PROJECT MANUAL

Convert Indoor Weapons Range
Department of Military Affairs
Armory Building
Oconomowoc, WI

For

State of Wisconsin
Department of Administration
Division of State Facilities
P.O. Box 7866
Madison, WI 53707-7866
PH# 608-266-2731
Fax # 608-267-2710

TGAR GROUP of ARCHITECTS
1213-55th St., Suite 200
Kenosha, WI 53140
Ph# 262-652-2417
Fax# 262-652-2435

Project # 06K3E
July 17, 2008

NOTICE OF SOLICITATION OF BIDS
DIVISION OF STATE FACILITIES

Convert Indoor Weapons Range
Department of Military Affairs
Oconomowoc, Wisconsin

Division Project No. 06K3E
Project Manager: Kevin Trinastic

CLOSING DATE FOR BIDS: 2:00 p.m. on August 14, 2008

The Division of State Facilities, hereinafter termed DSF, hereby announces that it is soliciting bids from qualified contractors for the above project.

Bids must be received at State of Wisconsin Administration Building, 101 East Wilson Street, 7th Floor, Madison, Wisconsin 53702, on or before the closing date and time indicated above. Please send the bid to the attention of: Mr. Kevin Trinastic

In general the work consists of: This project will convert indoor weapons ranges for use as usable locker room or storage rooms. Work to include minor demolition, constructing new walls, new finishes, install new metal doors and frames, and provide energy efficient lighting within an new acoustical ceiling system.

Bid documents may be obtained from State of Wisconsin Division of State Facilities website at www.doa.state.wi.us, under “Projects Bidding”. Addenda will be posted to this website no less than (7) days prior to bid opening. Prospective bidders shall register via email to Kevin.Trinastic@Wisconsin.gov in order to ensure receipt of addenda.

Any questions regarding this project should be referred to:
Kevin Trinastic, Project Manager
Division of State Facilities
101 E. Wilson
P.O. Box 7866
Madison, WI 53707
Kevin.Trinastic@wisconsin.gov
608-261-8368 Phone
608-267-2710 Fax”

A pre-bid tour will be scheduled for July 31st, 2008 at 11:00 a.m. at the site.

Bid documents will be available on July 22, 2008 and thereafter.

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Bid Solicitation

Convert Indoor Weapons Range
Department of Military Affairs
Oconomowoc, Wisconsin

DOA/DSF Project No. 06K3E

Drawings: Bound Separately
T100 Title Sheet, Site Location Maps
A100 Floor Plans, Schedules, Details
H100 HVAC Plans, Schedules, Details
E100 Electrical Plans, Schedule

LETTER OF SOLICITATION

Convert Indoor Weapons Range
Department of Military Affairs
Oconomowoc, Wisconsin]

DOA/DSF Project Number 06K3E

The State of Wisconsin Department of Administration – Division of State Facilities is soliciting bids for the project described herein. No deposit is required to obtain bid information documents. A Bid guarantee **will** be required. **This project has less than a 30-day bid solicitation period.**

Project Location:

Department of Military Affairs
Armory Building]
1215 Wall Street
Oconomowoc, WI 53066

Submission of Bids:

Bid dollar amount must be entered on DSF Bid Form (provided herein) and the bid form signed by authorized representative of the company submitting the bid and shall be delivered hardcopy in a sealed envelope to:

Mr. Kevin Trinastic
DOA/DSF, 101 E. Wilson St, 7th Floor, Madison WI 53702

For bids mailed via US Postal Service, send to:
Mr. Kevin Trinastic
DOA/DSF, P.O. Box 7866, Madison WI 53707-7866

and must be received by DSF on or before **2:00 pm, August 14th, 2008**. Each bid shall be clearly identified on exterior label of the sealed envelope with the Project Name, DOA /DSF Project Number, Location, Bid Date, Name and Address of Company submitting Bid, name of DSF Project Contact, and clearly marked "BID". Any changes or amendments to the bid form may disqualify the bid. The bidder is responsible for the sealed bid being delivered to the 7th floor DSF reception desk for receipt stamping before the time specified for the bid opening.

Addendum:

Any addendum issued during the time of bid solicitation shall become a part of the Contract Documents. Receipt of such addendum shall be acknowledged in the appropriate space provided on the Bid Form. Bid may be rejected if receipt of an addendum applicable to the award of contract has not been acknowledged on the Bid Form.

