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.

Non-metallic raceway shall have a screw applied base. Both the base and cover shall be manufactured of rigid PVC materials.

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.

All fittings including, but not limited to, extension boxes, elbows, tees, fixture bodies shall match the color of the raceway.

The raceway and all systems devices shall be UL listed and exhibit nonflammable self-extinguishing characteristics, tested to specifications of UL94V-0.

The communications and other low voltage systems raceway and devices shall adhere to the EIA/TIA Category 6 bend radius standard.

**AUXILIARY GUTTERS (WIREWAYS) INSTALLATION**
Bolt auxiliary gutter to wall using two-piece hangers or steel channels fastened to the wall or in self-supporting structure.

Gasket each joint in oil-tight gutter.

Mount rain-tight gutter in horizontal position only.

Maintain grounding continuity between raceway components to provide a continuous grounding path under provisions of Section 26 05 26.

**COORDINATION OF BOX LOCATIONS**

Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

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.

No outlet, junction, or pull boxes shall be located where it will be obstructed by other equipment, piping, lockers, benches, counters, etc.

Conduit and boxes shall not be fastened to the metal roof deck. If conduit and boxes are required to be located and installed on roof decks, the conduit and boxes are required to be spaced minimum 1-5/8 inch off the lowest part of the metal roof decking material, per NEC 300.4 (E).

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.

In case of any question or argument 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.

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.

Locate and install boxes to allow access to them. Where installation is inaccessible, coordinate locations and provide 18 inch (450 mm) by 24 inch (600 mm) access doors. Boxes must be installed within 12” from edge of the access door.

Locate and install to maintain headroom and to present a neat appearance.

Install boxes to preserve fire resistance rating of partitions and other elements, using approved materials and methods.

**PULL AND JUNCTION BOX INSTALLATION**

Pull boxes and junction boxes shall be minimum 4 inches square (100 mm) by 2 1/8 inches (54 mm) deep for use with 1 inch (25 mm) conduit and smaller. On conduit systems using 1 1/4 inch (31.75 mm) conduit, minimum junction box size shall be 4 11/16 inches square by 2 1/8 inches deep.

Where used with raceway(s) containing conductors of 4 AWG or larger, pull box shall be sized as required unless otherwise noted on the drawings.

Where used with raceway(s) containing conductors on systems over 600V, pull box shall be sized per NEC 314 Part IV unless otherwise noted as larger on the drawings.

Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install DANE COUNTY approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

Provide Pull and Junction boxes for communications and other low voltage applications (a) in any section of conduit longer than 100 feet, (b) where there are bends totaling more than 180 degrees between pull points or pull boxes and (c) wherever there is a reverse bend in run. Locate boxes on straight section of raceway (e.g. do not use boxes in place of raceway bends).

Support pull and junction boxes independent of conduit.

**IN GRADE HANDHOLES AND BOXES**

Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

Unless otherwise indicated and detailed, support units on a level bed of crushed stone or gravel, graded from 1/2 inch (12.5 mm) sieve to No. 4 (4.25 mm) sieve and compacted to same density as adjacent undisturbed earth.

Elevation: In finished areas, set so cover surface will be flush with finished grade.

Unless approved by DANE COUNTY review staff, handholes and boxes shall **NOT** be installed in paved or concrete drives or walks.

Units shall be selected with depth sufficient to allow for conductor bending/ wire management and allow sufficient conduit elevation above compacted bed to prevent water infiltration in conduit.

Provide conduit sealant to seal conduits against water and gas intrusion, such as Polywater® FST™-250 Foam Duct Sealant, Raychem RDSS Rayflate Duct Sealing System, or approved alternate. Sealant shall be re-enterable, shall be compatible with the conduit and conductor types being used, and shall comply with NEC 225.27, 230.8, and 300.5(G).

**OUTLET BOX INSTALLATION**

Do not install boxes back-to-back in walls. Provide minimum 6 inch (150 mm) separation, except provide minimum 24 inch (600 mm) separation in acoustic-rated walls.

Power:

Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction, or drywall shall be minimum 4 inch square, with device rings. Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes. A single gang box can be used in drywall and masonry, for a single device location, when a single conduit enters box.

Shallow 4 inch square by 1 1/2 inch deep boxes can be used as device boxes for power provided the box and plaster ring is sized for installed device and conductors.

Low Voltage:

Recessed (1/4 inch maximum) outlet boxes in masonry, concrete, tile construction or drywall shall be minimum 4 11/16 inch square by 2 1/8 inch deep with single gang device ring (unless noted otherwise on drawings). Device covers shall be square-cut except rounded corner plaster rings are allowed in drywall applications. Angle cut plaster rings are not permitted. Coordinate masonry cutting to achieve neat openings for boxes.

Provide one conduit from each communications outlet box. Conduit runs between outlet boxes for communications are not allowed. Terminate conduit [above accessible ceiling] [above accessible ceiling in corridor] [on cable tray] [as detailed on drawings].

Provide knockout closures for unused openings.

Support boxes independently of conduit except for cast boxes that are connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.

Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Sectional boxes may only be used with the pre-approval of the State of Wisconsin DANE COUNTY Electrical Inspector for remodeling applications where it is impractical to install multi-gang boxes. Provide non-metallic barriers to separate wiring of different voltage systems.

Install boxes in walls without damaging wall insulation.

Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

Ceiling outlets shall be 4 inch square, minimum 2 1/8 inch (54 mm) deep except that concrete boxes and plates will be approved where applicable. Position outlets to locate luminaires as shown on reflected ceiling plans.

In inaccessible ceiling areas, position outlets and junction boxes within 6 inches (150 mm) of recessed luminaire, to be accessible through luminaire ceiling opening.

Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

Provide cast ferroalloy or aluminum outlet boxes in exterior and wet locations.

Surface wall outlets shall be 4 inch (100 mm) square with raised covers for one and two gang requirements. For three gang or larger requirements, use gang boxes with non-overlapping covers.

END OF SECTION

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# SECTION 26 05 53
# IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 - GENERAL

### SCOPE
The work under this section includes the products and execution requirements relating to labeling of power, lighting, general wiring, signal, fire alarm, and telecommunications wire and cabling. Further, this section includes labeling of all terminations and related sub-systems, including but not limited to nameplates, stenciling, wire and cable marker labeling of all backbone fiber optic (inter-building, tie & riser) cables, terminating equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
- Materials

PART 3 - EXECUTION
- General
- Junction and Pullbox Identification
- Communication System Identification and Labeling
- Communication Conduit Labeling
- Power and Control Wire Identification
- Nameplate Engraving
- Panelboard Directories

### RELATED WORK
Applicable provisions of Division 1 shall govern work under this section.

Section 26 05 13 – Medium-Voltage Cables
Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
Section 26 05 23 – Control-Voltage Electrical Power Cables
Section 28 05 53 – Identification for Electronic Safety and Security
Section 27 00 00 – Communications Cable and Equipment

### SUBMITTALS
Include schedule for nameplates and stenciling.

Prior to installation, the Contractor shall provide samples of all label types planned for the project. These samples shall include examples of the lettering to be used. Samples shall be mounted on 8 1/2" x 11" sheets annotated, explaining their purposed use.

## PART 2 - PRODUCTS

### MATERIALS
Labels: All labels shall be permanent, and machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS ARE ALLOWED.

Label size shall be appropriate for the conductor or cable size(s), outlet faceplate layout and patch panel design. All labels shall be self-laminating, white/transparent vinyl and be wrapped around the cable or sheath. Flag type labels are not allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

Nameplates: Engraved three-layer laminated plastic, black letters on a white background. Emergency system shall use white letters on red background.

Tape (phase identification only): Scotch #35 tape in appropriate colors for system voltage and phase.

Adhesive type labels not permitted except for phase and wire identification.

## PART 3 - EXECUTION

### GENERAL

Where mixed voltages are used in one building (e.g. 4160 volt, 480 volt, 208 volt) each switch, switchboard, junction box, equipment, etc., on each system must be labeled for voltage in addition to other requirements listed herein.

All branch circuit and power panels must be identified with the same symbol used in circuit directory in main distribution center.

Clean all surfaces before attaching labels with the label manufacturer's recommended cleaning agent.

Install all labels firmly as recommended by the label manufacturer.

Labels shall be installed plumb and neatly on all equipment.

Install nameplates parallel to equipment lines.

Secure nameplates to equipment fronts using screws, or rivets. Secure nameplate to inside of recessed panelboards in finished locations.

Embossed tape will not be permitted for any application.

**JUNCTION AND PULLBOX IDENTIFICATION**

The following junction and pullboxes shall be identified utilizing spray painted covers:

| System | Color(s) |
|---|---|
| Secondary Power – 480Y/277V | Brown |
| Secondary Power – 208Y/120V, 240/120V | White |
| Emergency Power – 480Y/277V | Brown/Red |
| Emergency Power – 208Y/120V | White/Red |
| Fire Alarm | Red |
| Temperature Control | Green |
| Door Control and Door Monitoring System | Orange |
| Sound and Intercom Systems | Blue |
| Video Surveillance System/MATV | Yellow |

**COMMUNICATIONS SYSTEM IDENTIFICATION AND LABELING**

All new outlet faceplates shall incorporate recessed label holders and shall be fitted with clear plastic covers. Where no such label holders are present on existing to remain outlets, the faceplate labels shall be protected with a clear over-laminate.

Labels shall be [White] background with [Black] lettering. Lettering size shall be as large as practicable (up to 16-point) to fit properly on the outlet label. No lettering shall be smaller than 12-point.

Copper Data and Fiber Optic Patch Panels shall be labeled identifying Outlet ID. Modular Jacks and/or Fiber Couplers shall be positioned in sequence of Outlet ID. Fiber Panels shall also be labeled with the fiber number. Fibers shall be sequenced in order per the manufacturer's color code.

**COMMUNICATION CONDUIT LABELING**

All conduits installed between Telecommunication Rooms shall be clearly labeled in accordance with ANSI/TIA/EIA-606. Both ends of the conduits shall be labeled. All labels shall be mechanical, no hand written labels. The label shall indicate the location of the far end of the conduit run and a unique conduit number. (i.e. TR-1A-01 or Room #216 – 01).

**POWER AND CONTROL WIRE IDENTIFICATION**

Provide wire markers on each conductor in panelboard gutters, pull boxes, outlet and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on schematic and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

All wiring shall be labeled within 2 to 4 inches of terminations. Each end of a wire or cable shall be labeled as soon as it is terminated including wiring used for temporary purposes.

**NAMEPLATE ENGRAVING**

Provide nameplates of minimum letter height as scheduled below.

Panelboards, Switchboards and Motor Control Centers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify voltage rating, source and room location of the source.

Equipment Enclosures: 1 inch (25 mm); identify equipment designation.

Circuit Breakers, Switches, and Motor Starters in Panelboards or Switchboards or Motor Control Centers: 1/2 inch (13 mm); identify circuit and load served, including location.

Individual Circuit Breakers, Disconnect Switches, Enclosed Switches, and Motor Starters: ½ inch (13 mm); identify source and load served.

Transformers: 1 inch (25 mm); identify equipment designation. 1/2 inch (13 mm); identify primary and secondary voltages, primary source, and secondary load and location.

Junction boxes: 1 inch (25 mm); identify system source(s) and load(s) served. Junction boxes may be neatly identified using a permanent marker.

**PANELBOARD DIRECTORIES**

Typed directories for panels must be covered with clear plastic, have a metal frame. Room number on directories shall be Owner's numbers, not Plan numbers unless Owner so specifies.

END OF SECTION

# SECTION 26 05 73
# SHORT CIRCUIT/COORDINATION STUDY

## PART 1 - GENERAL

### SCOPE

The electrical contractor shall retain the services of an independent third party firm, or the equipment manufacturer's technical services group, to perform a short circuit/coordination study.

The studies shall include all portions of the electrical distribution system from the normal power source or sources, and emergency/standby sources, down to and including the smallest circuit breaker in the distribution system (for short circuit calculations). Normal system connections and those which result in maximum fault conditions shall be adequately covered in the study.

The firm should be currently involved in medium- and low-voltage power system evaluation. The study shall be performed, stamped and signed by a registered professional engineer in the State of Wisconsin. Credentials of the individual(s) performing the study and background of the firm shall be submitted to the A/E for approval prior to start of the work. A minimum of five (5) years experience in power system analysis is required for the individual in charge of the project.

The firm performing the study should demonstrate capability and experience to provide assistance during start up as required.

The study and assessment shall be performed on SKM Dapper, Captor and PowerTool software or EasyPower product suite software.

Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Data Collection for the Study
- Submittals

PART 2 - PRODUCTS
- Not Used

PART 3 – EXECUTION
- Short Circuit and Coordination Study
- Field Settings

### RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Section 26 14 13 - Switchboards
Section 26 24 16 – Panelboards

### REFERENCE STANDARDS

Standards listed in the IEEE "Buff Book", latest edition
National Fire Protection Association (NFPA) 70E, latest addition
IEEE 1584 – Guide for Performing Arc Flash Calculations

### DATA COLLECTION FOR THE STUDY

The contractor shall provide the required data for preparation of the studies. The engineer performing the system studies shall furnish the contractor with a listing of the required data immediately after award of the contract.

The contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.

**SUBMITTALS**

PRELIMINARY REPORT

Submit a draft of the studies to the A/E for review prior to delivery of the final study to the Owner. Make all additions or changes as required by the reviewer.

For building construction projects, submit a draft of the studies to the A/E for review prior to A/E approval of project electrical switchgear, panelboard and generator shop drawings.

FINAL STUDY REPORT

Provide studies in conjunction with equipment submittals to verify equipment ratings required.

The results of the power system studies shall be summarized in a final report and provided in the following formats. Provide (2) bound hard copies of the final report. Provide (2) electronic copies (on CD) of the final report and one-line diagrams in PDF format. Provide (2) electronic copies (on CD) of the final report in MS Word format and the one-line diagrams in CAD format.

Also provide (2) electronic copies (on CD) of all files generated by the SKM or EasyPower software for all scenarios evaluated in the studies. The files shall permit the studies to be opened, reviewed or updated by any user of the analysis software used for the studies.

The report shall typically include the following sections:

I. Overview
II. Short Circuit Study
    - SC-1 Purpose
    - SC-2 Explanation of Data
    - SC-3 Assumptions
    - SC-4 Analysis of Results
    - SC-5 Recommendations
    - SC-6 Fault Analysis Input Report from Software Program
    - SC-7 Fault Contribution Report
III. Protective Device Coordination Study
    - PDC-1 Purpose
    - PDC-2 Explanation of Data
    - PDC-3 Assumptions
    - PDC-4 Analysis of Results
    - PDC-5 Recommendations (Including NEC 700-27 Requirement)
    - PDC-6 Results from Software Program
    - PDC-7 Example Drawings
IV. Appendices
    - APP-1 One-line Diagrams from Software Program
    - APP-2 AutoCAD One-line Diagrams
    - APP-3 Protective Device Summaries from Software Program
    - APP-4 Reference Data
    - APP-5 Sample Work Permit Form
    - APP-6 Copy of Warning Labels, including study date

The above sections shall include the following items in detail:

- Obtain available fault current from the local utility company.

- Short circuit studies shall evaluate the available fault current at each bus (each change of impedance), including all three-phase motors.

- Coordination study recommendations for relay settings, breaker settings, and motor protection settings.

- Recommendations for improving the coordination and/or load distribution, as well as ground fault requirements.

- IEEE standard one-line diagram with equipment evaluation and circuit breaker settings that clearly define the system data and are easy to interpret. The diagrams should include the bus names and references used in the studies.

- The contractor shall provide a one-line diagram that meets IEEE/ANSI standard 141, mounted on 24" x 36" (minimum) Styrofoam backboard. This one-line diagram shall be mounted in each electrical room.

## PART 2 - PRODUCTS

Not used.

## PART 3 - EXECUTION

### SHORT CIRCUIT AND COORDINATION STUDY

The short circuit, coordination studies shall be performed using SKM Dapper, Captor and PowerTool for Windows software or EasyPower product suite Windows based software packages. In the short circuit study, provide calculation methods and assumptions, the base per unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and recommendations. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed 3-phase bolted fault at each supply switchgear lineup, unit substation primary and secondary terminals, low voltage switchgear lineup, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboard, and other significant locations throughout the system. Provide a ground fault current study for the same system areas, including the associated zero sequence impedance data. Include in tabulations fault impedance, X to R ratios, asymmetry factors, motor contribution, short circuit KVA, and symmetrical and asymmetrical fault currents.

In the protective device coordination study, provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Include a detailed description of each protective device identifying its type, function, manufacturer, and time-current characteristics. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.

Include on the curve sheets power company relay and fuse characteristics, system medium-voltage equipment relay and fuse characteristics, low-voltage equipment circuit breaker trip device characteristics, pertinent transformer characteristics, pertinent transformer characteristics, pertinent motor and generator characteristics, and characteristics of other system load protective devices. Include at least all devices down to largest branch circuit and largest feeder circuit breaker in each motor control center, and main breaker in branch panelboards.

Include all adjustable settings for ground fault protective devices. Include manufacturing tolerance and damage bands in plotted fuse characteristics. Show transformer full load and 150, 400, or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters, and significant symmetrical and asymmetrical fault currents. Terminate device characteristic curves at a point reflecting the maximum symmetrical or asymmetrical fault current to which the device is exposed.

Select each primary protective device required for a delta-wye connected transformer so that its characteristic or operating band is within the transformer characteristics, including a point equal to 58 percent of the ANSI

withstand point to provide secondary line-to-ground fault protection. Where the primary device characteristic is not within the transformer characteristics, show a transformer damage curve. Separate transformer primary protective device characteristic curves from associated secondary device characteristics by a 16 percent current margin to provide proper coordination and protection in the event of secondary line-to-line faults. Separate medium-voltage relay characteristic curves from curves for other devices by at least a 0.4-second time margin.

Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors, or generators as noted on drawing one-lines.

Utilize equipment load data for the study obtained by the Contractor from contract documents, including contract addendums issued prior to bid openings.

Include fault contribution of all motors in the study. Notify the Engineer in writing of circuit protective devices not property rated for fault conditions.

Provide settings for the chiller motor starters or obtain from the mechanical contractor, include in the study package, and comment.

When an emergency generator is provided, include phase and ground coordination of the generator protective devices, to meet NEC 700.27 requirements. Show the generator decrement curve and damage curve along with the operating characteristic of the protective devices. Obtain the information from the generator manufacturer and include the generator actual impedance value, time constants and current boost data in the study. Do not use typical values for the generator.

Evaluate proper operation of the ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided, and discuss the neutral grounds and ground fault current flows during a neutral to ground fault.

For motor control circuits, show the MCC full-load current plus symmetrical and asymmetrical of the largest motor starting current to ensure protective devices will not trip major or group operation.

**FIELD SETTINGS**

The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit study, protective device coordination study and arc flash risk assessment.

Necessary field settings and adjustments of devices and minor modifications to equipment to accomplish conformance with the approved short circuit and protective device coordination study shall be carried out by the Contractor at no additional cost to the owner.

END OF SECTION

# SECTION 26 09 28
# LIGHTING CONTROL PANELS

## PART 1 - GENERAL

**SCOPE**
The work under this section includes power supplies, relays, control equipment, enclosures, and low-voltage switches associated with low voltage lighting control. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Record Documents
- Operation and Maintenance Data
- Warranty

PART 2 - PRODUCTS
- System Description
- Operator Interface
- Inputs and Outputs
- Diagnostic Aids
- Communication Accessories
- Programming Software
- System Management Software
- Miscellaneous

PART 3 - EXECUTION
- Examination
- Installation
- Factory Commissioning and Programming
- Factory Support
- Construction Verification
- Functional Performance Testing
- Agency Training

**RELATED WORK**
None

**SUBMITTALS**
Submit product data indicating system and component construction, ratings, and operating parameters.

Submit manufacturer's installation instructions.

**RECORD DOCUMENTS**
Provide drawings showing where the lighting control panels are located within the building. Provide schedules indicating switch locations (room numbers) in the building and the associated relay number(s) in the panels. If multiple lighting control panels are networked together, provide a riser diagram showing how the lighting control panels are connected to each other.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**WARRANTY**
Manufacturer shall supply a 3-year warranty on all hardware and software. A limited 10-year warranty shall be provided on all relay cards.

## PART 2 - PRODUCTS

**SYSTEM DESCRIPTION**
The lighting control system shall consist of low voltage relay control panel(s) as indicated on the drawing and schedules.

The lighting control system shall consist of an nLight ARP low voltage relay control panel(s) with 0-10v output channels and up to 24 to 48 control relay outputs per panel.

Each low voltage ARP lighting control panel shall be controlled by low voltage switches for as well as on/off/dimming controls manual control per the IECC. The panel shall feed each circuit with line voltage and low voltage wire that is to be connected to Acuity Reloc fixtures for control.

The system shall include an nLight Eclypse for Programmable intelligence shall include Time-Of-Day control, 32 holiday dates, warn occupants of an impending off, timed inputs, preset control, auto daylight savings, astronomical clock w/offsets, local control, digital switches, and network overrides.

The system shall also include external nLight sensors to be placed in the space to provide proper coverage pattern and will operate based off time-schedule during normal and after hours. The nLight sensors shall connect back to the nLight Eclypse to adhere to time schedule functionality during normal and after hours.

Enclosure
Each control panel shall be enclosed in a lockable NEMA class 1 enclosure. The enclosure shall be manufactured out of 1/16" steel and shall provide pre-punched knockouts for efficient installation. Include space for 10-percent minimum additional relays in each cabinet and enclosure.

Barriers
The control panel enclosure shall be provided with barriers for separating line and low voltage circuits. Barriers shall also be provided for voltage separation or for separation of emergency circuits from normal power circuits. Emergency circuit barriers shall be painted red to denote the emergency circuits.