DSF Project Contact:

Mr. Kevin Trinastic
DOA/DSF 101 E. Wilson St, 7th Floor, Madison WI 53702.
Phone: 608-261-8368
E-Mail: Kevin.Trinastic@wisconsin.gov

General Project Description:

This project involves the conversion of the indoor weapons range into usable locker room / storage space with minor demolition, new partitions, new energy efficient lighting system within a new acoustical ceiling system.

General Site Information:

Site visits to Oconomowoc Armory building should be coordinated with Kenneth Prieur. ISee title sheet for location maps. There are no security related issues regarding contractor use of the site. Contractor needs to coordinate efforts will site contact Kenneth Prieur.

Site Inspection:

A site visit by each bidder is highly recommended prior to submitting the bid for this work. To arrange for such site visit, please contact **Mr. Kenneth Prieur, SSG NGWI, phone no. 262-567-2652.**

Failure to visit the site or failure to examine any and all Contract Documents will in no way relieve the successful contractor from necessity of furnishing any materials or equipment, or performing any work, that may be required to complete the work in accordance with the Contract Documents.

Bid Guarantee:

A bank certified check, a cashier's check or a bid bond prepared on the Bid Bond Form bound herein, payable to the State in an amount not less than 10% of the maximum bid shall accompany each bid as a guarantee, that if the bid is accepted, the Bidder will execute and return the proposed Contract and Performance-Payment Bond within ten (10) days after being notified of the acceptance of his bid. The company issuing the Bonds must be licensed to do business in Wisconsin.

Any bid which is not accompanied by a bid guarantee will be considered NO BID and will not be read or accepted.

If the Bidder is unable to deliver the contract, certificate of insurance, request for subcontractor approval or performance payment bond, the bidder may limit liability to the amount of the bid guarantee by giving written notice of intent not to execute the contract, to DSF within seventy-two (72) hours of notification as the low bidder. If no such notice is given, DSF reserves the right to obtain the amount of the difference in bid price between the low bidder and the next low bidder.

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

Withdrawal of Bids:

Bids may be withdrawn by written request received from Bidder or an authorized representative thereof prior to the time fixed for opening of bids, without prejudice to the right of the Bidder to file a new bid. Withdrawn bids will be returned unopened. Negligence on the part of the Bidder in preparing his bid, confers no right for withdrawal of the bid after it has been opened.
No bid may be withdrawn for a period of thirty (30) days after the date set for the opening thereof.

If a bid contains an error, omission or mistake, the Bidder may limit liability to the amount of the Bidder's guarantee by giving written Notice of Intent not to execute the Contract to DSF within seventy-two (72) hours of notification as the low bidder. If no such notice is given, DSF reserves the right to obtain the amount of the difference in bid price between the low bidder and the next low bidder.

Security for Performance-Payment:
Simultaneously with the delivery of the signed Contract, the Bidder shall be required to furnish a Performance-Payment Bond using the Performance-Payment Bond Form attached herein. The Performance-Payment Bond shall be issued in the amount equal to %100 percent of the Contract price, as security for the faithful performance of the Contract, payment of all persons performing labor or furnishing materials for the Project, and payment of all other debts incurred in the performance of the Work. The Surety Company shall be licensed to do business in Wisconsin. The Bond must be dated the same date or subsequent to the date of the Contract.

A certified copy of power of attorney shall be provided by the Surety Company showing that the agent who signs the Bond has the power of attorney to so sign for the Surety Company. This certification must be signed by the Secretary or Assistant Secretary of the company and not by an attorney-in-fact. The certification must bear the same or later date as the bond.

If the Bidder is a partnership or a joint venture, a certified list providing the names of individuals constituting the partnership or joint venture must be furnished. The Contract itself may be signed by one partner of the partnership, or one partner of each firm comprising the joint venture, but the Performance-Payment Bond must be signed by all of the partners.

If the Bidder is a corporation, it is necessary that a current certified copy of the resolution or other official act of the directors of the corporation be submitted showing that the person who signs the contract is authorized to sign contracts for the corporation. IT IS ALSO NECESSARY THAT THE CORPORATE SEAL BE AFFIXED TO THE RESOLUTION, CONTRACT, AND PERFORMANCE-PAYMENT BOND. If the Bidder's corporation has no seal, it is required that the above documents include a statement or notation to the effect that the corporation has no seal.