Switch Plates
Switch Plates shall be thermoplastic. The switch plate color shall match the switches furnished by the Lighting Control Panel manufacturer.

## PART 3 - EXECUTION

### EXAMINATION
Verify panel relay quantities and low-voltage switch quantities.

Verify that surfaces are ready to receive work.

Verify that required utilities are available, in proper location, and ready for use.

Beginning of installation means installer accepts existing conditions.

### INSTALLATION
Install in accordance with manufacturer's instructions.

Network the low-voltage switches together.

Network the lighting control panels together.

Connect the lighting control panel(s) to the facility's data network. Coordinate required IP addresses with facility staff.

### FACTORY COMMISSIONING and PROGRAMMING
Provide factory commissioning for a complete and operational system. Program the system for scheduled time or local switch ON operation of local lighting, with sweep OFF operation at times as directed by the facility staff.

Provide one additional factory commissioning follow-up site visit for making any agency-desired programming changes after one month of operation.

Turn over programming software to user agency staff.

### FACTORY SUPPORT
Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**FUNCTIONAL PERFORMANCE TESTING**

Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 26 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**

Provide two four-hour training sessions to agency staff on two separate days.

END OF SECTION

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# SECTION 26 24 13
# SWITCHBOARDS

## PART 1 - GENERAL

**SCOPE**

The work under this section includes main and/or distribution switchboard(s) specified herein and shown on the Drawings. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- Delivery, Storage, and Handling
- Extra Materials

PART 2 - PRODUCTS
- Switchboard Construction and Ratings
- Pull Box
- Pull Section
- Main Circuit Breaker
- Main Fusible Switch
- Circuit Breaker Distribution Sections
- Fusible Distribution Sections
- Coordination of Overcurrent Protective Devices
- Instruments and Sensors
- Surge Protective Devices

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Adjusting
- Construction Verification Items
- Agency Training

**RELATED WORK**

Applicable provisions of Division 1 govern work under this section.

Section 26 05 73- Short Circuit/Coordination Study and Arc Flash Risk Assessment
Section 26 27 13 – Electricity Metering
Section 26 43 13 - Surge Protective Devices for Low Voltage Electrical Power Circuits
Section 26 08 00 - Commissioning of Electrical
Section 01 91 01 or 01 91 02 – Commissioning Process

**REFERENCES**

ANSI C57.13 – Instrument Transformers
NEMA AB 1 - Molded Case Circuit Breakers
NEMA KS 1 - Enclosed Switches
NEMA PB 2 - Dead Front Distribution Switchboards
NEMA PB 2.1 - Proper Handling, Installation, Operation and Maintenance of Deadfront Switchboards Rated 600 Volts or Less.
UL-891 - Dead Front Switchboards

**SUBMITTALS**

Include plan and elevation layouts showing overall dimensions and compartment layout with available spaces; conduit entrance locations and requirements; nameplate legends; one-line diagrams; size and number of bus bars per phase, neutral, and ground; switchboard instrument details; instructions for handling and installation of switchboard; and electrical characteristics including voltage, frame size and trip ratings, withstand ratings, time-current curves, and interrupting ratings confirming a fully-rated system for all equipment and components.

Submit the required coordination study and the overcurrent device set point recommendations to the consulting engineer for review and approval. Submittal shall be on or before date of switchboard and panelboard equipment submittal.

Documentation shall be provided for Arc Energy Reduction where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200A or higher.

**OPERATION AND MAINTENANCE DATA**

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

1. Bus tightening intervals and procedures
2. Overcurrent protective device testing and maintenance procedures
3. Coordination study and the overcurrent device set point recommendations
4. Field report noting final adjustments to overcurrent protective device settings

**DELIVERY, STORAGE, AND HANDLING**

Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

Handle in accordance with NEMA PB2.1 and manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

**EXTRA MATERIALS**

Submit one set of spare fuses of each size and type used in the equipment provided.

## PART 2 - PRODUCTS

**SWITCHBOARD CONSTRUCTION AND RATINGS**

Switchboard electrical rating and short circuit current rating shall be as shown on the Drawings and as required by short circuit/coordination study.

The switchboard and overcurrent devices contained within shall be **fully-rated**.

Main Section Devices: Individually mounted.

Distribution Section Devices: Group-mounted and/or individually mounted, complete with bus in an integrated assembly. All breakers shall be bolted, quick-make, quick-break, trip indicating and common trip on all multi-pole breakers. No handle ties will be permitted.

Buses:

The switchboard bussing (and all other current carrying parts such as fingers, neutral and ground buses) shall be plated copper. The bussing shall be of sufficient cross-sectional area to meet UL 891 temperature rise requirements.

For 4-wire systems, the neutral bus shall be the equivalent ampacity as the phase bus bars.

Provide a copper ground bus through the length of the switchboard sized per UL 891 and NFPA requirements. Bus shall be predrilled for two hole, bolt type mechanical connections.

Ground bus shall be continuous throughout the length of the switchboard. Factory supplied bus jumpers shall be utilized for field connection of ground bus between shipping splits. Field fabricated jumpers are not permitted.

Distribution sections shall be fully bussed and fully equipped for the future breakers, including all connectors and mounting hardware.

Line and load terminations shall be rated for the size, number of conductors and conductor material.

Line and Load Terminations: Accessible from the front only of the switchboard, suitable for the conductor materials used.

Enclosure:
Factory assembled, dead front, metal-enclosed, and self-supporting switchboard assembly conforming to NEMA PB2, and complete from incoming line terminals to load side terminations.

All closure plates shall be screw removable and small enough for easy handling by one person.

Finish: Manufacturer's standard medium gray enamel over external surfaces. Coat internal surfaces with minimum one coat corrosion resistant paint, or plate with cadmium or zinc.

Enclosure shall be NEMA PB 2 Type [1 - General Purpose.] [3R - Raintight.]

[Front][Front and Rear] accessible only.

The center grip of the operating handle of all switches or circuit breakers, when at its highest position, shall not be more than 6 feet 3-1/2 inches high in the switchboard enclosure. Note: The switchboard is mounted on a 3-1/2 inch housekeeping pad equal to 6 feet - 7 inches maximum operating handle height above floor.

[Provide metering transformer compartment for Utility Company's use. Compartment size, location, bus spacing and drilling, door, and locking and sealing requirements shall meet the requirements of the local utility company. Compartment shall be in compliance with local utility service requirements.]

**PULL BOX (TOP HAT)**
Same construction as switchboard, width and depth to match switchboard. The top and sides shall be removable.

**PULL SECTION**
Same construction as switchboard, width, depth and height to match switchboard. The top and sides shall be removable.

Provide a pull section on all switchboards fed with incoming cables.

Compartment shall include switchboard bus extension drilled and tapped for the incoming cable terminations.

Compartment width shall be minimum [24”] [30”] [36”] [42”].

**MAIN FUSIBLE SWITCH**
Individually mounted bolted pressure type fuse switch. Switch shall be UL listed for 100% of the continuous rating without exceeding 60 degree C. rise over a maximum 40 degree C. ambient.

Switch shall be furnished with Class L fuse clips and be UL listed for 200,000 amps interrupting capacity.

Switch shall utilize stored energy dead front operating mechanism to provide quick positive switching independent of the speed of the operating handle. Switch shall be manually operated [and electrically tripped].

Fuse access door shall be mechanically interlocked with the operating handle and shall have provisions for locking in the open position.

Individually mounted mains shall be located (top, middle or bottom) per manufacturers requirements based on location of cabling entrance into section. Provide minimum distance between cable entry opening and termination lugs of main OCPD per manufacturer [and local utility].

Provide Infrared inspection window to inspect line and load side termination lugs of individually mounted main OCPD.

Electrically tripped switch shall be closed after the opening spring has been charged ready for electrical opening by the solenoid or manual opening by the mechanical pushbutton.

Supply the following accessories with the switch:

Ground fault protection with test panel for 480/277volt switchboards 1000 amperes and larger. Ground fault trip shall be of the residual type and include a memory circuit for positive tripping action despite intermittent arcing ground faults. Provide an integral means of testing the ground fault system to meet the on-site testing requirements of NEC Article 230-95(c).

Protection which shall open the switch upon loss of phase by the utility.

Blown fuse protection to open the switch upon operation of one or more fuses.

**CIRCUIT BREAKER DISTRIBUTION SECTIONS**

Distribution circuit breakers shall be group mounted in frame sizes 100 amp through 1200 amp. Frame sizes larger than 1200 amp shall be individually mounted.

Frame sizes larger than 1200 amp, individually mounted circuit breakers shall be provided with infrared inspection windows to inspect line and load side termination lugs. Mounting locations shall allow for front inspection.

The circuit breakers are to be totally front accessible and mounted in the switchboard to permit installation, maintenance and testing without reaching over line side bussing. The circuit breakers are to be removable by the disconnection of only the load side terminations and line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors are not acceptable.

Circuit breakers shall be provided with provisions for mounting handle padlock attachments.

Breaker feeder lugs shall be dual rated for use with either aluminum or copper conductors.

Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

A minimum of 20% future circuit breaker spaces shall be included. Spaces for future circuit breakers shall be “prepared” spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future breakers are added, only the breaker itself needs to be purchased by the installer.

Circuit breakers in 480V switchboards shall be fully adjustable LSI circuit breakers with electronic trip for frame sizes 400A and greater. When ground fault protection is required on the main overcurrent device, fully adjustable LSIG circuit breakers with electronic trip units shall be provided for feeder circuit breaker frame sizes 400A and greater.

Circuit Breakers:

Electronic Trip Circuit Breakers: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time, short time and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

Molded Case Circuit Breakers: As scheduled on the drawings, integral thermal and instantaneous magnetic trip elements in each pole.

Provided for Arc Energy Reduction where the highest continuous current trip setting for which the actual overcurrent device installed in a circuit breaker is rated or can be adjusted is 1200A or higher.

**COORDINATION OF OVERCURRENT PROTECTIVE DEVICES**

Provide a coordination study of the electrical system and recommend set points for all of the overcurrent and ground fault trip adjustments on the equipment provided. The coordination study and set point recommendations shall be submitted to the consulting engineer for approval. Submittal shall be on or before date of switchboard and panelboard equipment submittal. The study shall meet the requirements of specification section 26 05 73.

**INSTRUMENTS AND SENSORS**
Provide an electronic meter (with meter test switch and instrument transformers) for Owner's use in the switchboard. Meter and related equipment shall meet the requirements of specification section 26 27 13.

**SURGE PROTECTIVE DEVICE**
Provide a surge protective device meeting the requirements of specification section 26 43 13. Surge protective devices shall be served from an overcurrent protective device within the switchboard.

Surge protective device shall be installed external to the switchboard.

## PART 3 - EXECUTION

**INSTALLATION**
Install switchboard in locations shown on Drawings, in accordance with manufacturer's written instructions and NEMA PB 2.1.

Install switchboard on a 3.5 inch high concrete equipment pad.

Install 90 degree C insulated conductors based on ampacity of 75 degree C conductors when utilizing 100% rated OCPD's. Consult manufacturer's requirements for specific devices.

Tighten accessible bus connections and mechanical fasteners after placing switchboard per manufacturer's requirements.

**FIELD QUALITY CONTROL**
Inspect completed installation for physical damage, proper alignment, anchorage, and grounding.

Check tightness of accessible bolted bus joints using a calibrated torque wrench. Tightness shall be in accordance with manufacturer's recommended values.

Measure insulation resistance of each bus section phase to phase and phase to ground for one minute each. Test voltage shall be 1000 volts, and minimum acceptable value for insulation resistance is 2 megohms.

[Ground-fault protection system shall be performance tested on site utilizing factory qualified personnel using a test process of primary current injection.]

Touch up scratched or marred surfaces to match original finish.

**ADJUSTING**
Adjust all operating mechanisms for free mechanical movement.

Adjust trip and time delay settings to values as recommended in coordination study or as instructed by the A/E. Include a copy of the coordination study and recommended circuit breaker set points in the O&M manual.

**CONSTRUCTION VERIFICATION**
Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION

# SECTION 26 24 16
# PANELBOARDS

## PART 1 - GENERAL

**SCOPE**
The work under this section includes main, distribution and branch circuit panelboards. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- Spare Parts

PART 2 - PRODUCTS
- Power Distribution Panelboards
- Branch Circuit Panelboards
- Coordination Branch Panelboards
- Coordination of Overcurrent Protective Devices

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Construction Verification Items
- Agency Training

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

Section 26 27 13 – Electricity Metering

**REFERENCES**
ANSI C57.13 – Instrument Transformers
NEMA AB 1 - Molded Case Circuit Breakers
NEMA KS 1 - Enclosed Switches
UL-891 - Dead Front Switchboards
Wisconsin Administrative Code SPS 316 - Electrical

**SUBMITTALS**
Include outline and support point dimensions, voltage, main bus ampacity, circuit breaker arrangement and sizes, and interrupting ratings confirming a fully-rated system for all equipment and components.

Submit required short circuit coordination study per specification section 26 05 73 to the consulting engineer for review and approval. Submittal shall be on or before date of panelboard equipment submittal.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**SPARE PARTS**
Keys: Furnish 2 keys for each panelboard to Owner.

Handle lock-off: Furnish (2) 20/1 circuit breaker handle lock-off devices for each panelboard to Owner.

One set of three spare fuses of each size and type utilized

## PART 2 - PRODUCTS

**POWER DISTRIBUTION PANELBOARDS**
Panelboards: Circuit breaker or fusible switch type.

Enclosure: NEMA Type 1. Minimum cabinet size: 6.5 inches (165 mm) deep; 26 inches (660 mm) wide. Constructed of galvanized code gauge steel.

Cabinet front cover and cabinet shall be Type 4X, 304 stainless steel in wet and damp locations including kitchen, foodservice and therapeutic/pool applications.

Power distribution panelboards installed in electrical rooms and mechanical rooms shall utilize a standard dead front cover. In all other areas provide cabinet front with hinged door, flush lock and hinged trim (door-in-door) to allow access to wiring gutters without removal of panel front. Hinged trim shall be held in place with screw fasteners. Finish in manufacturer's standard gray enamel.

Provide metal directory holders with clear plastic covers.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Neutral and ground bars can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/coordination study.

Main breakers shall be individually mounted. Back feed mains shall NOT be utilized.

The circuit breakers are to be totally front accessible and mounted in the panelboard to permit installation, maintenance and testing without reaching over line side bussing. The circuit breakers are to be removable by the disconnection of only the load side terminations and line and load side connections are to be individual to each circuit breaker. Common mounting brackets or electrical bus connectors are not acceptable.

Circuit breakers shall be provided with provisions for mounting handle padlock attachments.

Breaker feeder lugs shall be dual rated for use with either aluminum or copper conductors.

Each circuit breaker is to be furnished with an externally operable mechanical means to trip the circuit breaker, enabling maintenance personnel to verify the ability of the circuit breaker trip mechanism to operate, as well as exercise the circuit breaker operating mechanisms.

A minimum of 20% future circuit breaker spaces shall be included. Spaces for future circuit breakers shall be “prepared” spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future breakers are added, only the breaker itself needs to be purchased by the installer.

Circuit breakers serving single motor loads shall be magnetic only, instantaneous trip. Overload protection shall be shall be part of the motor combination controller.

Circuit breakers in 480V power distribution panelboards shall be fully adjustable LSI circuit breakers with electronic trip for frame sizes 400A and greater.

Circuit Breakers:

Electronic Trip Circuit Breakers: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time, short time and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

Molded Case Circuit Breakers: As scheduled on the drawings, integral thermal and instantaneous magnetic trip elements in each pole.

Fusible Distribution Switches:

Fusible switches shall be quick make, quick break and shall be group mounted in panel type construction. Switches of 30 amperes to 200 amperes shall have plug-on line side connections. Each switch is to be contained in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses which shall be interlocked with the operating handle to prevent opening the cover when the switch is in the "ON" position.

This interlock shall be constructed so that it can be released with a standard electrician's tool for testing fuses without interrupting service. Units shall have padlocking provisions in "OFF" position

and operating handle position shall give positive switch position indication, i.e. red for "ON" and black for "OFF". Switches shall pass industry standard $I^2t$ with-stand tests and fuse tests.

A minimum of 20% future fusible switch spaces shall be included. Spaces for future fusible switches shall be "prepared" spaces. These spaces shall be provided with the necessary mounting hardware and bus extensions so that when future fusible switches are added, only the fusible switch itself needs to be purchased by the installer.

Surge Protective Device: Provide a surge protective device meeting the requirements as specified on drawings. Surge protective devices shall be served from an overcurrent protective device within the power distribution panelboard. Surge protective device shall be installed external to the distribution panelboard.

**BRANCH CIRCUIT PANELBOARDS**

Lighting and Appliance Branch Circuit Panelboards: Circuit breaker type.

The panelboard and overcurrent devices contained within shall be **fully-rated.**

Enclosure: Type 1. Minimum cabinet size: 5-3/4 inches (144 mm) deep; 20 inches (508 mm) 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.

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.

Provide flush or surface cabinet front 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.

Provide metal directory holders with clear plastic covers.

Provide panelboards with copper bus (phase buses, bus fingers, etc.), ratings as scheduled on Drawings. Provide ground bars in all panelboards. Phase, neutral and ground bar terminations can be dual rated ALCU9. All spaces shall have bus fully extended and drilled for the future installation of breakers.

Incoming conductors shall terminate at lug landing pads rated for the panelboard.

Provide compression type lugs to accommodate the conductor shown on drawings.

Minimum System (i.e. individual component) Short Circuit Rating: As shown on the Drawings and as required by short circuit/ coordination study.

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.

Do not use tandem circuit breakers.

Circuit breakers shall be bolt-on type with common trip handle for all poles. No handle ties of any sort will be approved.

Provide a minimum of 10% spare circuit breakers in branch panelboards.

All of the panelboards provided under this section shall be by the same manufacturer.

All sub-feed panelboards installed side by side shall utilize same enclosure height.

## PART 3 - EXECUTION

**INSTALLATION**

See section 26 05 29 for support requirements.

Install panelboards plumb with wall finishes.

Height:

Power Distribution panelboards: Minimum 12” above finished floor and maximum of 6’-7” to center of the grip of the operating handle of the top most mounted switch or circuit breaker, when at its highest position.

Branch panelboards: 6’-0” to top of panelboard.

Install a crimp type stud termination to stranded conductor when terminating on circuit breakers without a captive assembly rated for terminating stranded conductors.

Provide filler plates for unused spaces in panelboards.

See section 26 05 53 for identification requirements. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.

Stub three (3) empty ¾” conduits to accessible location above ceiling or below floor out of each recessed panelboard. Cap these conduits to prevent material from entering them.

**FIELD QUALITY CONTROL**

If aluminum conductors size #1/0 and larger (per Section 26 05 19) are to be used as panelboard feeders, it is the responsibility of the contractor to provide panelboards with adequate wire bending space to accommodate the aluminum conductors and terminators to meet allowable code requirements. The Contractor shall circuit the panelboards as shown on the drawings. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 10 percent, rearrange circuits in the panelboard to balance the phase loads within 10 percent.

Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections.

END OF SECTION

# SECTION 26 27 13
# ELECTRICITY METERING

## PART 1 - GENERAL

**SCOPE**
The work under this section includes electronic meters including test switch and instrument transformers as specified herein and shown on the Drawings. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Utility Metering
- Electronic Meter at Main Electric Service (Non-Utility Metering)
- Meter Test Switch
- Sub-Meter(s)
- Meter Interface Gateway
- Provisions for Sub-Meters
- Accessories
- Current Transformers
- Potential Transformers

PART 3 - EXECUTION
- Installation
- Construction Verification Items
- Agency Training

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

Section 26 24 16 - Panelboards

**REFERENCES**
ANSI C57.13 - Instrument Transformers

**SUBMITTALS**
Provide product data showing model numbers, dimensions, mounting requirements, and parameters measured and displayed.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

## PART 2 – PRODUCTS

**UTILITY METERING**
Provide a stand-alone CT cabinet, or a separate utility metering section in the switchboard. Provide a meter socket with a 1-inch conduit to the CT cabinet. Coordinate approved manufacturer(s), style, and location of metering equipment with local utility requirements.

All meter potential leads and control power leads shall be fuse protected. Provide a fused disconnecting device or circuit breaker with downstream fuses in the main switchboard or panelboard for protection of the meter potential leads and control power leads. Fuses shall be sized per manufacturer's recommendations. scribed in the "Meter Interface Gateway" subsection of this specification.]

Provide shorting block(s) for the CT leads.

**CURRENT TRANSFORMERS**
Current Transformers: ANSI C57.13; 5 ampere secondary, with primary/secondary ratio as shown on Drawings, burden and accuracy consistent with connected metering and relay devices, 60 Hz.

Sub-meters may use 0-2V Current Sensors or 0-0.333V Current Transducers in lieu of Current Transformers.

Mount and brace transformers to withstand 100,000 amp short circuit current.

**POTENTIAL TRANSFORMERS**

Provide potential transformers (PT's) only if required by the meter manufacturer. Most meters can measure 480V potential and below without the use of external PT's.

Potential Transformers: ANSI C57.13; 120 volt secondary, burden and accuracy consistent with connected metering and relay devices, 60 Hz.

Potential transformers on 480/277 volt systems shall be rated 277 – 120 volts, connected phase-to-neutral, and installed on each phase.

## PART 3 - EXECUTION

**INSTALLATION**

The meters shall be mounted in the locations indicated on the drawings. Mounting height shall be 5'-6" or less from finished floor.

New meters installed in existing equipment:

All unused openings shall be covered with a metal closure plate painted to match the existing enclosure.

Any extension of wiring needed to accommodate the meters shall be done using terminal blocks and #10 AWG stranded copper wire, 600 volt type SIS insulation. Splices are not allowed.

Provide a separate enclosure for the new meter if adequate space is not available in the existing panels.

Dangerous voltage will develop in the open circuit secondary windings of energized current transformers. De-energize the current transformers by short circuiting the secondary windings before disconnecting or connecting instruments to current transformers.

Verify the proper operation of all meters. Compare the meter display readings to measurements taken with a clamp on amp-meter and hand held volt meter.

Provide all programming and field set-up of the meters required for measurement and communication of the electrical data.

**CONSTRUCTION VERIFICATION**

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01 or 01 91 02.

END OF SECTION

**SECTION 26 27 26**
**WIRING DEVICES**

## PART 1 - GENERAL

**SCOPE**
The work under this section includes wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through service fittings, access floor boxes, photo cells and time clocks. Included are the following topics:



**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

**QUALITY ASSURANCE**
Refer to Division 1 for General Conditions, Product and Substitution requirements.

Manufacturers listed in specifications and drawings are those the design is based upon.

**SUBMITTALS**
Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

Manufacturer's Instructions:

Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

Include instructions for storage, handling, protection, examination, preparation, operation and installation of product.

## PART 2 - PRODUCTS

Residential grade devices are acceptable in apartments.
Specification grade devices shall be used everywhere else.
Verify standard device color with Architect prior to placing order.

**WALL SWITCHES**
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.

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.

Dwelling unit switches shall be rated 15 amps

Handle: Color as selected by Architect, made of nylon or high impact resistant material.

**RECEPTACLES**
Convenience and Straight-blade Receptacles: NEMA Type 5-20R, nylon or high impact resistant face. Receptacles shall be UL498 Listed and meet Federal Specification WC-596. All duplex receptacles shall be heavy duty Specification Grade, 20 amp rated. 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, Cooper model 5362C.

Generally, all receptacles shall be duplex convenience type unless otherwise noted.

Dwelling unit receptacles shall be rated 15 amps

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.

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 2094.

Dwelling unit bathroom GFCI receptacles shall be rated 20 amps

Specific-use Receptacle Configuration: As indicated on drawings.

**OCCUPANCY SENSORS**
All occupancy sensors shall be hardwired type; battery type shall not be permitted.

Wall Mounted (Wall Switch Type)
The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing for detecting room occupancy. The unit shall fit in/on a standard single gang switch box and require only two wires and a grounded box for operation. Dual technology shall be used in all public restrooms.

Rated capacity: 600 watts minimum at 120 volts, 60 Hz; 1000 watts minimum at 277 volts, 60 Hz

Sensitivity shall be user adjustable or self adjusting type.

The delay timer shall be adjusted within a range of 6 to 14 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.

The off switch shall have manual override for positive off and automatic on.

The test LED shall indicate motion.

The area of coverage shall be approximately 180 degrees by 35-40 feet.

The unit shall have a five year warranty.

Ceiling mounted
The sensor shall use either passive infrared or, if dual technology, passive infrared and passive acoustic sensing for detecting room occupancy. The unit shall fit in/on a standard octagon box. Dual technology shall be used in all public restrooms.

Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps.

Sensitivity shall be user adjustable or self adjusting type.

The delay timer shall be adjusted within a range of 6 to 14 minutes by the contractor in the field. The sensor shall have a test mode for performance testing.

The coverage area shall be 360 degrees by approximately 15 feet radius when mounted at 9 foot height. The sensor shall have provisions, such as masking, to block out problem areas.

Test LED to indicate motion.

The unit shall have a five year warranty.

**WALL DIMMERS**
Wall Dimmers: linear slide semiconductor type.

Rating: 600 Watts minimum, larger size to accommodate load shown on Drawings.

**DEVICE PLATES AND BOX COVERS**
Decorative Cover Plate: Color as selected by Architect, smooth thermoplastic nylon. Note requirement for red plates on emergency outlets.

Weatherproof Cover Plate: Gasketed metal with hinged device covers.
Surface Cover Plate: Raised galvanized steel.

**PHOTO CELLS**
The controller shall be rated 2000 watts tungsten at 120, 240 or 277 volts. The cell shall be cadmium sulfide, 1" diameter.

The enclosure shall be die cast zinc, gasketed for maximum weather proofing.

The enclosure shall include the positioning lug on the top of the enclosure.

The unit shall have a delay of up to two minutes to prevent false switching. ON/Off adjustment shall be done by moving a light selector with a range from 2 to 50 foot-candles.

Mounting shall be for a 1/2" conduit nipple.

The unit shall have a 5 year warranty.

The contacts shall be SPST normally closed.

The operational temperature range shall be -40 to 140 degrees F(-40 to +60 degrees C).

**TIME SWITCH**
The switch shall be programmed to automatically turn lights off after a preset time.
The delay timer shall be adjustable with a range of 5 minutes to 12 hours.

Switch shall be rated for 120/277V, 1200W load.

The switch shall beep warning every 5 seconds during the last minute of countdown. Also, the switch shall flash lights (for warning) at one minute before timer expires.

Time scrolling shall be provided to override preset time by pressing the ON/OFF switch for four seconds.

LCD provided to show count down time.

The switch shall have zero crossing circuitry.

## PART 3 - EXECUTION

**INSTALLATION**
Install wall switches 48 inches above floor, OFF position down.

Install wall dimmers 48 above floor; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.

Install convenience receptacles 18 inches above floor.
Install as indicated on drawings for counters, backsplashes.

Install box for telephone jack 18 inches above finished floor. Install box for telephone jack for wall telephone 54 inches above finished floor, or as indicated on drawings.

Install specific-use receptacles at heights shown on Contract Drawings.

Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.

Install decorative plates on switch, receptacle, and blank outlets in finished areas.

Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

Install devices and wall plates flush and level.

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.

**FIELD QUALITY CONTROL**
Inspect each wiring device for defects.
Operate each wall switch and sensor with circuit energized and verify proper operation.
Verify that each receptacle device is energized.
Test each receptacle device for proper polarity.
Test each GFCI receptacle device for proper operation.

**OCCUPANCY SENSORS**
Sensors used in return air plenum ceiling areas shall be installed in an approved enclosure or UL listed for return air plenum.

Sensitivity Test: After the sensor has been energized for at least 15 minutes, walk to the middle of the room (if conference room) or sit at the normal desk position (if and office). Make no motion for 20 seconds. Move one arm up and down slowly. The test LED should blink.

Time Delay Test: Set the time delay for 10 minutes. Walk into the room to activate the sensor then leave room. Sensor must turn lights off at approximately 10 minutes. Walk into the room again to reactivate the lights. Lights should activate within 1 second.

**ADJUSTING**
Adjust devices and wall plates to be flush and level.

Mark all conductors with the panel and circuit number serving the device with a machine generated label, at the device.

END OF SECTION

# SECTION 26 27 28
# DISCONNECT SWITCHES

## PART 1 - GENERAL

**SCOPE**
The work under this section includes disconnect switches, fuses and enclosures. Included are the following topics:
PART 1 - GENERAL
- Scope
- Related Work
- Quality Assurance
- Submittals

PART 2 - PRODUCTS
- Disconnect Switches
- Fuses

PART 3 - EXECUTION
- Installation

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

**QUALITY ASSURANCE**
Refer to Division 1 for General Conditions, Product and Substitution requirements.
Manufacturers listed in specifications and drawings are those the design is based upon.

**SUBMITTALS**
Include outline drawings with dimensions, and equipment ratings for voltage, ampacity, horsepower, and short circuit.

## PART 2 - PRODUCTS

**DISCONNECT SWITCHES**
Fusible Switch Assemblies: NEMA Type HD; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: designed to accommodate Class R cartridge type fuses.

Nonfusible Switch Assemblies: NEMA Type HD; quick-make, quick-break, load interrupter, enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

Provide enclosures clearly marked for maximum voltage, current, and horsepower rating.
Indoor: NEMA type 1.
Outdoor: NEMA type 3R, raintight

Approved Manufacturers: Square D, Cutler Hammer, General Electric.

Provide manufacturer's equipment ground kit in all disconnect switches.

FUSES
Fuses 600 Amperes and Less: ANSI/UL Class RK1RK5; sized as indicated on Drawings; dual element, current limiting, one-time fuse, 600 volt.
Interrupting Rating: 200,000 rms amperes.

Provide spare set of fuses for each size utilized

## PART 3 - EXECUTION

**INSTALLATION**
Install disconnect switches where indicated on Drawings.

Provide identification as specified in Section 26 05 53.

END OF SECTION

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# SECTION 26 28 16
# ENCLOSED SWITCHES AND CIRCUIT BREAKERS

## PART 1 - GENERAL

**SCOPE**
The work under this section includes enclosed molded case circuit breakers. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Operation and Maintenance Data
- Regulatory Requirements
- Delivery, Storage, and Handling

PART 2 - PRODUCTS
- Circuit Breakers
- Ratings
- Enclosure
- Accessories

PART 3 - EXECUTION
- Installation
- Field Quality Control

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

**REFERENCES**
NEMA AB 1 - Molded Case Circuit Breakers.

**SUBMITTALS**
Include circuit breaker ratings, withstand ratings, frame size, time-current and let-through current curves, outline dimensions, and terminal lug sizes.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**REGULATORY REQUIREMENTS**
Circuit breakers listed by Underwriter's Laboratories, Inc., and suitable for specific application.

**DELIVERY, STORAGE, AND HANDLING**
Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

## PART 2 - PRODUCTS

**CIRCUIT BREAKERS**
Molded Case Circuit Breakers: Inverse time with integral thermal and instantaneous magnetic trip elements in each pole.

Electronic Trip Circuit Breaker: As scheduled on the drawings, electronic circuit breakers shall have, at a minimum, adjustments for long time trip, short time trip and instantaneous trip. Provide integral ground fault sensing with adjustable ground fault trip where indicated on the drawings.

**RATINGS:**
Ratings as shown on the Drawings.

**ENCLOSURE**
Enclosure:
- Indoor: NEMA Type -1code gauge steel with rust inhibiting primer and baked gray enamel finish.

Outdoor: NEMA Type 3R code gauge zinc coated steel with baked gray enamel finish or NEMA 4 when indicated on drawings.

Corrosive Areas, Kitchen/Food service areas, Therapeutic/Pool spaces and Damp/Wet locations: NEMA Type 4X, 304 stainless steel with brushed finish.

**ACCESSORIES**

Handle Lock: Include provisions for padlocking.

## PART 3 - EXECUTION

**INSTALLATION**

Install enclosed circuit breakers where shown on Drawings, in accordance with manufacturer's instructions.

**FIELD QUALITY CONTROL**

Inspect visually and perform several mechanical ON-OFF operations on each circuit breaker.

END OF SECTION

# SECTION 26 32 13
# ENGINE-DRIVEN GENERATOR SETS - NATURAL GAS

## PART 1 - GENERAL

### SCOPE

The work under this section includes providing a complete factory assembled packaged engine generator system with controls and startup testing. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Permits
- Submittals
- Operation and Maintenance Data
- Quality Assurance
- Extra Materials

PART 2 - PRODUCTS
- System Ratings
- Engine and Engine Equipment
- Alternator
- Over Current Protective Device
- Accessories

PART 3 - EXECUTION
- Examination
- Installation
- Field Quality Control
- Construction Verification Items
- Functional Performance Testing
- Agency Training

### RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Section 23 24 00 - Internal Combustion Engine Piping
Section 26 05 73 - Short Circuit/ Coordination Study and Arc Flash Risk Assessment
Section 26 36 00 - Transfer Switches

### REFERENCE STANDARDS

NFPA 101 - Life Safety Code
NFPA110 – Emergency and Standby Power Systems
ANSI/NEMA MG 1 - Motors and Generators
UL2200 – Stationary Engine Generator Assemblies

### PERMITS

The Contractor shall be responsible for obtaining all necessary permits for the complete installation of the generator fuel system and related equipment.

### SUBMITTALS

Submit shop drawings showing detailed equipment assemblies and indicate dimensions, weights, loads, required clearances, plan and elevation views with overall location and interconnection point dimensions, method of field assembly, components and location and size of each field connection.

Include product data for generator and all accessories: batteries and charger, engine generator set, muffler, exhaust piping external to unit, outdoor enclosure, remote annunciator(s), remote emergency stop, load center and lighting integral to enclosure, cooling system heaters. In addition, fuel consumption rate curves at various loads, ventilation and combustion air requirements, thermal damage curves for generator, time current characteristic curves for generator protective device (if included) and electrical ratings and diagrams including schematic and interconnection diagrams.

Certified Test Reports. Factory test reports including noise level, exhaust emissions, and field quality tests.

Certification of Torsional Vibration Compatibility.

Documentation for a 1 year comprehensive engine, parts, and enclosure warranty.

Wiring diagram for status of generator output circuit breaker(s) or OCPD serving the emergency side of each automatic transfer switch. Include annunciation and indication monitoring integral to annunciator panel. Submit manufacturer's installation instructions.

Provide verification of coordination for Emergency and Legally Required Standby systems overcurrent devices with all supply side overcurrent protective devices.

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**QUALITY ASSURANCE**
Manufacturer: Company specializing in packaged engine generator systems with minimum ten years documented experience. Packaged generator assembly shall meet UL 2200 requirements.

Supplier: Authorized distributor of engine generator manufacturer with service facilities within 100 miles of project site.

**EXTRA MATERIAL**
Provide two additional sets of each fuel, oil, and air filter elements required for the engine generator system and one additional set of all required belts.

## PART 2-PRODUCTS

**SYSTEM RATINGS**
Generator Set Rating: 180 kVA, 0.8pf, 208/120VAC, 3 phase, 4 wire, 12 wire re-connectable, 60 Hz. Standby power rated.

Motor starting KVA shall be 180 kVA based on a sustained RMS voltage drop of no more than 35% of no load voltage with the specified kVA load at near zero power factor applied to the engine-generator set. Units serving fire pumps shall not have Voltage drops at less than 15%.

The generator set manufacturer shall verify the engine as capable of driving the generator with all accessories in place and operating at the nameplate rating after de-rating for the range of temperature expected in service and the altitude of the installation.

The engine-generator set shall be capable of picking up 100% of nameplate kW, less applicable de-rating factors, in one step with the engine-generator set at operating temperature.

Voltage regulation shall be ±1.0% of rated voltage for any constant load between no load and rated load. Random voltage variation with any steady state load from no load to full load shall not exceed ±1.0% of rated voltage.

Frequency regulation shall be ±0.5% from steady state no load to steady state rated load.

Harmonic distortion shall not exceed 5% total harmonic distortion at full linear load and no single harmonic shall exceed 3% of rated voltage.

Telephone Influence Factor: TIF shall be less than 50.

**ENGINE AND ENGINE EQUIPMENT**
**Engine Type**: Water-cooled, four cycle, internal combustion engine.

**Fuel Type**: Natural Gas
**Governor**: Isochronous electronic type to maintain engine speed within 0.5 percent, steady state, and 1 percent, no load to full load, with recovery to steady state within 2 seconds following sudden load changes.

**Safety Devices**: Engine shutdown on high water temperature, low oil pressure, over-speed, and engine over-crank. Limits as selected by manufacturer.

**Engine Accessories**: Include intake air filter, fuel filter, fuel priming pump, automatic electric fuel shutoff, fuel/water separator, gear-driven water pump, positive displacement mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements, dipstick oil level indicator, and oil drain valve with hose extension. Include engine mounted battery charging alternator with solid state voltage regulator.

**Engine Jacket Heater**: Thermal circulation type water heater with integral thermostatic control, sized to maintain engine jacket water at 90 degrees F (32 degrees C). Heater voltage shall be served from integral Branch Circuit Panelboard.

**Cooling System**: Unit mounted radiator using glycol coolant, with blower type fan, coolant pump and thermostat temperature control sized to maintain safe engine temperature in ambient temperature of 105 degrees F. Radiator shall be provided all ductwork required with a duct adapter flange permitting the attachment of air discharge duct directing the discharge of radiator air to exterior louver location.. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.

**Exhaust System:** Provide critical grade silencer, with muffler companion flanges and flexible stainless steel exhaust fitting, suitable for horizontal orientation, sized in accordance with engine manufacturer's instructions. The muffler shall be mounted so its weight is not supported by the engine.

Flexible exhaust connections shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.

Provide an exhaust condensation trap with manual drain valve to trap and drain off exhaust condensation and to prevent condensation from entering the engine. Provide drain line to drip pan.

Provide a suitable rain cap at the stack outlet. Provide all necessary flanges and special fittings for proper installation.

The Division 23 Contractor shall mount and install all exhaust components as shown on drawings and as required to comply with applicable codes and regulations. All components shall be properly sized to assure proper operation without excessive back pressure when installed as shown on the drawings. Make provisions as required for pipe expansion and contraction.

**Fuel System**: Provide fuel lockout solenoid and fuel regulator, based on manufacturers operating pressure, between 7”-14” H2O.

Provide flexible supply and return line fittings and all connections for connecting fuel system to the engine in compliance with applicable codes and regulations. All fuel piping shall be pressure tested for minimum 2 hours. Primary regulator and flexible fuel hose with stainless steel over-braid shall be provided by the generator supplier.

Coordinate with local utility gas provider for new gas service and associated regulator. Piping shall be compliant with utility company installation requirements. Provide a gas meter and regulator for the generator service. Meter and regulator serving generator shall be separate from the building’s gas service and shall be connected on the supply side of the main gas shutoff valve.

Provide separate identifying labeling and tags at shutoff valves indicating an emergency generator and main building.

**Batteries**: Heavy duty, diesel starting type, lead-acid storage batteries. Provide a DC 12 volt system with number of batteries and battery capacity as sized by the manufacturer adequate for (4) 30 second cranking periods (total of 2 minutes) along with all additional loads being run on the DC system. Battery submittals shall include type, amp-hour rating and cold cranking amps.

**Mounting:** Provide unit with suitable spring-type vibration isolators and mount on structural steel base.

**ALTERNATOR**
Insulation: ANSI/NEMA MG 1, Class H.

Alternator Speed: 1,800 rpm

The unit shall be single bearing, self-aligning 4-pole, brushless, synchronous type, revolving field windings, and direct driven centrifugal blower for proper cooling and minimum noise. No brushes will be allowed.

The unit shall be 3-phase, broad-range, re-connectable and shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit. Leads shall terminate in NEMA 1 connection enclosure. A fully rated, isolated neutral connection shall be included by manufacturer.

The alternator shall meet temperature rise standards of UL2200 (120 degrees C). The insulation system material shall be class "H".

The regulator design shall include torque-matching characteristics to allow the engine to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to optimize motor starting capability and provide the fastest possible recovery from transient speed dips. Regulators which use a fixed volt per hertz characteristic are not acceptable.

The alternator shall include a permanent magnet generator (PMG) exciter and electronic voltage regulator, and shall be self-ventilated drip-proof construction built in accordance with NEMA, AIEE and ANSI standards.

The alternator shall be protected against overloads and short circuits by electronic control panel protective functions. Functions shall be implemented electronically in the control panel. The generator design shall be of the self-protecting type as demonstrated by the prototype short circuit test. Systems utilizing 3-wire, solid state control elements rotating in the rotor, will not be acceptable.

**OVER CURRENT PROTECTIVE DEVICE**

[No circuit breaker required: Provide a NEMA 1 connection cabinet, factory wired line side, field connectable load side, sufficiently sized for 125% of generator nameplate rating. Bus shall be pre-drilled for two-hole cable connectors. Generator shall be provided with Overcurrent Protection per NEC Article 445.12]

[Circuit breaker required: Provide a mainline molded case circuit breaker(s), 100% electronic, [ Amp], on generator output with adjustable long time and short time delay and instantaneous trip; complying with NEMA AB 1 and UL489. Trip settings shall be factory set to generator thermal damage curve.]

[Include battery-voltage operated shunt trip, connection to open circuit breaker(s) when generator is shut down by internal or external protective devices.]

[Provide an additional set of load side lugs on the generator output bus to serve a remote load bank.]

**ACCESSORIES**

Provide the following accessories with the engine generator set.

**Silencer:** Outdoor enclosure mounted: Critical grade, minimum 30 dB reduction. Silencer shall be located inside enclosure.

**Enclosure**: Weather protective housing with the following features: Skin Type.

- Vandal-resistant
- Aluminum body
- Lifting points on base frame
- Stainless steel flush fitting latches and hinges
- Stainless steel fasteners
- Sheet steel components pre-treated with zinc phosphate prior to polyester powder coating
- Multiple lockable panels/doors on each side installed to allow access to components requiring maintenance
- Radiator fill access door with lockable cover
- Engine cooling via airflow through enclosure
- Lube oil and coolant drains piped to the exterior of the enclosure skid base
- Battery can only be reached through lockable doors
- Air discharge to be [horizontal] [vertical] from radiator.
- Sound attenuation housing to limit noise level not to exceed 75dB at 23 feet @ rated output.

**Load Center - Enclosure**: Integral load center 60/2 amps to serve accessories including, but not limited to, the battery charger, engine heater, enclosure lighting, and convenience receptacle. Panelboard and all associated accessory circuitry shall be field installed by the Electrical Contractor.

Load center style panelboard: plug-on circuit breaker type, fully rated, Type 3R enclosure, 3-3/4" D, 14.25" W, code gauge steel, surface mounted with ground bar and lock kit. Copper bus, minimum system (i.e. individual component) short circuit rating: 10,000A. Provide with typed circuit identification directory label. Load center shall be independently supported to equipment pad or unit frame on frame side of engine isolation to avoid load center vibration. Panelboard and all associated accessory circuitry shall be field installed by the Electrical Contractor.

**Electrical Devices - Enclosure**: GFCI WP receptacle. Devices and associated circuitry shall be field installed by the Electrical Contractor.

**Electrical Lighting - Enclosure**: Manual switch inside access door and LED lighting fixture(s). Lighting fixture, switch and associated circuitry shall be field installed by the Electrical Contractor.

**Battery Tray**: Plastic coated metal tray treated for electrolyte resistance, constructed to contain spillage of electrolyte.