Contract Payment:
The State of Wisconsin shall issue a single contract for this work. The Contractor shall furnish, on forms supplied by DSF, a detailed estimate giving a cost breakdown of the proposed values for work performed which, if approved by DSF, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as possible.

Payments to the Contractor under the Contract Documents will be made as provided for as the work progresses. Payment requests from the Contractor will be processed monthly, except for special circumstances approved by DSF. The Contractor seeking payment must perform all the conditions required for payment and must have met the obligations which are necessary to qualify for any partial payments. The Contractor shall provide a final settlement certificate stating that all claims have been settled and payments made for all labor and materials.

Wage Rates: Wage rates shall NOT apply to this project.

Contract Commencement And Completion:
The successful Contractor must agree to commence work on or before a date to be specified in a written "Notice to Proceed" and to fully complete all work within 90 days consecutive calendar

days thereafter. Completion time will be converted to a specific date at the time the "Notice to Proceed" is issued. Refer also to Conditions of the Contract for Small Projects, Article entitled "Time for Completion".

Plans, Permits and Approvals:
Plans, specifications and calculations will require submittal to the Wisconsin Department of Commerce for Plan Review and Approval prior to commencing work. The A/E and DSF will be responsible for all submittals to the Department of Commerce to obtain approved documents and any associated fees. The successful bidder is responsible for any other required submittals, including fees, to any other regulatory agency requiring permits or approvals as may be required for this project.

Contract Conditions:
Conditions of the Contract for Small Projects (copy enclosed) apply to this project.

Minority Business Participation:
The State of Wisconsin agencies and DSF have a responsibility to encourage MBE Participation in state construction projects, and as such, will give a 5% bid preference to a qualified responsible bid submitted by a minority business. MBE shall submit evidence with bid that the firm is certified as MBE by Department of Commerce, Bureau of Minority Business Development.

Contractor Qualifications:
DSF will make such investigations as deemed necessary to determine the ability of the Proposing Firm to fully, safely and responsibly carry out all contract requirements stipulated herein. DSF reserves the right to reject the bid if evidence submitted by, or investigation of, the bidding firm fails to satisfy DSF that the firm is deemed responsible and qualified to carry out the obligations of the contract and fully complete all the work described in these bid solicitation documents.

Award of Contract:
If the lowest dollar-amount bid submitted by a qualified and responsible bidder does not exceed the authorized project funds, a contract will be awarded accordingly. DSF reserves the right to reject any or all bids, or accept any bid.

WisBuild ™ DSF INFORMATION SYSTEM:

Contract offer and construction phase records including Questions, Requests for Information, Construction Bulletins, Bids, Change Orders, Schedule of Values, and Requests for Payment will be processed electronically on the WisBuild™ DSF Information System. Other construction phase records and applications will be implemented, as they become available.

Successful bidders shall have available for use within 72 hours of the bid date and maintain over the course of the construction phase, from date of Notice-to-Proceed through receipt of Final Payment, an Internet connection to access and utilize the WisBuild™ DSF Information System.

Minimum requirements - any computer which has a hard drive for storing data, and a modem and which can run version 4.x or later of Microsoft Internet Explorer or Netscape Navigator or Netscape Communicator - an Internet connection.

Recommended equipment - any computer which has a processor speed of 200 mHz or greater, a hard drive for storing data, a 56k/v.90 modem, and versions 4.x or later of Microsoft Internet Explorer or Netscape Navigator or Netscape Communicator - an internet connection which can support data transfer speeds of 56k or greater.

Information and instructions for application training and support, user names and passwords to access the WisBuild™ DSF Information System will be issued at time of contract offer.

SOLICITED BID FORM

Convert Indoor Weapons Range
Department of Military Affairs
Oconomowoc, Wisconsin

DOA/DSF Project Number 06K3E

We agree to execute the contract, if offered, and provide all labor and material required for construction of the above project for the following dollar amount, and in strict accordance with the attached contract documents.