**Battery Charger**: A 10-ampere voltage regulated battery charger shall be provided for the engine-generator set. Charger shall be equipped with float, taper and equalize charge settings. Charger shall include overload protection, voltage surge suppressor, DC voltmeter and fused AC input. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of:

Loss of AC power - red light (no relay contact)
Low battery voltage - red light
High battery voltage - red light (no relay contact)
Charger fail - red light

**Engine-Generator Digital Control Panel - Unit mounted**: Provide a control panel with the top not more than six (6) feet above finished floor (this may require remote mounting). NFPA – 110, NEMA Type 1 generator mounted control panel enclosure with engine and generator controls and indicators containing the following:

Automatic remote start capability
"Run-Off-Auto" switch
Shut downs as required by NFPA 110 5.6.5.2(3)
Alarms as required by NFPA 110 5.6.5.2(4)
Individual alarm indication as required by NFPA 110.5.6.5.2(4) and table 5.6.5.2
Controls as required by NFPA 110 5.6.5.2(5)

Include remote starting control circuit, with RUN-OFF-AUTO selector switch on engine generator control panel.

Fuel pressure, water temperature, and lube oil pressure shall be monitored by the engine-generator controller.

The control shall include surge suppression for protection of solid state components. A front control panel illumination lamp with On/Off switch shall be provided. The engine-generator set starting batteries shall power the monitor.

**Auxiliary Relay**: 3PDT, operates when engine runs, with contact terminals prewired to terminal strip.

**Remote Alarm Contacts**: Pre-wire form C contacts to terminal strip for remote alarm functions required by ANSI/NFPA 110.

**Remote Mounted Annunciator Panel:** Digital. Annunciator panel shall be powered from unit storage battery and located outside of the generator room (EPS) at a location accessible and monitored by staff. Refer to drawings for location[s]. A remote, audible alarm shall be provided per NFPA110-5.6.5.2(4).

The annunciator shall have provisions for spare relay based inputs for audible/ visual alarms to meet the requirements of these specifications. Refer to Generator Source Alarm Annunciation/ Indication.

The annunciation alarm shall be capable of being silenced and the panel shall include repetitive alarm circuitry so that after the audible alarm has been silenced, it re-activates after the fault condition has been cleared.

Provide all wiring and raceway systems as required.

**Remote Emergency Stop "Mushroom" Switch:** Provide emergency shut off switch on the unit generator and one remote mounted device at location indicated on drawings.

Remote mounted devices installed outdoors shall be installed in approved wet location wiring method.

Shut off switch: Red button with (2) N.O. and (2) N.C. contact block. Switch shall be capable of lockout and tagout.

Provide label with "Emergency Shut Down"- White letters on Red background.

Provide all wiring, raceways and mounting systems as required.

**Generator Source Alarm Annunciation/Indication:** Provide audio/visual alarm indication to generator control panel and to remote annunciator panel if the generator output circuit breaker(s) or OCPD serving the emergency side of each automatic transfer switch is in the "Tripped or "Open" position. Provide monitoring micro-switches. Provide wiring diagram at equipment submittal. Green light to indicate OCPD is closed and Red light to indicate OCPD is open. One point per each OCPD. Provide all wiring, raceway and contacts as required for this function. Separation between NEC article 700 wiring shall be maintained.

Provide wiring diagram at equipment submittal.

**Building Automation Alarm Interface:** Provide a "Trouble" and "Generator Run" set point to be tied into the building's fire alarm system.

Provide alarm set point for each monitored generator output circuit breaker(s) or OCPD serving emergency side of each automatic transfer switch indicating tripped or open position.

Provide all wiring and raceway to the building automation system control panel.

**Generator Feeder:** The ampacity of the conductors from the generator terminals to the first distribution device containing overcurrent protection shall not be less than 115% of the nameplate current rating of the generator.

**Connection Cabinet:** Provide stainless steel wall mounted NEMA 4X combination manual transfer switch/ connection cabinet to meet the requirements of NEC 700.3 (F). Cabinet shall contain silver plated copper bus rated 115% of generator nameplate with mechanical set screw lugs.

## PART 3 - EXECUTION

**EXAMINATION**
Verify that required utilities are available in proper location and ready for use.

**INSTALLATION**
Install in accordance with manufacturer's instructions.

Generator set shall be anchored to concrete pad.

Coordinate with local utility gas provider for new gas service and associated regulator. Piping shall be compliant with utility company installation requirements. Shut off valve handle shall be removed and located inside generator enclosure if valve is installed exposed at generator.

Utility costs for service installation shall be separate from this work.

Generator, associated transfer switches and distribution equipment installed indoors shall be located in separate rooms from normal electrical service equipment. Rooms shall have minimum 2 hour rating. No other equipment, including architectural appurtenances, except those that serve the space shall be permitted in this room. The room housing the Generator (EPS) and the room housing the generator distribution equipment and transfer switches (EPSS) shall be ventilated to and from the exterior.

Interior and exterior Generator installations shall be provided with battery powered emergency lighting to illuminate area surrounding generator/ generator enclosure.

Generator Emergency Shutdown switch shall be located [outside interior generator room] [on exterior building adjacent to exterior generator enclosure].

Outdoor Generator Enclosure Accessory Panelboard: **The accessory source panel and all related branch circuitry shall be furnished and installed by the Electrical Contractor. This includes, but is not limited to, the circuiting for the battery charger, engine heater, enclosure lighting, and convenience receptacle.**

**Feeders:**
Feeder wiring serving emergency loads shall be installed per NEC 700.10(D)(1) through (D)(3).

**Control Conductors:**
All generator control conductors installed between transfer equipment and the emergency generator serving Emergency, Legally Required Standby and Optional Standby systems shall be kept entirely independent of each other and all other wiring. **This shall require a dedicated conduit system between each transfer switch and the emergency generator**.

All Emergency branch control conductors installed between transfer equipment and the emergency generator shall be installed per NEC 700.10(D)(1) through (D)(3).

**Grounding:**
When 4-pole transfer switches are utilized, the generator shall be installed and connected as a separately derived system and the factory installed generator ground/neutral bonding strap shall be maintained.

When 3-pole transfer switches are utilized, the generator shall be installed and connected as an equipment connection (not a separately derived system) and the factory installed generator ground/neutral bonding strap shall be removed.

**Labeling:**
Provide a sign at service entrance equipment indicating type and location of onsite emergency power sources (EPS).

Provide a sign at grounding electrode conductor when grounding connection is remote from generator. Sign shall identify location of all emergency and normal sources connected to that location.

**FIELD QUALITY CONTROL**
Operational testing of complete emergency electrical system shall be conducted prior to scheduling the required full load test to ensure complete system operation.

The scheduling of the tests shall be **approved** by the electrical inspector prior to test commencement.

Provide full load testing utilizing a portable test bank for four hours continuous, minimum. During the first two hours, step increase the load from 0% to 100% in at least six equal steps. At the end of two hours, continue running test at 100% load. Record the following in 20 minute intervals throughout the four hour test: kilowatts, amperes, voltage, coolant temperature, room temperature, generator frequency (Hz), oil pressure, fuel consumption.

**CONSTRUCTION VERIFICATION**
Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 26 08 00 in accordance with the procedures defined for construction verification in Section 01 91 01 or 01 91 02.

**FUNCTIONAL PERFORMANCE TESTING**
Contractor is responsible for utilizing the functional performance test forms supplied under specification Section 26 08 00 in accordance with the procedures defined for functional performance testing in Section 01 91 01 or 01 91 02.

**AGENCY TRAINING**
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01, or 01 91 02.

END OF SECTION

# SECTION 26 36 00
# TRANSFER SWITCHES

## PART 1 - GENERAL

**SCOPE**
The work under this section includes transfer switches (less than 600V) for standby generator systems. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Quality Assurance
- Submittals
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Automatic Transfer Switch
- Ratings
- Automatic Sequence of Operation
- Accessories

PART 3 - EXECUTION
- Installation
- Field Adjustments

**RELATED WORK**
Applicable provisions of Division 1 govern work under this section.

Section 26 32 00 - Packaged Generator Assemblies.

**QUALITY ASSURANCE**
Manufacturer: Company specializing in automatic transfer equipment with five years documented experience.

**SUBMITTALS**
Submit product data showing overall dimensions, electrical connections, electrical ratings, all specified accessories, interlock methods, and environmental requirements.

Submit manufacturer's installation instructions.

**OPERATION AND MAINTENANCE DATA**
The manuals shall contain at least the following:

- Instructions for operating equipment under test and emergency conditions.
- Identification of operating limits which may result in hazardous or unsafe conditions.
- Document ratings of equipment and each major component.
- Routine preventive maintenance and lubrication schedule.
- List of special tools, maintenance materials, and replacement parts.
- Technical data sheets.
- Wiring diagrams

## PART 2 - PRODUCTS

**AUTOMATIC TRANSFER SWITCH**
Description: NEMA ICS 2; automatic transfer switch. In applications where the switch serves as the service entrance disconnect, the switch shall be rated as suitable for use as a service disconnecting means.

Configuration: The transfer switch shall be electrically operated and mechanically held. The electrical operation shall be by a solenoid mechanism operating from the same source to which the load is being transferred.

The switch shall be rated for continuous duty and be mechanically interlocked to be in either the normal or the emergency position.

The switch shall be controlled by electronic solid state components with printed circuit control boards, and industrial grade plug in control relays.

The switch shall be designed and built so that it can be manually operated under no-load conditions from behind a barrier partition or with the door closed. The enclosure shall allow for inspection of the internal operation of the switch through a full sequence of the transfer cycle with the door open and the switch de-energized.

**RATINGS**

Ratings: As scheduled on drawings.

**AUTOMATIC SEQUENCE OF OPERATION**

Initiate Time Delay to Start Alternate Source Engine Generator: Upon initiation by normal source monitor.

Time Delay to Start Alternate Source Engine Generator: 0 to 10 seconds, adjustable.

Initiate Transfer Load to Alternate Source: Upon initiation by normal source monitor and permission by alternate source monitor.

Time Delay Before Transfer to Alternate Power Source: 0 to 60 seconds, adjustable.

Initiate Re-transfer Load to Normal Source: Upon permission by normal source monitor.

Time Delay Before Transfer to Normal Power: 0 to 30 minutes adjustable.

Time Delay Before Engine Shut Down: 0 to 30 minutes, adjustable, unloaded operation.

Operating transfer time of the switch in either direction shall not be greater than 1/6 of a second.

**ACCESSORIES**

Manual Operator: Provide manual operator to allow switch to be operated under no-load conditions from behind a barriered partition or with the door closed.

Indicating Lights: LED type. Mount in cover of enclosure to indicate NORMAL SOURCE AVAILABLE, ALTERNATE SOURCE AVAILABLE, SWITCH POSITION.

Test Switch: Mount in cover of enclosure to simulate failure of normal source by interrupting the power signal to the normal source monitor.

Return to Normal Switch: Mount in cover of enclosure to initiate manual transfer from alternate to normal source.

Transfer Switch Auxiliary Contacts: Minimum 2 normally open; 2 normally closed.

Normal Source Monitor: Monitor each line of normal source voltage; adjustable set points; initiate transfer when voltage drops below 85 percent.

Alternate Source Monitor: Monitor alternate source voltage and frequency; adjustable set points; inhibit transfer when voltage is below 85 percent or frequency varies more than 3 Hertz from rated nominal voltage.

The switch shall contain an in-phase monitor or adjustable time delay transition to inhibit closing of the switch into high levels of motor residual voltage.

A factory installed equipment ground bar shall be provided in each switch enclosure.

Three-pole transfer switches shall contain a factory installed fully rated solid neutral lug assembly.

Provide digital metering on all transfer switches 200A and larger. Metering shall provide, at a minimum, measurement of voltage, current and kW demand for each phase on the load side of the switch.

Provide a minimum of 4 hours of on site training by the switch manufacturer’s authorized agent.

## PART 3 - EXECUTION

**INSTALLATION**

Install in accordance with manufacturer's instructions.

Starting contacts for all transfer switches shall be wired in parallel to the generator starting circuit so that any transfer switch that senses a loss of normal power will start the generator. This includes contacts as part of the fire pump controller. This control wiring is not shown on the plans but is required to be provided by the electrical contractor.

**FIELD ADJUSTMENTS**

The contractor shall field adjust all timing and voltage settings of the transfer switch as necessary for proper operation of the switch, related loads and sources.

END OF SECTION

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# SECTION 26 43 13
# TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

## PART 1 - GENERAL

**SCOPE**
The work under this section includes transient voltage surge suppressors (TVSS) as indicated on the project drawings and electrical diagrams. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Warranty
- Submittals

PART 2 - PRODUCTS
- Transient Voltage Surge Suppressors (Below 600V)

PART 3 - EXECUTION
- Installation

**RELATED WORK**
Applicable provisions of Division 1 govern work under this Section.

**REFERENCE STANDARDS**
NEMA LS-1 Standard on Low-Voltage Surge Protection Devices.
IEEE C62.62 Standard Test Specification for Surge Protective Devices For Low-Voltage AC Power Circuits.
IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
UL1449, Second Addition – Standard For Safety For Transient Voltage Surge Suppressors.

**QUALITY ASSURANCE**
The manufacturer shall have been in the TVSS industry for a minimum of 5 years.

**WARRANTY**
The manufacturer shall provide a 5 year warranty from the date of shipment of the TVSS.

**SUBMITTALS**
Include all TVSS data necessary to show device is in compliance with all product specifications. Include product data sheets which show the device dimensions, weight, connections, and mounting requirements, along with installation instructions.

## PART 2 - PRODUCTS

**TRANSIENT VOLTAGE SURGE SUPPRESSORS** (Below 600V)
The transient voltage surge suppressor (TVSS) shall be suitable for use on service entrances (ANSI/IEEE Standard C62, Category C environments). The TVSS shall be connected in parallel with the facility's electrical system.

The TVSS shall be listed in accordance with UL 1449, Second Addition.

The TVSS shall be made up of metal oxide varistors (MOV's), selenium cells, silicon avalanche diodes, or a combination thereof, ensuring that all of the performance requirements are met. Gas tubes shall not be used. The entire unit shall be enclosed in a metal or ABS enclosure, NEMA rated for the location. The TVSS device shall be a unit separate from the switchboard or panelboard (not integral to, or installed within the switchboard or panelboard).

The TVSS shall have a maximum continuous operating voltage (MCOV) rating not less than 115% of nominal voltage of the system it is protecting.

The TVSS shall have no less than line to neutral (L-N), line to ground (L-G), and neutral to ground (N-G) protection modes for wye configured systems. For a delta configured system, the device shall have line to line (L-L) and line to ground (L-G) protection modes.

The TVSS shall provide noise attenuation of 31dB minimum over the range of 100 kHz to 100 MHz.

The TVSS shall have a suppressed voltage rating (SVR) as assigned by UL1449, Second Addition which shall not exceed the following:

400 for L-N, L-G, N-G modes in 120/208V wye system.

The TVSS shall have a single-pulse (8 X 20 microsecond waveform as specified in ANSI/IEEE Standard C62) surge current capability of 100 kA (minimum) for each of the L-N, L-G and N-G modes in wye systems, and for each of the L-L and L-G modes for delta systems. Per phase rating not accepted.

Each TVSS shall include externally-mounted LED visual status indicators that indicate the on-line status of the unit, for each phase.

## PART 3 - EXECUTION

**INSTALLATION**

Install TVSS devices in accordance with manufacturer's written instructions, applicable requirements of NEC and NEMA standards, and recognized industry practices.

TVSS devices shall be installed at the locations shown on the drawings, or as indicated in the one-line diagram. They shall be parallel-connected to, and located adjacent to the switchboard or panelboard being protected. Locate as close as practical to the neutral bus bar, keeping lead length to a minimum. TVSS devices shall be connected through a multi-pole circuit breaker (30A maximum), not into main lugs. Where circuit breakers are unavailable, a fused disconnect switch should be used to connect to the leads and facilitate servicing of the device. Use schedule 40 PVC conduit between the TVSS device and the switchboard or panelboard. To connect the TVSS device to the circuit breaker or disconnect switch, use #10 conductors or the manufacturer’s recommended conductor size (whichever is larger). Avoid sharp bends, excess length, and splices in the wires. (Where possible, use a close-nippled connection with wires going directly to the breaker of the switchboard or panelboard).

Setup and test per the manufacturer's recommendations.

END OF SECTION

**26 51 13**
**LIGHTING FIXTURES, LAMPS, AND BALLASTS**

## PART 1 - GENERAL

### SCOPE
The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:



### RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Section 26 27 26 - Wiring Devices

### REFERENCE STANDARDS
RoHS - Restriction of Hazardous Substances. Council of the European Union (EC) Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

LM-79-08 (or latest) - IES Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

LM-80-08 (or latest) - IES Approved Method for Measuring Lumen Maintenance of LED Light Sources.

TM-21-11 (or latest) - IES Technical Memorandum on Projecting Long Term Lumen Maintenance of LED Light Sources.

NEMA SSL 1-2010 (or latest) - Electronic Drivers for LED Devices, Arrays, or Systems.

### DEFINITIONS
Driver - the power supply used to power LED luminaires, modules, or arrays.

L70, $L_{70,}$ or $L_{70\%}$ - The reported life of an LED component or system to reach 70% lumen maintenance, or 70% of the LED's original light output. This test is being developed by the IES and is currently described by TM-21-11.

LED's - Broadly defined as complete luminaire with light emitting diode (LED) packages, modules, light bars or arrays, complete with driver.

LED luminaire failure - Negligible light output from more than 10 percent of the LED's constitutes luminaire failure.

### SUBMITTALS
Include outline drawings, lamp and ballast data, support points, weights, accessory information and performance data for each luminaire type.

For each luminaire type, submit luminaire information including catalog cuts with highlighted catalog numbers and required accessories:

- Luminaire:
  - Manufacturer and catalog number.
  - Type (identification) as indicated on the plans and schedule.
- Ballast:
  - Manufacturer and catalog number.
  - Type (Programmed Start, etc.), Ballast Factor, THD, etc.
  - Quantity per luminaire.
- Lamps:
  - Manufacturer, catalog number, and wattage
  - Quantity per luminaire

**OPERATION AND MAINTENANCE DATA**
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

**EXTRA MATERIAL**
Provide three (3) percent of each lamp type, but not less than one (1) of each type.

Provide one (1) of each type of LED module, light bar, or array (if applicable). If the LED's are integrated into the luminaire and are not separate components, then extra LED's are not required.

Provide one (1) ballast of each type. This includes LED drivers.

## PART 2 - PRODUCTS

**INTERIOR LUMINAIRES AND ACCESSORIES**
See the Luminaire Schedule on the drawings for type of luminaires and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Luminaires manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated luminaires, and meet the intent of the design.

Luminaire shall be certified by a Nationally Recognized Testing Laboratory (UL, ETL, or IEC).

Provide luminaires with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

Fluorescent T8 lamps and ballasts shall be listed on CEE high-performance qualifying product list and approved by Focus–On–Energy.

**LAMPS**
General Use Incandescent Lamps and Incandescent Reflector Lamps are prohibited. Use LED retrofit lamps or LED luminaires in lieu of incandescent or halogen luminaires. LED retrofit lamps shall be:

- Rated for the voltage of the incandescent lamp/luminaire they are replacing.
- Dimmable where required as indicated on the plans.
- Rated for the luminaire in which they are being installed. Verify whether the luminaire is enclosed and whether the LED retrofit lamp is rated for enclosed luminaires and the temperatures that will be encountered.
- LED lamps/luminaires shall provide delivered footcandles equal to or greater than the footcandles provided by an equivalent incandescent lamp/luminaire.
- LED retrofit lamps shall have an average rated life of 25,000 hours, minimum.
- Lamp color temperature shall be nearly equal to the incandescent lamp it is replacing.

  Manufacturer names and catalog numbers are used to develop quality and performance requirements only. Lamps manufactured by others will be accepted provided they meet or exceed the specifications.

All lamps shall be new.

**LED LUMINAIRES**

- LED Luminaires shall meet all DesignLights Consortium® (DesignLights.org) Product Qualification Criteria. This does not require that the luminaire be listed on the DesignLights Consortium's® Qualified

Products List, but they must meet the Product Qualification Criteria. The technical requirements that the luminaire shall meet for each Application Category are:

- Minimum Light Output.
- Zonal Lumen Requirements.
- Minimum Luminaire Efficacy.
- Minimum CRI.
- L70 Lumen Maintenance.
- Minimum Luminaire Warranty of 5 years (not pro-rated) to include LED driver and all LED components.