ALL WORK

Bid dollar amount to accomplish ALL WORK required to fully complete the project in accordance with the Contract Documents,

for the sum of ($_____)

The following addenda have been received and are included in this bid:

Addenda No_____ Date_____

Addenda No _____ Date_____

Addenda No_____ Date_____

NAME OF FIRM _____

ADDRESS_____
(STREET, CITY, COUNTY, STATE, ZIP)

TELEPHONE_(_____)_____

FAX_(_____)_____ **E-MAIL**_____

PRINTED NAME_____

SIGNATURE_____

DATE_____ **TITLE**_____

STATE OF WISCONSIN
DEPARTMENT OF ADMINISTRATION
DIVISION OF STATE FACILITIES (DSF)
DOA-4506 (R01/97)
s. 16.855(2)(b)1. Wisconsin Statutes

Mailing Address: **Post Office Box 7866, Madison, WI 53707-7866**
Street Address: **101 E. Wilson Street, 7th Floor, Madison, WI 53702**
Phone: **608 / 266-2731**; *FAX*: **608 / 267-2710**
http://www.doa.state.wi.us/dsf/index.asp

BID BOND

KNOW ALL PEOPLE BY THESE PRESENTS, that _____
(a corporation of the State of _____) (individual), (partnership) (hereinafter referred to as the "Principal"), and _____, a corporation of the State of _____
Name of Surety
(thereinafter referred to as the "Surety"), are held and firmly bound unto the State of Wisconsin, for Department of Administration, Division of State Facilities (hereinafter referred to as "DSF"), in the penal sum of ten percent (10%) of the amount of the total bid or bids of the Principal herein accepted by DSF, for the payment of which the Principal and the Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The conditions of this obligation are such that, whereas the Principal has submitted, or is about to submit, to the State of Wisconsin a certain bid, including the related alternate and combined bids attached hereto and hereby made a part hereof, to enter into a Contract in writing for _____
Type of Work
for the _____
Project

(1) If said bid is rejected by DSF, then this obligation shall be void.

(2) If said bid is accepted by DSF and the Principal shall execute and deliver a Contract in the form specified by DSF (properly completed in accordance with said bid) and shall furnish a bond for the Principal's faithful performance of said Contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said bid, then this obligation shall be void.

(3) If said bid is accepted by DSF and the Principal shall fail to execute and deliver the Contract and the performance and payment bond noted in (2) above, all within the time specified or any extension thereof, the Principal and Surety agree jointly and severally to forfeit to DSF the penal sum mentioned above, it being understood that the liability of the Surety for any and all claims hereunder shall in no event exceed the penal sum of this obligation as stated. Notice will be given by DSF to the Principal and Surety of intent to request payment of all or any part of the penal sum, a minimum of 7 calendar days before making demand of payment. Payment of the penal sum by the Surety and its bond shall be received by DSF within 72 hours following demand by DSF.

The Surety, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which DSF may accept such bid, and said Surety does hereby waive notice of any such extension.

IN WITNESS WHEREOF, the Principal and the Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, on the day and year set forth below.

SEAL: _____ _____
Principal Date

By: _____

SEAL: _____ _____
Name of Surety Date

By: _____

NOTE TO SURETY AND PRINCIPAL: The bid submitted, which this bond guarantees, may be rejected if the following instrument is not attached to this bond: Power of Attorney showing that the agent of Surety is currently authorized to execute bonds on behalf of the Surety, and in the amounts referenced above.

This form can be made available in accessible formats upon request to qualified individuals with disabilities.

STATE OF WISCONSIN
DEPARTMENT OF ADMINISTRATION
DIVISION OF STATE FACILITIES (DSF)
DOA-4505 (R09/03)
s. 779.14 Wisconsin Statutes

Mailing Address: **Post Office Box 7866, Madison, WI 53707-7866**
Street Address: **101 E. Wilson Street, 7th Floor, Madison, WI 53702**
Phone: **608 / 266-2731**; *FAX*: **608 / 267-2710**
http://www.doa.state.wi.us/dsf/index.asp

PERFORMANCE-PAYMENT BOND (100%)

This Surety Bond instrument is hereby executed to guarantee performance and payment of a proposed contract between the herein named Principal and the State, dated _____, 20__, a copy of which is hereto attached and made a part hereof for the construction of

Project Title _____

_____

Project Location _____

Project Number _____ Contract For _____ work.
All, General, HVAC, Roofing, Etc.

KNOW ALL PEOPLE BY THESE PRESENTS That _____
Name of Contractor

of _____ as contractor, herein called "Principal", and _____
City and State Name of Surety

_____ of _____ as Surety, herein called
City and State

"Surety", are held firmly bound to the State of Wisconsin, for the Department of Administration, Division of State Facilities herein called "the Owner", in the amount of $_____ for the payment of all claims, costs, charges and the faithful performance of the contract as hereinafter set forth. For the payment of which, well and truly to be made, we bind ourselves, our heirs, successors, executors, and administrators, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that if the said bounded Principal shall perform and fulfill all the undertakings, covenants, terms, conditions, agreements, and shall promptly make payment pursuant to Section 779.14 of the Wisconsin Statutes to all persons who supply labor and material to said project in the prosecution of the work provided for in the within and foregoing contract, and subsequent amendments thereto, notice of such amendments to the Surety being hereby waived, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

FURTHER, labor performed and materials furnished, used or consumed in making the public improvement or performing the public work, include, without limitation because of enumeration, fuel, lumber, building materials, machinery, vehicles, tractors, equipment, fixtures, apparatus, tools, appliances, supplies, electric energy, gasoline, motor oil, lubricating oil, greases, state imposed taxes, premiums or worker's compensation insurance and contributions for unemployment compensation.

FURTHER, that no final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

PROVIDED, FURTHER, that the undersigned states that pursuant to express authority the corporate seal affixed to this instrument is the seal of this surety company, that the seal was affixed and this instrument was executed for and on behalf of this surety company; that authority has not been revoked by this surety company; that this instrument was executed as the free act and deed of this surety company; that the certificate from the Commissioner of Insurance showing authority of this surety company to transact business in the State of Wisconsin, in accordance with Section 779.14(1), Statutes, has been obtained and will be provided to the Owner upon request; and further, that this surety bond was written through an agent duly licensed as such on the date thereof.

IN WITNESS WHEREOF, this instrument is executed this the _____ day of _____, 20___.

FOR THE PRINCIPAL

By_____ _____
*Corporate Secretary — President, Partner or Individual

(SEAL) Witnessed by _____

Witnessed by _____
Two witnesses must attest above signatures

FOR THE SURETY

_____ _____
*Corporate Secretary — Attorney-In-Fact, or Authorized Officer

(SEAL) _____
(Street or P. O. Box)

_____
(City, State and Zip Code)

_____
(Telephone Number)

ACKNOWLEDGEMENT
STATE OF _____)
) ss
COUNTY OF _____)

I, _____, a Notary Public of said County and State, do hereby certify that _____

_____, Attorney-in-Fact or authorized officer of _____,
Name of Surety

who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person and acknowledged that he/she signed, sealed and delivered said instrument for and on behalf of _____, for the uses and purposes therein set forth.
Name of Surety

Given under my hand and notarial seal at my office at _____, _____, in said county,
City State

this _____ day of _____, 20_____, A.D.

_____
Notary Public

My commission expires _____

This Performance-Payment bond is

APPROVED

_____
Administrator, Division of State Facilities

* If signatory is a corporation, Secretary of corporation shall attest, otherwise leave blank.

STATE OF WISCONSIN
DEPARTMENT OF ADMINISTRATION
DIVISION OF STATE FACILITIES (DSF)
DOA-4532 (R 01/06)

Mailing Address: **Post Office Box 7866, Madison, WI 53707-7866**
Street Address: **101 E. Wilson Street, 7th Floor, Madison, WI 53702**
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CONDITIONS OF THE CONTRACT FOR SMALL PROJECTS

This document is intended for use on: 1) delegated projects, 2) projects using solicited bid procedures, and 3) small projects bid under s.16.855 procedures that have only one prime contract.

INDEX

1. CONTRACT DOCUMENTS

A. The Contract Documents consist of the documents listed in the table of contents of this specification or in the Owner's invitation to bid the contract, in addition to which may be addenda, change orders, and other documents pertaining to the project.

B. The intention of the Contract Documents is to describe the labor, materials, equipment, performance standards, schedules, and costs set forward and agreed to by the Contractor and the Owner. In the event of a conflict or ambiguity in the Contract Documents, they shall be interpreted to include all necessary Work needed for a complete, working installation.

2. DEFINITIONS

A. "Architect/Engineer (A/E)"…A person, firm, or corporation who is under contract with DSF, or a DSF or State agency employee, who is responsible for preparation of the drawings, specifications, and other related design and construction inspection services.

B. "Bidding and Contract Requirements"... means all items except Technical Specifications and Drawings as described in the Table of Contents of this Letter of Solicitation including "Bidding Requirements", "Contract Forms", "General Conditions", "Supplementary General Conditions", "General Requirements".