*Additional requirements:*

- Color Temperature of 3000K-4100K for interior luminaires as listed in the Luminaire Schedule on the plans. The color temperature of exterior LED luminaires should not exceed 4100K (nominal).
- Color Consistency: LED manufacturer shall use a maximum 3-step MacAdam Ellipse binning process to achieve consistent luminaire-to-luminaire color for interior luminaires. Exterior luminaires shall use a maximum 5-step MacAdam Ellipse binning process.
- Glare Control: Exterior luminaires shall meet DesignLights Consortium's® criteria for Zonal Lumen Distribution requirements or Backlight-Uplight-Glare (BUG) standards for exterior luminaires.
- Luminaire shall be mercury-free, lead-free, and RoHS compliant.
- Luminaire shall comply with FCC 47 CFR part 15 non-consumer RFI/EMI standards.
- Light output of the LED system shall be measured using the absolute photometry method following IES LM-79 and IES LM-80 requirements and guidelines.
- Luminaire shall maintain 70% lumen output (L70) for a minimum of 50,000 hours.
- Driver shall have a rated life of 50,000 hours, minimum.
- Lumen output shall not depreciate more than 20% after 10,000 hours of use.
- Driver and LEDs shall be furnished from a single manufacturer to ensure compatibility.
- Luminaire Color Rendering Index (CRI) shall be a minimum of 80 for interior luminaires, and a minimum of 70 for exterior luminaires.
- LED luminaire shall be thermally designed as to not exceed the maximum junction temperature of the LED for the ambient temperature of the location the luminaire is to be installed. Rated case temperature shall be suitable for operation in the ambient temperatures typically found for the intended installation. Exterior luminaires to operate in ambient temperatures of -20°F to 122°F (-29°C to 50°C).
- LED driver shall have a minimum power factor (pf) of 0.9 and a maximum crest factor (cf) of 1.5 at full input power and across specified voltage range.
- Luminaire shall operate normally for input voltage fluctuations of plus or minus 10 percent.
- Luminaire shall have a maximum Total Harmonic Distortion (THD) of 20% at full input power and across specified voltage range.
- Wiring connections to LED drivers shall utilize polarized quick-disconnects for field maintenance.
- All connections to luminaires shall be reverse polarity protected and provide high voltage protection in the event connections are reversed or shorted during the installation process.
- Fuse Protections: All luminaires shall have built-in fuse protection. All power supply outputs shall be either fuse protected or be Polymeric Positive Temperature Coefficient (PTC)-protected as per Class 2 UL listing.
- All luminaires shall be provided with knockouts for conduit connections.
- The LED luminaire shall carry a limited 5-year warranty minimum for LED light engine(s)/board array, and driver(s).
- Provide all of the following data on submittals:
  - Delivered lumens
  - Input watts
  - Efficacy
  - Color rendering index.

*LED Luminaires used for Emergency Egress Lighting:*

- The failure of one LED shall not affect the operation of the remaining LEDs.

*Emergency LED Luminaire Compatibility with Inverters:*

- Emergency Inverters shall be sine-wave type, or have written confirmation from the luminaire manufacturer that the luminaire will function with a square-wave inverter.

*Dimming:*

- LED driver shall be compatible with dimming controls where dimming is indicated on the plans. Dimmable drivers shall use Dimming Constant Current (DCC) or Pulse Width Modulation (PWM) operation.
- LED luminaires shall dim to (20%, 15%, 10%, 5%, or 0.1%) as specified in the Luminaire Schedule on the plans without visible flicker or "popcorn effect". "Popcorn effect" is defined as the luminaire being on a

pre-set dimmed level (less than 100%), and going to 100% prior to returning to the pre-set level when power is returned to the luminaire.

## PART 3 - EXECUTION

### INSTALLATION

Verify ceiling types with Architectural plans or with existing ceilings. Verify specified luminaires are compatible with specified ceiling type(s) prior to ordering luminaires.

Install in accordance with manufacturer's instructions.

Install suspended luminaires using aircraft cable, or pendants supported from swivel hangers. Heavy duty chain supports may be used where indicated on the luminaire schedule. Provide aircraft cable, pendants, or chain lengths required to suspend luminaire at indicated height. All aircraft cables or pendant supported luminaires shall have an independent support to structure at all cable or pendant support locations. When chain is used, tie-wrap the luminaire whip to the chain.

Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.

Provide independent support for all luminaires over 50 lbs.

Locate ceiling luminaires as indicated on reflected ceiling plan.

Install surface mounted luminaires and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

The Contractor shall install luminaire supports as required. Luminaire installations with luminaires supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all luminaires adequately, providing extra steel work for the support of luminaires if required. Any components necessary for mounting luminaires shall be provided by the Contractor. No plastic, composition or wood type anchors shall be used.

Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure

Install recessed luminaires to permit removal from below.

Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.

Install code required hardware to secure recessed grid-supported luminaires in place.

Install wall mounted luminaires and exit signs at height as scheduled. Use pendants supported from swivel hangers in exposed ceiling/structure locations where necessary to mount exit signs at the specified height.

Install accessories furnished with each luminaire.

Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Bond luminaires and metal accessories to branch circuit equipment grounding conductor.

Install specified lamps in each luminaire and exit sign.

Dimmed luminaire circuits shall have separate neutrals.

Dimmed LED luminaires shall have a positive OFF, which requires turning off the circuit to the luminaire so that the luminaires don't "glow" at the lowest dimmed setting. This shall be accomplished using a switch, relay, or some other means acceptable to The Engineer/Owner.

### ADJUSTING AND CLEANING

Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

Aim and adjust luminaires as indicated on Drawings or as directed by the A/E.

Touch up luminaire finish at completion of work.

**INTERFACE WITH OTHER PRODUCTS**
Interface with air handling accessories furnished and installed under Division 23.

Provide controls as indicated on the plans. Refer to section 26 27 26 - Wiring Devices. Controls shall be compatible with the luminaires/ballasts/drivers being installed.

**FIELD QUALITY CONTROL**
Operate each luminaire after installation and connection. Inspect for proper connection and operation.

END OF SECTION

# SECTION 28 31 00
# FIRE DETECTION AND ALARM

## PART 1 - GENERAL

### SCOPE

The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations associated with the installation of the new Fire Alarm System as shown on the drawings and as herein specified. Included are the following topics:

**PART 1 - GENERAL**
- Scope
- Related Work
- Description of Work
- Regulatory Requirements
- Manufacturer Provided Services
- Quality Assurance
- Qualifications
- Submittals
- Department of Safety and Professional Services Plan Review
- City of Madison – Fire Department Inspection / Fire Alarm Work Permit
- Project Record Drawings
- Operation and Maintenance Manuals
- Product Delivery, Storage and Handling
- Spare Parts
- Supervision
- Power Requirements

**PART 2 - PRODUCTS**
- Enclosures
- Multiplex/Intelligent Fire Alarm Control Panel
- Operation - Multiplex/Intelligent Fire Alarm System
- Central Monitoring
- One-Way Voice Communication Sub-System
- Operation - One-Way Voice Communication
- Remote Annunciator Panel
- NAC Booster Panels (Remote Power Supplies)
- Multiplex/Intelligent Peripheral devices
- Fault Isolator Module (FIM)
- Audio Visual Notification Appliances
- Printers and Terminals
- Special Devices

**PART 3 - EXECUTION**
- General
- Raceways
- Conductors
- Device Mounting
- Identifications
- Testing
- Warranty
- Training

### RELATED WORK

The work covered by this section of the specifications shall be coordinated with the related work as specified elsewhere under the following project sections:
Section 26 05 00 - Common Work Results for Electrical
Section 26 05 26 – Grounding and Bonding for Electrical Systems
Section 26 05 29 – Hangers and Supports for Electrical Systems
Section 26 05 33 – Raceway and Boxes for Electrical Systems
Section 26 05 53 – Identifications for Electrical Systems

### DESCRIPTION OF WORK

Furnish and install a complete Multiplex/Intelligent Fire Alarm System within the Blue Shed Highway Storage Facility, 2302 Fish Hatchery Road, Madison, Wisconsin, as described herein and as shown on the plans; to be wired, connected, and left in first class operating condition.

The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

The New Fire Alarm System shall consist of a single Main Fire Alarm Control Panel (FACP), Fire Alarm Annunciator Panel (FAAP), unless a different design is submitted and approved.

The New Fire Alarm System shall be configured as a local protective signaling system, as defined in NFPA-72, and shall use/incorporate the following features, as a minimum:

The latest intelligent analog, addressable technology (detectors/sensors and modular panel equipment) currently available from the manufacturer

Floors with more than 25 Addressable Devices shall be split into isolated SLC circuits where each circuit shall not have more 25 devices. Where this is done, the floor shall be "split" along a logical, physical boundary.

Network Connections, Data, Audio, and Signaling Line Circuits, which functionally link together multiple panels or Transponders shall be wired in an NFPA Style 6 (Class A) arrangement.

Initiating Device Circuits (IDCs) shall be limited to short runs from Monitor Modules to the connected device, unless specifically stated otherwise herein, and shall be configured as NFPA Style B (Class B), with individual zone supervision.

Notification Appliance Circuits (NACs) shall be configured as NFPA Style Y (Class "B"). Audible NACs serving Speakers shall be installed using shielded cable, such that the speakers do not generate unwanted noises, due to cross-talk with other circuits.

Data Circuits to Annunciators shall be configured as NFPA Style 4 (Class "B"). All annunciators shall be fully supervised.

The system shall be an intelligent/analog type, and shall consist of the following panels:

| PANEL NAME: | PANEL TYPE: | PANEL LOCATION: |
|---|---|---|
| FACP | Main Fire Alarm Control Panel | Office Building |
| FAAP | Fire Alarm Annunciator Panel | Office Building |
| | | |

**REGULATORY REQUIREMENTS**

The complete installation shall conform to the applicable sections of the latest edition of the following Codes and Standards:

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA):

| | |
|---|---|
| NFPA-70 | National Electrical Code (NEC) Generally, and Article 760 in particular |
| NFPA-72 | National Fire Alarm Code |
| NFPA 101 | Life Safety Code |
| IBC | International Building Code |
| IFC | International Fire Code |
| IMC | International Mechanical Code |

STATE OF WISCONSIN – DEPARTMENT OF COMMERCE (COMM)

NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION (NEMA)

UNDERWRITERS' LABORATORIES, INC. (UL)

| | |
|---|---|
| UL-864 | Control Units for Fire Protective Signaling Systems |
| UL-268 | Smoke Detector for Fire Protective Signaling Systems |
| UL-217 | Smoke Detectors for Single and Multiple Station |
| UL-521 | Heat Detectors for Fire Protective Signaling Systems |
| UL-464 | Audible Signaling Appliances |
| UL-1971 | Visual Signaling Appliances |
| UL-38 | Manually Actuated Signaling Boxes |
| UL-1481 | Power Supplies for Fire Protective Signaling Systems |

**MANUFACTURER PROVIDED SERVICES**

A manufacturer-trained service technician shall provide the following installation supervision. This Technician shall be certified by the equipment manufacturer, and shall have had a minimum of two (2) years of service experience in the fire alarm industry.

The technician's name shall appear on equipment submittals and a letter of certification from the fire alarm manufacturer shall be sent to the project engineer. The manufacturer's service technician shall be responsible for the following items:

Pre-installation visit to the job site to review equipment submittals and verify method by which the system should be wired.

Periodic job site visits to verify installation and wiring of system, and to perform any partial system programming – required to permit portions of the existing system to be removed.

Upon completion of wiring, final connections shall be made under the supervision of this technician, and final checkout and certification of the system.

At the time of final checkout, technician shall give operational instructions to the Owner and/or his representative on the system.

All job site visits shall be dated and documented in writing and signed by the Electrical Contractor. Any discrepancy shall be noted on this document and a copy kept in the system job folder that shall be available to the Project Engineer any time during the project.

**QUALITY ASSURANCE**

Unless specifically stated otherwise, each and all items of the fire alarm system shall be listed as a product of a SINGLE fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the UL label.

Notification Appliances may be products of a single, different manufacturer – provided that the Primary Equipment Provider or Manufacturer provides written documentation of compatibility, and agrees to assume any and all responsibility for compatibility with the Control Equipment.

In addition to previously listed UL standards, all control equipment shall be listed under the following UL Standards:

| | |
|---|---|
| UOJZ | UL category UOJZ as a single control unit. Partial listing shall NOT be acceptable. |
| UL 864 | Transient protection |
| UL 497B | Isolated Loop Circuit Protectors. Where fire alarm circuits leave the building, additional Transient protection must be provided for each circuit. |
| UL 1481 | Power Limited Applications. |

**QUALIFICATIONS**

All equipment shall be supplied by a firm, which specializes in fire alarm and smoke detection systems with a minimum of five (5) years-documented experience. The company shall be an authorized distributor of the proposed equipment

All work shall be performed by a licensed contractor, who is regularly engaged in the installation and servicing of fire alarm systems. Proof of five (5) years documented experience and of factory authorization to furnish and install the equipment proposed shall be furnished prior to contract award, if required by Division of State Facilities.

Contractor shall be located within three (3) hours of travel time or less from the site of this project.

**SUBMITTALS**

Under the provisions of Section 26 05 00 and Division 1, submit the following for approval prior to ordering any equipment in accordance with requirements of Division 1, General Conditions. Submit a total of six (6) sets.

Copies of CAD Files (AutoCAD or DXF Format) for the Fire Alarm floor plans will be made available to the successful bidder for preparation of the required shop drawings and as-builts

<u>REQUIRED SUBMITTAL MATERIALS</u>

The following items, and any additional items required per Section 26 05 00, shall be included within the submittal package:

Although they may be submitted under separate cover, Submittal Brochures / Booklets / Binders and Shop Drawings shall be submitted together, and shall be treated as a complete set.

COVER SHEET:
The submittals shall contain a cover sheet, which shall include the following information:

Submittal Date
Specification Section(s)
Fire Alarm Contractor (Contact Name, name, address, and telephone number)
Electrical Contractor (Contact Name, name, address, and telephone number)
Project Name, Project City, Project State, and Project Address.

TABS AND TABLE OF CONTENTS:
The Table of Contents shall appear immediately behind the Cover Sheet, and shall contain a complete listing of all of the tabs contained within the binder / booklet.

Tabbed index sheets shall be inserted into each of the binders, such that each binder is clearly sub-divided into sections. Tabbed sections shall be provided, at minimum, for the following:

One section for each building – ALL submittal data, which applies to any particular building, shall be located within the tabbed section for the corresponding building. All submittal data within each "building" section shall appear in the same order.

One section for manufacturer's data sheets – divided into sub-sections for the following:

Panel Equipment (Panels, Panel Components / Modules, Printers, Annunciators, etc.)
Addressable Field Devices (Initiating and Control / Monitoring / Isolation)
Non-Addressable Field Devices (Initiating Devices, relays, etc.)
Notification Appliances
Fire-Fighter Communications Equipment if applicable

EQUIPMENT LIST:
A complete equipment list of all components, including the following: Quantity, Manufacturer, Part Number, and Description. If the supplier uses different part numbers from those of the actual manufacturer, the actual manufacturer and part numbers as they appear – marked on the shipping box / packages, shall also be identified on this list.

Each Equipment List shall include a complete listing of the modules, components, and software included for each modular Fire Alarm Control Panel, Network Panel, Transponder, Outboard Gear Panel or Annunciator. Such items shall be listed in a manner that clearly indicates that such items are parts of / components of a larger unit. Simply stating a single part number and description for such panels shall be unacceptable.

A separate list shall be included for each section, with items grouped by system.

For projects involving multiple systems, separate equipment lists shall be provided - one for each system.

Spare Parts shall also be listed separately, and shall be identified clearly as "Spare Equipment".

PRODUCT DATA:
Manufacturer's product data sheets, and equipment description of all system components. These data sheets shall be highlighted or suitably marked, so that included items and options are indicated. On data sheets that include multiple products, products that are not used shall be crossed out.

Product Data Sheets shall be organized, in order, corresponding to the FIRST occurrence of the corresponding item on the equipment list

SEQUENCE OF OPERATION:
Complete sequence of operations of all functions of the system. This sequence of operation shall be custom-created for this particular job.

In order to satisfy this submittal requirement, it shall be acceptable to include copies of the "Operation" portions of the specifications, including any applicable schedules / other supplementary information. Copied specification pages shall be marked and highlighted, where the programmed operation will differ from the specified operation. Copied specification pages shall be marked "no

changes", where no significant deviation will occur. Other acceptable alternatives shall include written narratives, organized in a logical manner, and Matrix Charts.

Where Matrix Charts are provided, such charts shall be organized and labeled clearly, and shall incorporate suitable levels of detail (refer to NFPA-72 (1999) A-7-5-2.2(9) for an example of an acceptable matrix chart). The Leftmost column of the Matrix Chart shall include groupings of initiating devices and other function switches. The Topmost Row shall include groupings of notification appliances and output devices.

BATTERY CALCULATIONS:
These calculations shall clearly illustrate both the Standby and Alarm loads, due to the various field devices and panel components / modules. It is generally recommended to submit such calculations in a "spreadsheet" format. These calculations shall include any reserve / additional capacity, as required elsewhere within these specifications. Final results shall indicate both the minimum battery capacity required and the capacity actually provided.

It shall be acceptable to provide Maximum / Full-Load calculations for items such as NAC Booster Panels. Where this is done, the calculation sheet shall be marked as, "typical of nnnx, nnny, nnnz …." (where nnnx, nnny, nnnz … = panel names).

AMPLIFIER CAPACITY CALCULATIONS
For all speakers plus all required spare capacity.

ADDRESSABLE DEVICE / DESCRIPTOR LIST - Prior to programming the system, submit a chart or printout, listing every system address provided for purposes of alarm initiation, status monitoring, supervised signaling, and auxiliary controls. This printout shall include the corresponding device type and field programmable "custom labels", as they will be displayed on the New System – at the FACP and Local Annunciator. The addresses listed within this document shall directly correspond to the addresses marked on the submitted floor plan drawings. This list will be modified as needed by the Owner and returned to the contractor for final programming in to the system.

NAC WIRE DROP CALCULATIONS:
Calculations shall be provided for at least one Notification Appliance Circuit (NAC) per building. This calculation should cover the "worst case" (longest and / or most heavily loaded) NAC(s) as installed within the facility. It is recommended that this calculation should follow a "spreadsheet" format, and should clearly indicate the following:

The name of the circuit
Point of origin of the circuit
Complete list of all devices served by the circuit, including location and type of each device
Alarm Current Draw for each device, at the applied voltage
Applied Voltage (Based on anticipated battery voltage after specified stand-by & alarm operation)
Acceptable Operating Voltage for each type of device on circuit
Calculated Voltage at each device on circuit

These calculations should mathematically prove that all Notification Appliances on the circuit will receive acceptable power for proper operation, under "worst-case-scenario" conditions.

SHOP DRAWINGS:
All submitted drawings shall be created using CAD, and shall be coordinated so that terminal numbering, circuit designation and equipment or device designations are the same on all drawings. All drawings must be submitted and approved by the engineer before ordering or fabrication starts, but such approval will not waive any specification requirements unless specifically stated. A/E shall provide copies of the floor plan drawings, in AutoCAD or DXF format, to the successful bidder.

Each and every sheet of the Shop Drawings shall be clearly and prominently identified as "SHOP DRAWINGS – PREPARED BY: (insert name of contractor firm preparing the shop drawings)", and shall be clearly and visibly different from the Contract Documents / Bidding Drawings. As a minimum, the name and company logo for the Electrical Contractor and the Fire Alarm Equipment Vendor should be added to each sheet, and a revision date shall be inserted on each sheet.

The submitted Shop Drawings shall include the following types of drawings:

PROJECT-SPECIFIC DRAWINGS:
Project-Specific Drawings. These drawings shall include the following:

SYSTEM RISER DRAWING:
A separate riser drawing shall be furnished for each system. Each System Riser shall illustrate all fire alarm circuits, which serve the facility, and shall incorporate the following information, in a clear, concise format:

- Point of origin of each circuit (usually a Panel, or a Module within a panel)
- Circuit type and labeling
- Area served by each circuit
- Wire / cable type and size
- Locations of Panelboards where primary system power is obtained
- The following information for each Field Device:
  - Device Type
  - Circuit(s) to which device is connected
  - Locations of any End-Of-Line Resistor (EOLR)
  - (and the circuit terminated by any such EOLR)

BLOCK DIAGRAMS:
Showing layout and operation of the entire system.

FLOOR PLANS:
These drawings shall consist of edited versions of the Contract Documents, which shall include the following information:

- Fire Department Response Location(s)
- Annunciator Location(s)
- Panel Location(s)
- Locations of new and known existing Junction Boxes
- Proposed routing of new and known existing raceways
- Conduit and raceways sizes
- Wire / cable type and size
- Device Addresses - The addresses shown on these drawings shall directly correspond to the chart or printout, as specified previously, which spells out specific information about each device, including the field programmable "custom label".

TYPICAL DEVICE / MODULE WIRING DETAILS:
Component and module wiring diagrams – intended to illustrate terminations and wiring connections to each typical Field Device (Detectors, Notification Appliances, etc.), and each typical panel component / module utilized within the system. This set of drawings shall only include diagrams for modules and components, which are actually used in the provided system(s).

These drawings shall incorporate clear labeling / nomenclature, which shall clearly indicate the corresponding field device or module, to which it corresponds.

OMISSION OF ANY OF THE ABOVE MATERIALS FROM THE SUBMITTALS SHALL RESULT IN AN IMMEDIATE REJECTION OF THE SUBMITTALS FOR THIS PROJECT. If the EC / FAC has any questions concerning the preparation of these materials, please contact the Engineer.

**DEPARTMENT OF SAFETY AND PROFESSIONAL SERVICES PLAN REVIEW**

REQUIRED DOCUMENTS (per building)

This project requires a submittal to the Department of Safety and Professional Services for review and approval. The following details the requirements of the contractor and the A/E with regard to the fire alarm Department of Safety and Professional Services submittal.