C. "Contract Documents"...means collectively, all documents enumerated in the Table of Contents of this Letter of Solicitation, excluding Bidding and Contract Requirements. These include the Technical Specifications, the Drawings, Addenda, Change Orders, Notice-to-

Proceed, and any changes in the Work negotiated and agreed to in writing by DSF and the Contractor before the execution of the Contract.

D. "Contractor"…A person, firm, or corporation who enters into a contractual agreement to assume responsibility for performing and completing all Work as set forth in the Contract Documents.

E. "Equals/Substitutions"…Means materials, equipment, or methods not specified in the Contract Documents that the Contractor proposes and warrants as suitable for the use intended and conforms to all other physical, functional, and performance requirements. Requests for Equals/Substitutions must be submitted to the Owner's Project Representative and electronic approval received prior to incorporation into the Work.

F. “Owner”...The Department of Administration’s Division of State Facilities (DSF). The Owner exercises the powers and duties prescribed by Section 16.85 Wisconsin Statutes. A Wisconsin State agency may exercise authority as the Owner as prescribed by Section 16.85 Wisconsin Statutes for Work on this project only. An Owner's Project Representative will be designated who will have authority to act on behalf of the Owner for administration of this contract.

G. “Shop Drawings/Submittals”...Defines drawings, product data, samples, or other information to be submitted by the Contractor to the A/E for approval before fabrication or installation. Shop Drawings/Submittals that are needed are identified in the Contract Documents or will be identified at the preconstruction meeting. The Contractor is responsible for assuring the drawing/submittals conformance with the requirements of this contract. Review and acceptance by the A/E does not relieve the Contractor from responsibility for errors or omissions.

H. “Substantial Completion”...Defines the point in time when the Work is completed to the extent that the Owner can make beneficial use of the Work for the purposes intended and the point in time when warranties and guarantees go into effect. There may be a "Punch List" of minor items of the Work or deficiencies that remain to be completed or corrected following Substantial Completion.

I. “Work”...Defines all labor, materials, equipment and special project requirements necessary to produce the end result described by the Contract Documents.

3. MATERIALS AND WORKMANSHIP

A. The Contractor shall provide all labor, materials, and equipment in a good-workman like manner in accordance with the Contract Documents and applicable industry standards, and to furnish upon request, to the Owner, information and test results having to do with the kind and quality of materials.

B. References to a standard specification of an association or manufacturer or to a State code means the most recent printed edition or catalog in effect on the date the contract is signed.

C. No material, equipment, or supply shall be purchased by the Contractor that is subject to any conditional agreement where title is retained by the seller. Any material, equipment, or supply will be furnished clear of any lien or claim.

D. Reference in the documents to a manufacturer’s trade name or number establishes a standard, and the Owner may consider any material or item that will perform adequately under the Contract Documents as Equals/Substitutions, subject to prior approval. No compromise in quality level is acceptable.

E. Use of any material or equipment other than what has been specified or approved by the Owner is not acceptable under the contract and shall be removed and replaced at the Contractor's expense.

4. PERMITS, REGULATIONS, AND TAXES

A. The Contractor shall obtain all permits, licenses, and approvals needed for the performance of the Work and will give all notices and comply with all laws, codes, rules and regulations that pertain to the performance of the Work.

B. The Contractor will pay all taxes required by law.

C. The Contractor shall notify the Owner of any variance in the Contract Documents needed to comply with codes, rules, and regulation upon which the Owner will correct the documents at no additional cost to the Contractor.

D. The Contractor shall include all charges in its bid and pay for water, sewer, and other utility connections made by municipalities.

5. CONTRACTOR'S OBLIGATIONS AND SUPERINTENDENCE

A. The Contractor shall provide and pay for all equipment, materials, supplies, and labor necessary for the completion of the Work within the time agreed, including transportation, storing, superintending, and installing. The Contractor shall be responsible for insuring that all Work strictly conforms to the requirements of this contract and shall maintain adequate inspection and quality control procedures to assure the same. The presence and observation of the Work by the Owner shall not relieve the Contractor of any obligations.

B. The Contractor shall attend a preconstruction meeting and any subsequent construction related meetings that are scheduled by the Owner's Project Representative. The Contractor shall make a timely submittal of all shop drawing/submittals that are required to describe how it will fulfill its responsibility under this contract. While the Contract Documents may identify minimum performance characteristics and brand names to establish the required level of quality, Equals/Substitutions may be considered. However, the Contractor shall be responsible to document the qualifications of a proposed Equal/Substitution, and any additional costs for achieving required performance shall be borne by the Contractor.