CONTRACTOR'S RESPONSIBILITY

a) Department of Safety and Professional Services approval is required prior to the start of fire alarm system construction. The contractor shall prepare and submit the required documents in a timely fashion to meet this requirement. If the contractor starts fire alarm system construction before approval is given by the Department of Safety and Professional Services, the contractor is responsible for all additional fees required by the Department of Commerce.

b) Initially, prepare one set of the Department of Safety and Professional Services fire alarm submittals and send it to the A/E for approval before proceeding with actual submittal to DSPS.

c) Contractor shall follow A/E's CAD standards when preparing fire alarm shop drawings, using information consistent with the project's construction drawings.

d) After obtaining A/E approval to proceed with the Department of Safety and Professional Services fire alarm submittal, prepare four (4) sets of the fire alarm shop drawings as approved by the A/E that will be sent to the Department of Safety and Professional Services by the contractor. These shop drawings shall be stamped, signed and dated by a Wisconsin registered architect, professional engineer or electrical designer taking responsibility for the shop drawings. Signing and sealing shall comply with SPS 361.31(1). Note that each shop drawing copy must be stamped, signed and dated unless there is a drawing index sheet, in which case only the four index sheets need to be stamped, signed and dated. Where the submitter is both the designer and installer of the fire alarm system, a signature only will suffice [ch. 443.14(6), Stats.]. It shall be an original signature and date.

e) Prepare one bound booklet of the fire alarm system device cut sheets and all calculations (indicating device power calculations, voltage drop calculations and battery calculations). These booklets do not need to be stamped, signed or dated.

f) Prepare a letter of transmittal listing all items being sent to the Department of Safety and Professional Services. Copy the A/E on the letter of transmittal only.

g) Complete the Application for Review, Buildings, HVAC, Fire and Components – SBD-118 form.

h) Calculate the SDB-118 submittal fee; write a check for the appropriate amount, payable to Safety and Professional Services.

i) Request a review date with Department of Safety and Professional Services, Division of Safety and Buildings by emailing the completed first page of the review application, SBD-118, to planschedule@commerce.state.wi.us. or, fax it to 877-840-9172.

j) Assemble the submittal and send the documents described in items (d), (e), (f), (g) and (h) above to the Department of Safety and Professional Services at the appropriate address shown on at the bottom of DBS-118.

k) If requested by the A/E, Department of Safety and Professional Services or its authorized representative, additional data pertaining to the construction, materials and equipment shall be submitted to the A/E to substantiate conformance to DSPS 361 code.

PLAN REVIEW FEES

Fees shall be determined in accordance with Table 302.31-1 or Table 302.31-2 found in Chapter SPS 302 of the Wisconsin Administrative Code.

Reduced plan review fees (Table 302.31-2) may be utilized for projects in municipalities that perform inspections as an agent of the Division of Safety & Buildings.

A list of "Delegated Municipalities" that perform inspections can be found at:
http://dsps.wi.gov/sb/SB-CommBldgsDeleMunis.html

Reduced fees (Table 302.31-2) do **not** apply to State-owned buildings.

In addition to the plan review fee, a plan entry fee of $100 shall be included with each submittal.

Per SPS 302.10, plan review fees shall be **doubled** for projects where the installation, erection or construction was initiated without the required Departmental approval.

WHAT TO SUBMIT

a) Four (4) sets of properly signed/sealed fire alarm plans.

In an effort to limit handling and mailing costs, the submitter may opt to submit one (1) complete set of plans and three (3) index sheets. The plan set will be retained. A copy of the approval letter will be attached to the index sheets and returned. It shall then be the responsibility of the submitter to properly attach the approval and index page to plans matching the copy on file with the Department.

A maximum of five (5) plan sets may be submitted. Additional plan sets (in excess of 5) will incur a $25/set fee.

b) One (1) set of battery calculations.

b) One (1) set of voltage-drop calculations for each notification circuit.

d) One (1) copy of applicable material data sheets.
e) A detailed, project-specific 'Sequence of Operation' which clearly identifies all functions of the fire alarm system, including the transmission of alarm, supervisory and trouble signals to an approved supervising station.
f) A completed SBD-118 application form.
The application must identify the Transaction ID No. related to the parent building review approval. Fire alarm submittals for new construction, building additions or building alterations cannot be reviewed prior to building plan approval.
The original supervising professional's signature for the building project is applicable to fire alarm submittals and a separate signature is not required. Standalone fire alarm system submittals do not require a supervising professional.
g) Plan review fee.

FORMS
SBD-118 (R11/11) can be downloaded from: http://dsps.wi.gov/sb/docs/sb-Form118App.pdf (PDF) or http://dsps.wi.gov/sb/docs/SB-Form118App.doc (Word)

Visit Department of Safety and Professional Services, Division of Safety and Buildings Commercial Buildings Plan Review info website for additional information: http://dsps.wi.gov/sb/SB-HomePage.html.

For scheduling of building, HVAC, and fire plans, use the electronic online request for commercial building plan appointments: http://dsps.wi.gov/sb/SB-DivPlanReview.html

Once approved, Safety and Buildings will retain one of the sets, and will return three sets, which shall be distributed as follows:

(1) copy shall be retained by the fire alarm contractor on-site, and shall be used as a reference / made available to any Department of Safety and Professional Services inspectors, who may make periodic inspection visits to the site.

(1) copy shall be forwarded to the Owner for their records.

(1) copy shall be retained by the Division 26 electrical contractor, for their records. If the Division 26 electrical contractor and the fire alarm contractor are the same firm, this copy shall be kept on site, at or near to the Fire Alarm Control Panel.

**CITY OF MADISON – FIRE DEPARTMENT INSPECTION / FIRE ALARM WORK PERMIT:**
PER A LOCAL ORDINANCE (City of Madison General Ordinance 34 – Fire Prevention Code)
EFFECTIVE AS OF JULY 2, 2002 - THE FIRE ALARM AND FIRE PROTECTION SYSTEMS, AS INSTALLED WITHIN THIS FACILITY ARE SUBJECT TO PERMIT REQUIREMENTS AND INSPECTIONS OF THE INSTALLATION BY THE CITY OF MADISON – FIRE DEPARTMENT / FIRE PREVENTION BUREAU:

THE FAC SHALL BE RESPONSIBLE FOR SCHEDULING, COORDINATING, AND ATTENDING THIS INSPECTION, AND FOR PAYMENT OF ALL ASSOCIATED INSPECTION / PERMIT FEES.

This process normally involves both a plan review and inspections; however, for State-Owned Buildings, the City of Madison only performs the inspections, with the Plan Review being performed by COMM / Safety & Buildings as specified previously under "Submittals".

Copies of the applicable Code can be obtained on-line, via the following link:

http://www.madisonfire.org/prevention/pdf/mgo34.pdf

Because of this Permit / Inspection process, the following procedure shall be followed by the Division 26 Electrical Contractor, (and by their sub-contractors, where particular arrangements have been made between the EC and their sub-contractor(s)):

First, the Electrical Contractor shall obtain State-Approval of the Installation Drawings, per the process previously described under "Submittals – Plan Review Process", as found within this specification.

Once the State-Approved Drawings are received by the contractor, and PRIOR TO STARTING ANY CONSTRUCTION, the Electrical Contractor shall completely fill-out submit the proper "City of Madison Fire Department – Fire Protection System Work Permit Application" form. If required, suitable fee payment shall accompany the form. Copies of this form may be obtained via the following link:

http://www.madisonfire.org/prevention/fire_protection_engineering/pdf_files/master_plan_review_permit_application.pdf

Once the form has been received, processed, and accepted by the Madison Fire Department (MFD), MFD will issue the proper permit, and construction may begin.

The inspection program involves at least two inspections, as follows:

A Rough-In Inspection shall be scheduled and performed, prior to installation of any new devices. In certain buildings (high-rises), multiple rough-in inspections may be required, as subsequent areas are completed. It is highly recommended that these inspections should be carefully scheduled and adhered to, since potentially costly mistakes can be prevented before the associated devices are completely installed.

Final Inspection of the System – prior to this inspection, the Electrical Contractor shall have conducted all necessary pre-testing.

Questions regarding this inspection program may be directed to:

City of Madison – Fire Department – Fire Prevention Bureau
325 West Johnson Street
Madison, WI 53703
Phone: (608) 266 – 4420 (Non-Emergency Number)

**PROJECT RECORD DRAWINGS**

Contractor shall submit to the A/E the as-built drawings for the entire work done under this project prior to final payment.

Work shall be done on Auto CAD using the contract drawings provided to the Contractor by A/E in the form of Auto CAD files. A hard copy of same shall also be submitted.

These drawings shall show:

Locations and addresses of Initiation Devices, Notification Appliances, isolation devices, status-monitoring devices, supervised signaling devices, and auxiliary control devices.
Circuit and Address information for each field device listed above.
Conduit layout and size
Number/size/type/Color-Code of conductors in each conduit run
Riser diagrams
Location of end-of-line devices
List of custom labels as installed for each address

Riser diagrams shall include location of emergency 120VAC panel, panel designation and circuit number used to feed each fire alarm panel. Also, indicate if panel is backed up by an emergency generator.

Riser diagrams shall include locations (room or area number) of notification, initiating, end-of-line devices and addresses for all addressable field devices.

Also see requirements in Division 1, General Conditions.

**OPERATION AND MAINTENANCE MANUALS**

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

In addition to the general content specified under GENERAL REQUIREMENTS supply the following additional documentation:

- A material guide, which shall contain the replacement part numbers and description of all components used. If this information is included in an instruction section for any of the equipment, it will not be necessary to duplicate the list. In either case, the parts list shall be associated with its respective chassis, modules or kit wherein it is found. A total listing of parts without such grouping will not be acceptable.

- Catalog data or literature
- Manufacturer's operating instructions.
- Manufacturer's maintenance instructions
- Installation instructions
- Name, address and telephone number of source for parts (i.e. keys, guards, etc) not supplied by the Fire Alarm Manufacturer
- Copies of all approved shop drawings
- An updated copy of the submitted sequence of operation, revised to reflect any implemented changes

**PRODUCT DELIVERY, STORAGE AND HANDLING**

Receive equipment at job site; verify applicable components and quantity delivered.

Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.

Do not install damaged equipment.

Store equipment in a clean, dry space and protect from dirt, fumes, water, and construction debris and physical damage. Make arrangements with the Owner at the pre-construction meeting for storage of equipment on the premises

**SPARE PARTS**

Contractor shall provide the following spare parts in quantities shown:

| Quantity : | Type of Device |
|---|---|
| (2) | Photoelectric smoke detectors |
| (2) | Heat detectors |
| (4) | Smoke and heat detector bases – "standard" 2-Wire Type |
| (1) | Monitor Module (of each type utilized in this project) |
| (1) | Control Modules |
| (2) | Wall-Mount Speaker/strobe Units. |
| (2) | Strobe-Only Unit, of each intensity used on the project. (If devices with field-selectable candela are used, then a total of (6) such units shall be provided |
| (2) | Pull Stations |

**SUPERVISION**

The system shall report a TROUBLE condition when any supervised circuit becomes disarranged, disconnected, or is manually disabled or overridden. Each supervised circuit shall be independently protected for short-circuit conditions, and shall be arranged so that faults on any one circuit do not prevent the proper operation of any other circuit in the system.

The following devices/circuits shall be supervised, as a minimum:

ALL communications links.
ALL Signaling Line Circuits
ALL Initiating Device Circuits.
All sprinkler flow and tamper switches..
ALL Notification Appliance Circuits.
Auxiliary manual control circuits.
Remote Control Relays / Control Modules.
Primary, AC Incoming power to the system.
The system's batteries.
System Expansion Modules
Auxiliary module LED's.

The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

Each independently supervised circuit shall include a discrete LCD readout, to indicate disarrangement conditions per circuit.

**POWER REQUIREMENTS**

Primary 120 VAC power, to all Fire Alarm equipment shall consist of dedicated branch circuits. These circuits shall be of a 3-conductor type, including a suitably sized green ground wire – SHARED NEUTRALS AND CONDUIT GROUNDS SHALL BE UNACCEPTABLE.

Each control panel shall receive 120 VAC power via a branch circuit in one of the building's emergency load panels. Each such branch circuit shall have a "breaker lock" to prevent accidentally de-energizing of the power to the fire alarm panel. Circuit breakers shall be painted red and labeled "FIRE ALARM". If more than one power circuit is used, each circuit shall be properly labeled as "FIRE ALARM", and shall also be labeled with additional information – in order to indicate which fire alarm equipment is powered from each such circuit.

All fire alarm power supplies, as well as any other supplemental power supplies, shall be installed in compliance with NFPA-70 – National Electrical Code (Latest Edition).

The panel shall include a disconnect switch for the AC power inside a locked enclosure near the panel or within the panel itself. This switch shall be labeled "Fire Alarm Power Disconnect".

Where the new control panel is to remain at same location as the existing panel, the contractor may re-use the existing branch circuit, if it meets the previously stated requirements stated above.

The control panel shall include electrical power surge and transient protection. If problems are anticipated, due to electrical transients associated with periodic generator testing, then the fire alarm equipment supplier shall provide suitable power filtering / suppression equipment, as recommended by the equipment manufacturer.

The system shall include sufficient back-up battery capacity to operate the entire system as follows, upon loss of normal 120 VAC power:

For panels, which are not connected to Dedicated Emergency Power (no Generator) Branch Circuits:
The Panel and associated devices shall operated in a normal (non-Alarm) mode for a period of 24 Hours. After the 24-Hour normal period has expired, sufficient capacity shall remain, such that the panel and associated devices shall operate in an Alarm mode (All Speakers EVAC) for a period of 10 minutes.

The panel shall include a power-limited, filtered and regulated battery charger. The charger shall be an automatic dual-rate (high rate/float maintenance) type. The charger shall charge a fully discharged battery to 70% in 12 hours. The charger shall monitor for AC fail/disconnect, low/no battery, and high battery level. The charger shall include switches and associated LEDs for high rate and AC disconnect. The charger shall provide a minimum of 5 AMPS regulated 24VDC for peripheral devices requiring +/-5% regulation and 8 AMPS at 24VDC for standard peripheral devices. The charger shall be designed specifically for, or shall be properly configured for the provided batteries, which shall be of one of the following types:

Sealed, Immobilized Electrolyte Lead-Acid type ("Gel-Cells") – Types which require fluid level maintenance, or which vent significant amounts of Hydrogen shall be unacceptable.
Nickel-Cadmium (Ni-Cad) batteries.

All batteries used in conjunction with the fire alarm system shall be installed in accordance with NFPA-70 – National Electrical Code (Latest Edition).

If these batteries are not located within or immediately adjacent to the fire alarm equipment, the location of such batteries shall be clearly indicated within the fire alarm equipment served by them, and the batteries and their enclosure shall be clearly marked as "FIRE ALARM"

All external circuits requiring system-operating power shall be 24VDC and shall be individually supervised and fused at the control panel.

## PART 2 - PRODUCTS

### ENCLOSURES

All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

Cabinet shall be equipped with locks and transparent door panel providing tamper proof enclosure yet allowing full view of the various lights and controls as required above.

### MULTIPLEX/INTELLIGENT FIRE ALARM CONTROL PANEL

A Multiplex intelligent Fire Alarm Control Panel (FACP) shall be installed as shown on the project drawings.

The control Panel shall be modular, expandable with solid state, microprocessor based electronics. It shall display through the front viewing window only those primary controls and displays essential to operation during a fire alarm condition.

The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The systems shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.

Simple Addressable systems, which do not support Analog Addressable or Intelligent Addressable detection technology shall also be unacceptable.

The control panel shall provide the following as standards:

Analog Addressable or Intelligent Addressable Detection, supporting the following:

- Drift compensation
- Sensitivity display in %
- Sensitivity adjustment
- Day/night sensitivity adjustment
- Auto Detector test to meet NFPA 72
- Alarm verification with tally counter
- Maintenance alerts

The number of Signaling Line Circuits (SLCs) required for the specified quantity of addressable field devices and peripherals, plus one (1) spare loop (SLC) for each five (5) active loops. Each active loop shall include 10% spare capacity or a minimum of 10 additional devices.

The number of Audible Notification Appliance Circuits (Speaker NACs) required for the specified quantity of speakers plus one (1) spare circuit for each ten (10) active circuits. Each active circuit shall include 25% spare capacity

The number of Visual Notification Appliance Circuits (Strobe NACs) required for the specified quantity of strobes plus one (1) spare circuit for each ten (10) active circuits. Each active circuit shall include 25% spare capacity or a minimum of 4 additional 110 cd devices

80-character liquid crystal display.
Printer interface
History log file with a minimum of 800 events
Field programmability
Silent walk test

The multiplex/intelligent system shall provide the ability to recall alarms and trouble conditions in chronological order for the purpose of recreating an event history.

The LCD shall display the following information relative to the abnormal condition of a point in the system prior to acknowledgement:

40 characters for:

- Point address and loop number (i.e. 555-L5)
- Type of device (i.e. smoke sensor, pull station, water-flow)
- Point status (i.e. alarm, trouble)

40 characters for:

- Custom location label (i.e. 4th Floor - Room 444)

Keyboards or keypads shall not be required to operate the system during fire alarm conditions.

The following software functions shall be provided, from the built-in system keyboard / display:

- Setting of time and date
- LED testing
- Alarm, trouble, and abnormal condition listing
- Enabling and disabling of each monitor point separately
- Activation and deactivation of each control point separately
- Changing operator access levels
- Walk Test enable / disable
- Running diagnostic functions

Displaying historical logs
Point listing

The following hardware switches/functions shall be provided:
Acknowledge alarm or trouble
Silence alarm or trouble
Reset system after alarm
Connect/disconnect Central Monitoring tie
Provide manual evacuation (drill)
Bypass elevator interface
Bypass AHU / Fan Interface
Bypass door holders

STATUS INDICATORS AND DISPLAYS
A local audible device shall sound during Alarm, Trouble or Supervisory conditions. This audible device shall also sound during each key-press to provide an audible feedback to ensure that the key has been pressed properly.

The 2-line by 40-character liquid crystal display shall be backlit for enhanced readability.

A cursor shall be visible on the LCD when entering information.

Scrolling through menu options or lists shall be accomplished in a self-directing manner in which prompting messages shall direct the user

CONTROLS
The following controls shall be accessible with the front door open.
Manual evacuation (drill)
LED / LCD Test Switch
Key pad for data input and microprocessor control
Bypass Function Switches and LEDs for the following:
Central Monitoring Bypass
HVAC / Fan Interface bypass
Door holder release bypass

LED SUPERVISION
All slave modules LEDs shall be supervised for burnout or disarrangement

ACKNOWLEDGMENT
Two methods of acknowledgment for each abnormal condition shall be provided. One may be chosen depending on the NFPA requirements.

First method - Acknowledge one event at a time from an unacknowledged list of events:

Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and require another acknowledge button. Press to acknowledge only the displayed point.

After all points have been acknowledged, the LEDs shall glow steadily and the Sonalert will be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed along with a prompt to review each list chronologically. The end of the list shall be indicated by an end of list message "END of LIST".

Second method- Pressing the appropriate acknowledge button shall globally acknowledge all points

SILENCING
If an alarm condition exists and the "Alarm Silence" button is pressed, all alarm audio and visual notifications appliances shall cease operation.

If trouble conditions exist in the system and the "Trouble Silence" button has been pressed, the aural trouble signal shall cease, but shall resound at time intervals to act as a reminder that the fire alarm system is not in a normal operating mode. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.

RESET
The SYSTEM RESET button shall be used to return the system to its normal state after an alarm condition has been remedied.

Should the Alarm Silence Inhibit function be active, the system shall ignore all key presses. An indication of enabling and disabling the inhibit state shall be provided as a feedback to the operator.

BYPASS FUNCTIONS

Bypass Switches shall be configured such that whenever any bypass function is active, a Trouble status condition shall be reported by the system, per the Trouble Sequence. The trouble message shall indicate the active function(s). Bypass LEDs shall be configured such that LEDs corresponding to the active function(s) shall illuminate, and shall remain lit until the associated bypass function is de-activated (until the system is restored to normal operating status). Switches and LEDs shall be provided for the following functions

Central Monitoring Bypass - When this bypass function is active; reporting of various status conditions to the reporting system shall be disabled.

HVAC / Fan Interface bypass - When this bypass function is active; actuation of the Control Modules or Supervised Relays, which interface to the AHU / Fan starters / Temperature Controls, and to any Smoke Dampers shall be prevented. (Smoke Control System bypass shall be accomplished via the separate, previously specified manual controls).

Door holder release bypass - When this bypass function is active; actuation of the Control Modules or Relays, which cause release of the Door Holders shall be prevented.

ACCESS TO OPERATOR FUNCTIONS:

The following Operator Function Access Restrictions shall be adhered to as closely as possible. Where system limitations do not allow for the restrictions to be configured exactly as listed, alternate methods will be considered, and shall be brought to the attention of the Engineer prior to bidding:

ACCESS LEVEL 1 - BASIC OPERATOR FUNCTIONS:

ACKNOWLEDGE – allows Basic Operators to acknowledge ALARM, TROUBLE, and SUPERVISORY conditions, and to view the lists / logs associated with these functions.

SIGNAL SILENCE – allows Basic Operators to silence the audible signals. The system shall not permit signals to be silenced during “alarm silence inhibit mode” (if “Inhibit Mode” is utilized).

SYSTEM RESET – allows Basic Operators to Reset the Fire Alarm System. The "System Reset" button shall be used to return the system to its normal state after an alarm condition has been remedied. The LCD display shall step the user through the reset process with simple English language messages.

ACCESS LEVEL 2 - HIGH SECURITY FUNCTIONS:

Changes to the linkage of Operator Functions to Access Level / Pass-Code Profiles may affect the ability of individuals to access required functions. Because of this, access to this linking function shall also be appropriately secured.

ACCESS LEVEL 3 - OTHER FUNCTIONS:

These functions shall include, but shall not be limited to:

- Enable / Disable Points
- Perform “Override” Functions / Features
- Generate Hard-Copy, Printed Reports
- Add / Delete / Change Pass codes, and associated links to system features
- Set / Change System Clock
- Set / Change Sensitivity of Detectors
- Clear History Logs

POINT LISTING

- All points list by address
- Monitor point list
- Signal/speaker list
- Auxiliary control list
- Feedback point list

HISTORY LOGGING

The system shall be capable of logging and storing the last 800 events (alarm & trouble) in a history log. These events shall be stored in a battery protected random access memory.

The following historical alarm/trouble log events shall be stored:

- Alarms
- Alarm Acknowledgment
- Alarm Silence
- System Reset
- Alarm Historical log cleared
- Trouble conditions
- Supervisory alarms
- Trouble acknowledgment
- Supervisory acknowledgment
- Alarm Verification tallies
- Walk Test results
- Trouble Historical log cleared

SILENT WALK TEST WITH HISTORY LOGGING

The system shall be capable of being tested by one person. While in testing mode the alarm activation of an alarm-initiating device shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after the logging of the alarm.

The momentary disconnection of an initiating or indicating device circuit shall be silently logged as a trouble condition in the historical data file. The panel shall automatically reset itself after logging of the trouble condition.

Should the silent walk-test feature be on for an inappropriate amount of time (30 minutes max.) it shall revert to the normal mode automatically.

The panel shall have the capability of dividing the system into distinctive walk test groups, a minimum of 8 groups.

Should an alarm condition occur from an active point, not in walk test mode, it shall perform operations described above.

After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

WATCH-DOG TIMERS

The system shall include independent "Watch-Dog" timers to detect and report failure of any microprocessor circuit, memory, or software.

FIELD PROGRAMMING

The system shall be fully programmable, configurable, and expandable in the field without the need for special tools or PROM programmers and shall not require replacement of memory IC's. All programming may be accomplished through the standard control panel keyboard or a keyboard at the printer, or the use of a PC. All programs shall be stored in non-volatile memory.

All programming or reprogramming shall be done by the supplier at no charge until the owner accepts the system.

SOFTWARE MODIFICATIONS

The system shall be capable of being programmed by means of a Field Configuration Program (FCP) allowing programming to be downloaded via portable computer from any node on the network.

Provide the services of a factory trained and authorized Technician to perform all system software modifications, upgrades, or changes. Response time of the Technician to the site shall not exceed 4 hours.

Provide all hardware, software, programming tools, access codes, and documentation necessary to modify the fire alarm system on site. Modification includes addition and deletion of devices, circuits, zones, and changes to system operation and custom label changes for devices or zones. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power-down of the system or loss of system fire protection while modifications are being made.

If the system access code is either a hardware key or a software key, the Contractor/Vendor shall provide the proper key to meet the above requirements."

TERMINAL/PRINTER INTERFACE

Fire Alarm Control Panel shall be capable of operating remote CRTs (serial data terminal) and/or printers.

Each output shall be ASCII, from an EIA RS-232-C serial data connection with an adjustable baud rate. A minimum of one such RS-232 port shall be provided.

Each RS-232-C port shall be capable of being configured for either a CRT or a printer.
One such port shall be configured for a supervised connection to the Fire Alarm System printer.
One such port shall be configured for non-supervised connection to the CRT or Laptop.

Data amplifiers or short-haul modems shall be used to increase CRT or printer line distance, if required.

SIGNALING LINE CIRCUITS:
The system must provide communications with intelligent addressable initiating and control devices individually. These devices shall be individually annunciated at the control panel and FAAP. Annunciation shall include the following conditions for each point:
Alarm
Trouble
Open
Short
Device missing/failed

All intelligent addressable initiation and control devices shall have the capability of being disabled or enabled individually.

Systems that require factory pre-programming or EPROMs to add or delete devices shall be unacceptable.

The communication format must be a completely digital poll/response protocol to allow t-tapping of the Signaling Line Circuit wiring. Systems that do not utilize full digital transmission protocol are not acceptable.

Special-purpose Isolator devices shall be used to provide further isolation / protection of sections of the Signaling Line Circuits. Areas served by Signaling Line Circuits shall be isolated as specified within the "scope" portion of this specification. The following Isolation devices shall be acceptable for use in performing this function:
Isolator Modules – Field Mounted.

**OPERATION - MULTIPLEX/INTELLIGENT FIRE ALARM SYSTEM**

PRIORITY:
Fire Alarm status conditions shall have the highest priority.

Supervisory status conditions shall have the second highest priority.

Trouble status conditions shall have the lowest priority.

STAND-BY MODE:
Under normal condition the front panel shall display a "System is Normal" message and the current time and date

SYSTEM RESPONSE
The time delay between the Alarm activation of an initiating device, and the automatic activation of the Notification Appliances and the annunciation of the Alarm status condition at the FACP and annunciators shall not exceed 5 seconds.

ALARM SEQUENCE:
The following events are not required to occur in the stated order. However, ALL automatic responses must be initiated within the time interval allotted by UL and NFPA codes and standards.

This "Fire Alarm Sequence" shall be initiated upon receipt of one of the following, valid Fire Alarm status conditions:
Actuation of any Manual Pull Station, any Fire Protective Sprinkler System, any other Automatic Fire Suppression System, from any Smoke Detector, any addressable Heat Detector, any beam-type Smoke Detectors, any non-addressable Heat Detector

The system alarm operation, subsequent to the activation of any of the conditions listed above, shall be as follows:

All audible notification appliances within the building shall sound, using a sequence that is compliant with NFPA-72.

All visual notification appliances within the building shall flash continuously until the system is acknowledged.

Any subsequent alarm shall reactivate the alarm audible and visual notification appliances [within the building] [within the affected Notification Area(s)].

All doors normally held open by door control devices within the building shall release.

Alarm outputs connected to the facility reporting system shall be activated.

The system Alarm LED shall flash on the FACP and the FAAP, until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on.

A subsequent alarm received from another device shall flash the system alarm LED on the FACP and the FAAP. The LCD display shall show the new alarm information.

A pulsing alarm tone shall occur within the FACP and the FAAP until the event has been acknowledged.

The system shall have a single key that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time and date of each occurrence.

A programmed Alarm Message shall appear on the FACP and the FAAP LCD displays. These field programmable messages shall be revised, as directed by the Owner, during shop drawing review. The alarm shall be displayed on an 80-character LCD display as follows:

40 characters for:
- Point address and loop number
- Type of device
- Point status

40 characters for:
- Custom location label

AUTOMATIC ALARM VERIFICATION:

The initial Alarm activation of any system smoke detector shall initiate an alarm verification operation whereby the panel will reset the activated detector and wait for a second alarm activation. If, after (20) seconds and within (30) seconds after resetting, a second alarm is reported from the same or any other smoke detector, the system shall process the alarm as described previously. If no second alarm occurs within (30) seconds, the system shall resume normal operation. The alarm verification shall operate only on single smoke detector alarm. Other activated initiating devices or multiple smoke detector alarms shall be processed and reported immediately.

The alarm verification operation shall be selectable by device or by group for addressable detectors and by IDC for non-addressable smoke detectors. Automatic Alarm Verification shall be enabled for all smoke detectors [including resident room smoke detectors if they are connected to the fire alarm system].

SELF-TEST AND AUTOMATIC DRIFT COMPENSATION:

The control panel shall continuously perform an automatic self-test routine on each Smoke Detector, which will functionally check detector electronics and ensure the accuracy of the values being transmitted to the control panel. Any detector that fails this test shall indicate a "*SELF TEST FAILED*" trouble condition with the detector location at the control panel.

All Intelligent Addressable Smoke Detectors used on this project shall incorporate automatic drift compensation / automatic sensitivity monitoring and adjustment, as described within the “definitions” portion of this specification section.

OPERATOR INTERFACE / MAINTENANCE FEATURES FOR AUTOMATIC SMOKE DETECTION:

An operator at the control panel shall have the capability to manually access the following information for each detector:

- Primary status
- Device type
- Present average value
- Present sensitivity value selected

Peak detection values
Detector range (normal, dirty, etc.)

Values shall be in "percent of smoke obscuration" format so that no interpretation is required by the operator.

An operator at the control panel shall have the capability to manually control the following for each detector:
Clear peak detection values
Enable or disable the detector
Clear verification tally
Establish alarm sensitivity
Control a detector's relay driver output

It shall be possible to program the control panel to automatically change the sensitivity settings of each detector based on time-of-day and day-of-week.

The control panel shall clear a “Detector dirty” trouble after a detector has been removed from its base cleaned and replaced.

TROUBLE SEQUENCE:
Disarrangement, disconnection, Power Failure, or malfunction of any supervised feature(s) / components of the System shall cause actuation of the following sequence of events:

A SYSTEM TROUBLE or POINT TROUBLE status condition shall be both audibly and visually indicated at the Fire Alarm Control Panel (FACP) and FAAP in a way which differentiates the TROUBLE status clearly from an ALARM. Audible indication shall cease, once the TROUBLE has been acknowledged.

In addition, a programmed message, similar in nature to the ALARM “Custom Labels”, shall appear on the FACP and FAAP. (Default messages, if TROUBLE Detector / Sensor / Module Point Messages are associated with ALARM messages, shall be acceptable.)

A “Trouble Reminder” Feature, which causes the FACP to re-sound the TROUBLE indicators when System / Point TROUBLE conditions remain on the system, shall be enabled, and shall be set to re-sound every twelve (12) hours.

Subsequent Troubles shall cause the FACP [and FAAP] [and the RFCC] TROUBLE LEDs and sounders to re-sound, along with the “Custom Label” and other information related to the “new” TROUBLE condition.

MANUAL DRILL
A manual evacuation (drill) switch shall be provided to operate the alarm indicating appliances without causing other control circuits to be activated.

LED AND LCD TEST
Activation of the Lamp Test switch shall turn on all LED indicators, LCD display, and the local sounder and then return to the previous condition.

SYSTEM DIAGNOSIS
The system shall include special software to detect, diagnose and report failures and isolate such failures to a printed circuit board level.

SILENT WALK TEST WITH HISTORY LOGGING
The actuation of the "Walk Test" switch/program at the control panel shall activate the "Walk Test" mode of the system, which shall cause the following to occur:
The Output Contacts, which provide the interface to the Fire Alarm System Reporting shall be bypassed.
Control relay functions shall be bypassed, such as door holders, elevator capture, fan shut down, etc.
The audio and visual circuits shall be bypassed.
The control panel shall show a trouble condition.
The alarm activation of any initiation device shall be silently logged as an alarm condition in the historical data file. The panel shall automatically reset itself after the logging of the alarm.
Any momentary opening of an initiating or indicating appliance circuit shall be silently logged as a trouble condition in the historical data file.
The panel shall automatically reset itself after logging of the trouble condition.
If the system becomes inactive for a period of longer than 10 minutes the panel shall default to normal fire alarm functions.

It shall not be required to manually restart or reboot the fire alarm panel after a silent walk test is completed.

**CENTRAL MONITORING**

The new Fire Alarm System shall be interfaced to the following systems utilizing dialer connection, for remote reporting of various conditions:

To the Owner-provided Security System, or an offsite commercial supervising station, as determined by the Owner.

The interface between the reporting system(s) listed above and the new Fire Alarm System shall be configured as follows:

Required relay (contact) outputs:

Fire Alarm: This contact shall actuate in response to any Fire Alarm status condition.

Gas Alarm: This contact shall actuate in response to any Gas Alarm status condition.

System Trouble: This contact shall actuate in response to the occurrence of any Trouble status condition on the Fire Alarm System.

The new fire alarm panel shall also be connected to the existing intelligent/voice communications network.

The interface between the existing reporting system and the new Fire Alarm System shall be configured as follows:
Point by point annunciation.
Voice communications by building.

The Contractor installing the new Fire Alarm System shall be responsible for coordination of the Fire Alarm System connections to these system(s), for all wiring and conduit between these system(s), and for all terminations at the Fire Alarm end of such interface wiring. All such wiring, raceway, and terminations shall be included per the Base Bid.

**ONE-WAY VOICE COMMUNICATION SUB-SYSTEM**

The FACP shall be provided with an Integrated, One-way Emergency Voice Communications (EVAC) sub-system. This EVAC sub-system shall be configured as a single-channel sub-system, with automatic and manual operation as specified within the "Operation" section of this specification section.

The Tone Generators, Microphones, Audio Controls, Selector Switches, LEDs, Amplifiers, and Speaker-Type NACs, which make up this sub-system shall all be modular components of the Fire Alarm Control Panel, and shall be listed by UL as modular components of the FACP. The Tone Generator and Audio Controls may share the same "system bus" as the other FACP components. The Primary Microphone and Audio Controls will be built-into the FACP.

FACP on-board diagnostics shall be configured to assist in the identification of individual module faults. Also, the EVAC components may share the FACP Power Supplies and Batteries.

Hand-held, push-to-talk microphone shall be provided within the FACP enclosure. Each microphone shall be a dynamic communication type with a frequency range of 200 Hz to 4000 Hz and shall be equipped with a self-winding five-foot coiled cable. An LED indicator shall be provided to indicate microphone push-to-talk button has been pressed and speaker circuits are ready for transmission. All Microphones shall be supervised for disconnection.

Audio control switches shall be furnished to provide manual controls of all audio functions. These switches and associated LED indicators shall be supervised for disarrangement or failure.

Audio power amplifiers shall be furnished with self-contained filtered 24VDC power supply, transformer and amplifier monitoring circuits. Amplifiers shall provide a 25 or 70 VRMS output with a frequency response of 4,000Hz to 14,000Hz. Minimum amplifier sizes shall be determined as follows:

Provide a minimum of: 1 Watt for each Speaker
Provide a minimum of: 10% Additional Amplifier Capacity

The Fire Alarm System shall include back-up amplifiers within each Amplifier-Equipped FACP or Amplifier-Equipped Remote Equipment Cabinet. When amplifiers are distributed throughout the building in the NAC supply panels, at minimum a back-up amplifier shall be provided for each group of amplifiers within the same equipment closet. These back-up amplifiers shall be configured such that upon failure of any other Fire Alarm Audio Power Amplifier:

A back-up amplifier shall be automatically routed into the signal path, such that the back-up amplifier shall functionally replace the failed amplifier.

A Trouble event shall be logged by the Fire Alarm System. This Trouble event shall indicate that an amplifier failure has occurred. If the system contains multiple amplifiers, the Trouble event message shall indicate which specific amplifier has failed.

Speaker circuits shall be capable of supplying audio signals at 25 or 70 VRMS supplied by the system amplifiers. Supervision for open, short or ground fault conditions shall be provided. Individual and distinct trouble indications shall be provided for each fault.

TONES FOR ONE-WAY EMERGENCY VOICE SUB-SYSTEM:
The Alert Tone and Digital Voice Message utilized by Automatic Mode shall be compliant with the latest NFPA-72. The Tone and Message shall be selected by the Owner and Engineer.

The Main Alert tone shall be the temporal code pattern. This temporal pattern shall be compliant with the latest ANSI standards, currently S3.41, and as described in the latest NFPA-72.

VOICE MESSAGE TRANSCRIPT FOR ONE-WAY EMERGENCY VOICE SUB-SYSTEM
Owner may select the following, or come-up with similar messages:

"Attention Please, there has been a report of a fire emergency. Proceed calmly to the nearest exit and leave the building immediately. All handicapped occupants shall use the building evacuation plan."

"Attention Please, there has been a report of a gas emergency. Proceed calmly to the nearest exit and leave the building immediately. All handicapped occupants shall use the building evacuation plan."

**OPERATION - ONE-WAY VOICE COMMUNICATIONS**
The One-Way Voice Communications sub-system shall function as an Emergency Voice Area Communications (EVAC) System, as defined within NFPA-72. This system shall be equipped with a Single-Channel, non-selective EVAC sub-system.

As a Non-Selective EVAC system, any message being broadcast shall always be broadcast to the entire facility

The One-Way Voice Communications System, as specified for this project, is intended to perform two primary types of functions:

AUTOMATIC FIRE ALARM FUNCTION SUMMARY
In the event of a Fire Alarm, this system shall automatically generate an Alert Tone and Digital Voice Message, and shall automatically broadcast and repeat this tone throughout the building. This function is intended to notify the occupants that they need to leave the building.

MANUAL VOICE FUNCTION SUMMARY
The intended purpose of the voice capabilities of the system are to provide an approved means for manually announcing supplemental evacuation instructions, and for other Emergency notifications.

The new Fire Alarm System shall be provided with suitable means to generate Manual EVAC messages from the following locations:

From the Master EVAC microphone, located within or adjacent to the FACP.

The FACP shall be equipped with programmed Control Switches and LEDs, for all manually selectable functions. These switches and LEDs shall be clearly labeled, in order to indicate the functions associated with them, or the status conditions, which they indicate.

Such switches and LEDs shall be configured for selection of the various modes. Whenever a Voice Sub-System Mode and / or a Notification Area is manually selected, LEDs located adjacent to the control switches shall illuminate in a distinctive manner, and a Trouble status condition shall be logged by the system. The Trouble status condition shall remain until all control switches are manually or automatically reset to their normal positions.

These LEDs shall be provided in order to indicate which mode is currently active, and to remind the system operator to return the switches to the normal position when use of the Voice Sub-System is no longer required.

In conjunction with the two primary functions of this sub-system, and because this system is intended to provide selective manual functions, the system shall provide a minimum of the following Modes of operation:

EVACUATION - AUTOMATIC MODE:
In most cases, the One-Way Voice Communications sub-system shall function automatically as a tone generator and Digital Message Generator. Whenever Automatic EVAC Mode is triggered, the system shall function according to the system programming. The Fire Alarm System shall be programmed such that this Mode shall ALWAYS be accompanied by simultaneous operation of ALL Visible Notification Appliance Circuits, within the active Notification Areas.

The actual sequence, signal tone, and digital voice message utilized by Automatic Mode shall be compliant with the latest edition of NFPA-72. Currently it is 3-12.6.3.1(a) (1996 Edition), and the tone and message shall be repeated automatically, until one of the following occurs:

Until the Audible Notification Appliances are Manually Silenced.
Until a Manual Talk Mode is selected.
Until the Fire Alarm System is Reset.

The sequence shall include a back-up tone generator, which operates in compliance with the latest edition of NFPA-72. Currently it is 3-12.6.3.2 (1996 Edition) in the event of failure of the primary tone / message generator.

Pressing the "Signal Silence" switch, at the FACP shall cause the audible and visual Notification Appliances to cease operation.

All Visual Notification Appliances shall continue to flash until the system is acknowledged.

MANUAL EVACUATION – ALL SPEAKERS MODE:
This mode shall only be initiated manually. Manual Evacuation mode shall be initiated by means of programmed Control Switches and LEDs. These switches and LEDs shall be appropriately labeled, in order to indicate their function.

Actuation of this mode shall not require the existence of a Fire Alarm status condition. This mode may be used for other Emergency Evacuation Notifications.

Whenever "Manual Evacuation – All Speakers" Mode is selected, the following shall occur:
The Audio Sub-System shall broadcast the evacuation tone (Temporal Pattern) through All Audible Notification Appliances, and shall actuate all Visual Notification Appliances.

If a Fire Alarm status condition does not exist, re-setting the Notification appliances shall be accomplished by setting all switches back to the normal (inactive) positions and / or by resetting the system.

If a Fire Alarm Status condition occurs while "EVACUATION - MANUAL MODE" is active, all other required actions shall be initiated.

MANUAL TALK MODE – ALL SPEAKERS:
This mode shall only be initiated manually. This mode shall be initiated by means of programmed Control Switches and LEDs. These switches and LEDs shall be appropriately labeled, in order to indicate their function.

Actuation of this mode shall not require the existence of a Fire Alarm status condition. This mode may be used for other Emergency Evacuation Notifications.

Whenever "Manual Talk – All Speakers" Mode is selected, the following shall occur:

An Alert / Warning Tone shall be broadcast through all system speakers for approximately two seconds. The purpose of this tone is to warn occupants that a manual voice message is about to be announced. At the end of this Alert / Warning Tone, messages spoken into the system microphone shall be broadcast through All Audible Notification Appliances.

All Visual Notification Appliances shall be activated upon selection of this mode, and shall remain in operation until this mode is de-activated.

If a Fire Alarm status condition does not exist, re-setting the Notification appliances shall be accomplished by setting all switches back to the normal (inactive) positions and / or by resetting the system.

If a Fire Alarm Status condition occurs while "Manual Talk – All Speakers" Mode is active, all other required actions shall be initiated.

If "Manual Talk – All Speakers" Mode is initiated during a Fire Alarm status condition, ALL Visible Notification Appliances shall continue to flash, until the system is silenced.

"DEAD-MAN" TONE:
The system shall automatically default to the Automatic Evacuation Mode, and shall broadcast the evacuation tone to the entire facility (tone generator / temporal pattern) if a manual talk mode is selected during an ALARM mode or an ALARM condition occurs while the manual talk mode was selected, and the microphone becomes inactive for more than one (1) minute.

**REMOTE ANNUNCIATOR PANEL**
Where shown on the plans, provide and install Fire Alarm Annunciator Panel (FAAP).

Each panel shall incorporate an Alphanumeric LCD Annunciator, which shall functionally duplicate the FACP display, as well as standard controls for Acknowledge, Silence, and Reset.

ANNUNCIATION FEATURES
The Annunciator portion of each panel shall consist of the standard, compact-size LCD Alphanumeric Annunciator, as manufactured by the Fire Alarm System Manufacturer. This unit shall mimic the display assembly of the FACP, and shall incorporate the following features:

- LCD Display
- Multi-function, integrated sounder – duplicates the FACP sounder
- LEDs for:
  - Power (Green)
  - Fire Alarm (Red)
  - Supervisory (Amber or Orange) [May also be used for Resident Unit/Dorm Room Smoke
  - Trouble (Yellow)
- Secured Switches (Secured under keyed door, or enabled via key switch) for:
  - Acknowledge
  - Signal Silence
  - System Reset

EVAC SUB-SYSTEM FEATURES
In addition to the Annunciation features listed above the FAAP panel shall incorporate additional features - for control of the EVAC sub-system.

The additional features included in these panels shall be as follows:

- A Microphone
- Audio Control Switches identical to those found in the FACP.
- Audio Status LEDs identical to those found in the FACP
- A locked panel access door. This door shall include a viewing port, which shall allow the LCD Display, and all indicator LEDs to be seen, without need to open the door. The door shall be secured by means of a key, which shall be identical to the key used to gain access to the FACP enclosure. When the panel access door is unlocked, trained personnel shall be able to access the Microphone and any other required Operator Interface Switches.

GENERAL REQUIREMENTS
FAAP shall incorporate the following features:

- Mar-resistant painted enamel or a stainless steel finish.

FAAP shall communicate with the Fire Alarm Control Panel by means of a supervised serial data link, as well as any required audio buss connections. The operating power shall be 24VDC and shall be fused at the control panel. LED annunciators and point-wired (non-serial) annunciators are not considered equal and shall be unacceptable.

All wiring between the FAAP panel and the fire alarm control panel shall be supervised for opens, grounds and shorts.

Under normal operating conditions, the LCD display shall indicate the time, date and "SYSTEM IS NORMAL" label.

During abnormal conditions, the LCD shall operate in the same manner as the FACP LCD Display.

**NAC BOOSTER PANELS (Remote Power Supplies):**
Where they are used, “NAC Power Booster Panels” shall be individually supervised. Interconnecting NAC Booster Panels in a manner, which prevents identification of individual panel TROUBLE conditions, shall not be approved. NAC Booster Panels shall be wired to dedicated Emergency Power Branch Circuits where available.

If NAC Booster Panels are needed at locations other than those identified on the construction drawings, the Electrical Contractor shall obtain approval for their proposed installation locations. At such locations, the EC shall provide any required circuit breakers, associated power wiring, and local smoke detection at the approved location. Power shall be obtained from the nearest available emergency panel. The cost of such equipment and installation shall be included within the base Electrical Bid.

**MULTIPLEX/INTELLIGENT PERIPHERAL DEVICES**
All devices shall be supervised for trouble conditions. The system control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Failure of a device shall not hinder the operation of other system devices.

DEVICE IDENTIFICATION
Each intelligent device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address shall not be acceptable.

Device addressing schemes which use permanently-imbedded, electronically-identifiable “serial number” which is similar to the address imbedded within Personal Computer Network Interface Cards shall be acceptable.

Fire Alarm Systems utilizing hand-held or briefcase-style programming tools. Which are used to electronically assign addresses and/or programming parameters to devices shall be acceptable. However one such programmer tool shall be provided to the Owner at no additional cost.

The address along with the loop number and end-of-line device if present shall be indicated, and be visible from the ground, on the device in the field using machine generated marking. Contractor shall provide a sample of such labeling scheme before using it.

End-of Line devices shall also be identified by means of permanent, machine generated label, affixed to the device.

Device identification schemes that do not use uniquely set addresses but rely on electrical position along the communication channel are unacceptable. These systems cannot accommodate t tapping and the addition of an intelligent device between existing devices requires re-programming all existing devices beyond added device.

The system must verify that proper type device is in place and matches the desired software configuration.

INTELLIGENT DETECTORS - GENERAL
Smoke and heat detectors must be approved by the A/E prior to installation.

Each detector shall incorporate the following features:
- LED(s), which shall flash to indicate communication with the Fire Alarm System, and which also illuminate in a steady manner when the detector is in an alarm status
- A means to allow field function testing of the detector
- A low-profile design / shape
- An insect screen
- Voltage and RF transient suppression techniques, in order to minimize false alarms

Smoke detectors shall communicate the actual smoke chamber values to the system control panel.

Smoke detectors shall be listed for sensitivity testing from the control panel. Sensitivity test results shall be logged and downloaded to a printer.

The detectors shall be plug-in units, which mount to a common base, and shall be UL 268 approved.

Each detector shall be compatible with the fire alarm panel and shall obtain its operating power from the SLC, to which it is connected. (Where relay or sounder-equipped bases are used, it shall be acceptable to require a separate 24 VDC or NAC connection.) Each detector shall be reset by actuating the control panel reset switch.

If field conditions so require the smoke detection devices shall not be installed until the construction is completed.

INTELLIGENT DETECTOR BASES

Bases shall be suitable for either smoke or heat detector mounting.

Either the base or the head shall contain electronic circuits that communicate the detector's status (normal, alarm, sensitivity status, trouble, etc.) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Contacts between the base and head shall be of the bifurcated type using spring-type, self-wiping contacts.

The base shall be lockable. The locking feature must be field-removable when not required.

Upon removal of the detector's head, a trouble signal shall be transmitted to the control panel.

The detector base shall be sealed against rear airflow entry.

Each detector's base or head shall contain LED(s), which shall flash when the detector is being scanned by the control panel. The LED(s) shall turn on steady when the detector is in an alarm condition.

INTELLIGENT PHOTOELECTRIC SMOKE DETECTORS

The detectors shall contain no radioactive material.

Detectors shall be of the solid state photoelectric type and shall operate on the light scattering photodiode principle using a pulsed infrared LED light.

INTELLIGENT THERMAL DETECTORS

The detectors shall be a combination rate-of-rise and fixed temperature 135 F unless noted.

Detectors shall sense within a temperature range of 32 F to 158 F. The control panel shall be capable of sensing either a set point of 135 F, or a rate-of-rise of 20 degrees F per minute for fire sensing.

ADDRESSABLE PULL STATIONS

Pull stations shall contain circuits that communicate the station's status (alarm, normal or trouble) to the control panel over two wires, which also provide power to the pull station. The address shall be field programmable on the station.

Manual stations shall be single-action type, constructed of metal or of high impact, red Lexan with raised white lettering and a smooth high gloss finish.

Station shall mechanically latch upon operation and remain so until manually reset by means of a key common to all system locks. Stations that require Allen wrenches or special tools to reset them shall not be accepted.

Manual stations shall be fitted with screw terminals or wire leads for field wire attachment.

INTERFACE MODULES - GENERAL

If external power to Addressable Interface Modules is required, such power shall be 24VDC, and shall be derived from a supervised fire alarm power supply.

Addressable Interface Modules may be provided in either a Class B or Class A supervision version.

In the Class B version the wiring shall be supervised by an end-of-line device.

In the Class A version the wiring shall be looped back and connected to the module to allow continual operation of the controlled devices even if the wiring sustains a single break.

The interface modules shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions.

INTERFACE MODULES - SUPERVISED CONTROL
Supervised Control Modules shall be utilized where needed, for control of Notification Appliances.

For Notification Appliances, speakers, and other device control with Class B or Class A wiring supervision, the interface module shall provide a double-pole/double-throw relay output, with supervision.

These interface modules shall communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and shall receive from the fire alarm control panel a command to transfer the relay.

INTERFACE MODULES - SUPERVISED MONITORING
Addressable Monitor Modules shall be suited for monitoring of water-flow, valve tamper, Fire Suppression Control Panels, and other non-intelligent detectors and systems.

Addressable Monitor Modules shall be provided in any needed configuration, and may be used to interface any of the following initiation devices to a Signaling Line Circuit, as follows:

Conventional 2-wire smoke detectors, including providing suitable power to the IDC.

Normally Open, dry contact type devices - with class B or class A wiring supervision:

These interface modules shall communicate the Initiating Device Circuit status (normal, alarm, trouble) to the control panel.

INTERFACE MODULES - NON-SUPERVISED CONTROL

This interface module shall provide double-pole/double-throw relay switching for loads up to 120VAC. It shall contain easily replaceable 2 amp fuses, one on each common leg of the relay.

**FAULT ISOLATOR MODULE (FIM)**

The system shall employ Fault Isolator Modules (FIM) on the Signaling Line Circuits. These FIM units shall be utilized in order to isolate portions of SLCs, in the event of short circuit conditions. The SLC segment protected by each FIM shall be separated from the SLC in a manner such that a single short-circuit condition may not affect more than 25 Addressable Field Devices / Detectors, which are served by the isolated SLC segment.

The FIM shall be located as close as practical to the point where the isolated SLC sub-circuit branches, and shall also be located at an accessible location.

**AUDIO VISUAL NOTIFICATION APPLIANCES**

SPEAKERS

Speakers shall have a metal or Lexan housing with field adjustable output taps ranging from 1/4 watt to 2 watts. Speakers selected for this project shall produce a Sound Pressure Level, at the 1 watt tap of at least 86 dBA at 10 feet – as tested per UL Standard 1480. Speakers shall have vandal resistant Lexan or metal grilles and shall be have sealed backs to protect the phenolic impregnated cone.

STROBES

ALL strobes, and the strobe portion of audible/strobe combination units, shall be of the Xenon type.

All strobes shall be designed for synchronized flash operation at one flash per second (1 Hz) minimum over the device's listed input voltage range. Strobes shall be synchronized such that all strobe units within the building shall flash simultaneously (As a minimum, all devices on each floor shall flash simultaneously, with flash timing within the limits established by current UL standards.).

**PRINTERS AND TERMINALS**

An acceptable alternative to a terminal & printer shall be terminal emulation software, and a six-foot cable – suitable for connection of a laptop PC to a non-supervised port, within the FACP.

**SPECIAL DEVICES**

TOOLS/KEYS

Contractor shall provide two (2) keys per pull station. Keys shall be identical and usable in all keyways associated with this project – including, but not limited to Manual Pull Stations, the FACP, and FAAP.

Provide one device programmer tool for fire alarm systems utilizing hand-held or briefcase-style programming tools used to electronically assign addressees and/or programming parameters.

## PART 3 - EXECUTION

### GENERAL

The complete installation shall be done in a neat, workmanlike manner in accordance with the applicable requirements of NFPA 70 - Article 760 and the manufacturer's recommendations.

Smoke detectors shall not be mounted until the construction is completed, unless they are covered with plastic bags or fitted covers immediately after installation to maintain cleanliness.

### RACEWAYS

NOTE: ALL FIRE ALARM SYSTEM WIRING SHALL BE INSTALLED WITHIN METALLIC CONDUIT UNLESS SPECIFIED.

All wiring shall be in a conduit system separate from other building wiring. See Section 26 05 33 – Raceway and Boxes for Electrical Systems for specifications.

All wiring shall be in minimum ½" steel raceway.

40% fill factor shall be applied to all conduit sizes.

The contractor shall size conduit and boxes by circular mil size of each cable in each conduit or box. The circular mil sizing can be found on the manufacture's spec sheet, then use the NEC codebook to make calculation to follow NEC Table 370-16(a) for box fill and Chapter 9 for conduit fill.

There shall be no sharp edges with installed materials.

Use only identified conduit entries or request approval for other penetrations in cabinets; (certain areas require clear space for interior components / batteries). Cabinet shall be grounded to either a cold water pipe or grounding rod.

### CONDUCTORS

All wire and cable associated with this system shall be as required by the equipment manufacturer. The following information is intended for estimating purposes only. However, the minimum wire gauges and colors specified shall be strictly adhered to. All cable shall be installed as per NEC Article 760.

Type FPL wiring is required if the system is run in conduit or 'free-air.

All initiation and notification circuit cabling shall be listed Type FPL (300V) in accordance with NEC article 760."

All cables and wires #14 AWG and larger shall be stranded.

Fire alarm wiring shall be held in place at the device box, by means of a two-screw connector, (do not use squeeze or crimp type connectors).

All wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, disarrangement of any components, any open circuits or grounds in the system, an audible and visual trouble signal shall be activated until the system is restored to normal.

All conductors shall be color-coded. Coding shall be consistent through out the facility. Green wire shall be used only for equipment ground.

Each Fire Alarm Control Panel, Annunciator Panel shall be connected to separate dedicated branch circuit from the building emergency panel, maximum 20 amperes. Circuit shall be labeled as "FIRE ALARM". The breaker shall be pained red and cap-locked.

Power wiring for Fire Alarm Control and Annunciator Panels shall be #12 AWG.

Fire Alarm Control and Annunciator Panels shall have #6 AWG green equipment ground wire.

Fire alarm risers, notification appliance circuits and interconnections to remote panels (per NFPA 72) shall have a minimum 2Hr fire alarm rating. All notification appliance circuits shall be protected from the fire alarm panel of origination to the signaling zone they serve.

Where fire alarm circuits enter or leave a building, additional transient 75 to 90 volt gas tube protection shall be provided for each conductor.

Leave 8-inch wire tails at each device box and 36-inch wire tails at the Fire Alarm Control and Annunciator Panels.

Cable for Intelligent detector Loops shall be 18 to 12 AWG twisted pair with a shield jacket or per manufacturers recommendations installed in ½" conduit. Shield continuity must be maintained and connected to earth ground only at the control panel.

SLC wiring must not be in the same conduit with AC power wiring or other high current circuits. T-taps or branch circuit connections are allowed for all class B SLCs.

Cable for RS 232-c devices (CRT, PRINTER) shall be dual pair twisted-shielded.

Cable for RS 485 devices (Remote Annunciators) shall be twisted-shielded pair (Belden 9841 or equivalent) for the data signal. Power wiring shall be 12 AWG.

All splices or connections shall be made within approved junction boxes and with approved fittings. Boxes shall be red and labeled "FIRE ALARM SYSTEM" or “FA” by decal or other approved markings.

Speaker and strobe circuits shall have separate conductors, and shall operate independently of each other.

Speaker wiring shall be #18 AWG twisted-shielded cable.

Strobe wiring shall be #14 AWG minimum.

Tray cable is not acceptable for use as fire alarm system wiring installed in conduit.

**DEVICE MOUNTING**

Unless otherwise noted on the drawings, plans, specifications or by the Architect or Engineer; the recommended mounting heights, and requirements are as follows:

FIRE ALARM CONTROL PANELS

Mount Fire Alarm Control Panel (FACP) such that all visual indicators and controls are located at 60 inches above floor level.

ANNUNCIATOR PANELS

Mount Fire Alarm Annunciator Panel (FAAP) such that all visual indicators and controls are located at 60 inches above floor level.

VISUAL AND AUDIO/VISUAL NOTIFICATION APPLIANCES

In Public-Mode Areas, as defined within NFPA-72, install flush, semi-flush or surface between 80 inches and 96 inches or 6 inches below finished ceiling or at 80 inches from the bottom of the device to the highest level of the finished floor. No devices protruding 4 inches or more shall be installed lower than 80 inches. If these requirements are not achievable, consult with the Engineer before installation.

Audio/visual devices may be installed on the ceilings only where indicated, or where approved in writing by the Engineer. (In such cases, these devices shall be installed in accordance with current NFPA 72 standards).

Except as noted in the previous paragraph, all audio/visual devices shall be installed at the same height through out the facility.

For surface mounting, use manufacture-supplied backboxes and trim plates, which shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its circuit number.

MANUAL STATIONS

The operable part of the manual stations shall be installed not less than 3 ½ ft. (42") and not more than 4 ft. (48”) above finished floor. All Manual Stations shall be in unobstructed locations. Mark the unit’s address on the inside and outside of housing.

All manual pull stations shall be installed at the same height throughout the facility.

For surface mounting, use manufacture-supplied backboxes and trim plates. Backboxes shall be painted Red or off White, and shall contain no visible conduit knock-outs. Mark each device with its loop and address.

During the installation of the new fire alarm systems, new pull stations should be covered or identified as not being operable so building occupants will not be confused as to which fire alarm pull station should be pulled during an alarm condition. Likewise, after the new system is installed, tested and accepted, the existing pull stations should be identified as not being operable (or permanently removed as soon as possible).

HEAT AND SMOKE DETECTORS

The location of detectors shown on the plans is schematic only. The detectors must be located according to code requirements.

Surface mounted detectors shall be installed using back boxes equal to the base's size. Standard octagon and square boxes are not acceptable.

Detectors should be located on the highest part of a smooth ceiling so that the edge of the detector is no closer than 4 inches from a sidewall. Ceilings with beams, joists or soffits that exceed 8 inches in depth require special planning and closer spacing.

If it is necessary to mount a detector upon a sidewall, the top of the detector (the sensing chamber portion of the device) shall be located no closer than 4 inches from the ceiling and no further away than 12 inches.

Smoke detectors should be installed to favor the air flow towards return openings and not located closer than 3 feet from air supply diffusers which could dilute smoke before it reaches the detector. No detectors shall be installed in direct airflow.

Duct smoke detector installation to be by this contractor and should be installed in the locations shown on the mechanical and electrical plans. Ensure that the duct smoke detectors are in serviceable locations. Consult with the mechanical designer for alternate locations if these are shown in non-serviceable locations. When locations on mechanical plans are not available, install in locations called for that provide accessibility for service. Do not install within four feet of a fan discharge

Heat and smoke detectors should be located near the center of the open area which they are protecting, thus providing coverage generally for 15-foot radius for heat and smoke detectors. Questionable locations shall be verified with Architect or Engineer before installation takes place.

Heat and smoke detectors / Sensors – both Intelligent and non-addressable, shall be installed in accordance with their UL Listed Spacing. The quantity of Heat and smoke detectors / Sensors depicted on the drawings is based on the 900 square foot per detector rule. If detectors with significantly different spacing requirements are selected by the Fire Alarm equipment provider / EC, then additional detectors / sensors, if required, shall be provided at no additional cost to the project.

**IDENTIFICATION**

Attach the label containing the address and SLC designation to:

- Each addressable detector. Label shall be visible and readable from the floor, 3/16" minimum character size (¼" is recommended).
- Each manual pull station. Label shall be placed on the top part
- Each Addressable Module. Label shall be attached to the faceplate

Label shall consist of black writing on white or clear background.

All junction boxes shall be painted red and labeled "Fire Alarm" or "FA".

All circuits must be labeled with the name of circuit and the area being served by the circuit.

Wire/cable splices in junction boxes shall be labeled indicating where the wire/cable is coming from and where it is going.

All conductors terminated in control panels, annunciator panels and extension panels shall be labeled.

All audio visual devices shall be labeled by each circuit and the order of the device on that circuit such as "Circuit No. 2, strobe No. 05 of 10".

All labels shall be permanent, and be machine generated. NO HANDWRITTEN OR NON-PERMANENT LABELS SHALL BE ALLOWED. Submit a sample for approval before using any labeling schemes.

Label size shall be appropriate for the conductor or cable size(s) and design. All labels to be used shall be self-laminating, white/transparent vinyl and be wrapped around the cable (sheath). Flag type labels are not

allowed. The labels shall be of adequate size to accommodate the circumference of the cable being labeled and properly self-laminate over the full extent of the printed area of the label.

Adhesive type labels not permitted except for phase and wire identification.

**TESTING**

Before proceeding with any testing, all persons, facilities and building occupants whom receive alarms or trouble signals shall be notified by the contractor to prevent unnecessary response or building occupant distress. At the conclusion of testing, those previously notified shall be notified that testing has been concluded.

The manufacturer's authorized representative shall provide on-site supervision of installation of the complete fire alarm system installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system prior to final inspection.

Contractor shall pre-test each and every device in the system before the system is considered ready for final inspection.

The completed and pre-tested fire alarm system shall be fully tested in accordance with NFPA-72 by the Contractor in the presence of the Owner's representative and the local Fire Marshal.

The Owner's representative may suspend or discontinue the tests at any time performance is considered unsatisfactory. Resumption of testing will cover untested elements and any replaced elements. The contractor shall furnish all test personnel, test instruments and equipment of the accuracy necessary to perform the test. Arrangements for testing must be made with the Owner's representative and the Engineer at least two weeks before the proposed testing date.

Upon the completion of a successful test, and prior to the final request for payment the Contractor shall:

- Certify the system to the Owner in writing
- Complete the NFPA 72 record of completion form
- Provide as builts and O&M manuals.
- Provide a signed statement that the Owner had received the specified system operation and maintenance training

The final payment will not be processed unless these documents are complete and are on hand.

**WARRANTY**

The Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects for a period of two (2) years from the date of substantial completion of the project.

At the end of the project, the Contractor shall post the warranty period along with the company's name and telephone number inside the fire alarm panel.

Any occupied facility shall not be without a UL and an NFPA approved and fully operational fire alarm system for a period longer than two (2) hours. Emergency response shall be provided within two (2) hours of the notification, to the contractor, of the failure of the system to perform operationally per UL and NFPA standards. Non-emergency service calls shall be responded to within twenty-four (24) hours of the notification to the contractor.

Emergency situations may include, but not limited to

- System can't be acknowledged or reset
- System is non-responsive to commands
- System in non-responsive to actuated alarm devices
- Malfunction of notification/initiating circuit(s)
- System going into alarm/trouble without indicating the source
- System is dead (no power), etc.

Repairs and/or replacement arising from emergency situations shall be completed within twenty-four (24) hours of the time of notification. Other than emergency, actual repairs and /or replacement shall be provided within seventy two (72) hours of the time of notification during normal working hours, Monday through Friday, excluding holidays. If the repairs involve parts that are not shelve items and require lead time, the contractor shall inform the Owner within twenty-four (24) hours from the time of notification of the exact time when the repairs will be completed.

If repair and/or replacement cannot be made within the prescribed time, then other means and methods of protection shall be provided to insure the safety of the building's occupants during which time the system is not in compliance with the standards. This may involve up to and include hiring Owner approved qualified personnel to stand a fire watch, all at the contractor's expense.

Warranty service for the equipment shall be provided by the system supplier's factory trained representative. Further, Warranty shall include all parts, labor and necessary travel.

**TRAINING**

The Contractor through his/her supplier shall provide, as part of this contract, a minimum of 4 hours system operation training for owner, the Architect/Engineer, and fire department personnel.

All training sessions shall be coordinated and scheduled by the EC, and shall be conducted at a time to be stipulated by the owner. All training and other indoctrination shall be completed prior to final inspection.

The contractor shall record all training and instructional sessions on DVD format. Provide a separate DVD for each system and label for the system demonstrated and turnover to the Owner.

Training shall not take place until all systems are 100% operational as determined by the Owner. Thepurpose of training is to fully prepare the facility maintenance staff for complete operational responsibility of the fire alarm system.

The facility maintenance staff shall be fully trained and be given the capability by the product Vendor and installing Contractor to modify, to program, to fully repair, to service, and to maintain the system after (and if desired, during) the warranty period.

The above training shall include, but not be limited to, providing and reviewing all programming software, access codes, and licenses that allow the Owner to add or to delete any points (i.e.: The mapping of devices), and to change a heat detector to a smoke detector. To meet this requirement, provide the necessary configuration and/or access code (hardware and/or software key). If the Vendor can not meet this requirement, the product is not acceptable

END OF SECTION