C. The Contractor shall give personal superintendence to the Work through a designated superintendent or foreperson knowledgeable and experienced with the Work and able to act for the Contractor in all matters. The Contractor shall schedule Work and coordinate the activities of any subcontractors to assure timely completion, and shall coordinate site access, storage, and construction activities with the Owner to minimize impacts on program operations.

D. The Contractor certifies that it is familiar with the site conditions that may affect the Work or its costs and shall perform the Work without additional expense to the State, except for Changes in the Work or unforeseen conditions that may arise.

E. The Contractor shall maintain a clean and safe work environment. Barricades and other appropriate safety measures required by Federal, State, or other governmental authority having jurisdiction shall be provided. Unused, discarded, or hazardous materials generated by the Work shall be properly managed and recycled or disposed in accordance with applicable rules or regulations. Disposal of hazardous materials shall be coordinated through the Owner's Project Representative.

F. The Contractor shall safely guard the Owner's and any adjacent property from injury or loss in connection with the Work and shall make good any loss from damage due to the

Contractor's actions or lack of actions. Stormwater runoff from excavations shall be properly managed to prevent soil erosion off site or into lakes, streams, or other surface waters.

G. The Contractor shall grant access to the Owner's Project Representative, A/E, and other authorized persons. Should it be necessary in order to examine the Work to tear out or remove portions, the Contractor shall immediately furnish all facilities necessary. If the Work is found defective, the Contractor shall assume all expenses for tearing out, inspecting, and satisfactory reconstruction. If the defective Work is found to be in compliance with the Contract Documents, the Contractor will be reimbursed for the direct costs involved.

H. The Contractor may use existing water and electrical sources available at the Work site, and existing toilet facilities, at no cost. Arrangements for use must be made through the Owner's Project Representative. The Contractor shall make it's own arrangements and pay for telecommunications services as needed.

I. All Work must be complete, tested, and ready for use by the Owner prior to Substantial Completion. The Contractor shall also provide operating and maintenance instructions for each item of equipment or device installed, including parts lists, description of control cycles, and wiring diagrams.

J. The Contractor shall maintain a set of record drawings on which changes and deviations from Contract Documents shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings. At the completion of the project, the Contractor shall submit the marked-up record drawings to the Owner's Project Representative prior to final payment.

6. CHANGES IN THE WORK

A. All changes shall be documented by an electronic Change Order to adjust the contract amount. Changes may be either an add or a deduct. Changes may be initiated either by an electronic Field Order from the Owner's Project Representative prior to determination of the final cost, or by an electronic Change Order that is based upon the final agreed upon total cost. Except in cases of emergencies, no change in the Work shall be made without the prior approval of the Owner.

B. Field Orders or other proposed changes in the Work can only be authorized by the Owner's Project Representative. When a change is initiated, the Contractor shall provide the Owner's Project Representative with an electronic proposal within 10 working days, unless both parties agree upon a different time period. The Contractor's proposal shall state the proposed cost of the change, with appropriate cost breakdown, any effect on the contract completion date, and pertinent information concerning the circumstances and scope of the change.

C. The cost of the change to be added or subtracted from the contract amount shall be calculated using one of the following methods:

1) By Unit Prices that are part of the approved contract or as agreed upon by the Owner's Project Representative.

2) A Lump Sum that is based upon the anticipated cost of labor, materials, equipment or large tool rental, and overhead and profit.

3) By Actual costs that are based upon documented labor and materials costs expended. Labor rates and other costs shall be established as outlined in "Procedures for the Change Order Proposal" guideline document that is available from DSF.

D. The overhead and profit markup on changes shall not exceed 15%. The markup for that portion of Work performed by a subcontractor shall be limited to 7.5%. A reasonable credit for overhead and profit shall be included in the amount of a deduct change. Overhead and profit includes expenses for estimating, change order processing, supervision, installation layout, small tools and supplies, job related general expenses, record drawings, and all other costs relative to change order proposals and field and office supervision.

7. TIME FOR COMPLETION AND SUBSTANTIAL COMPLETION

A. The date of beginning the Work and the time of completion are essential conditions to the contract. All Work shall be prosecuted regularly and diligently and the Contractor agrees that the time for completion is reasonable.

B. The Contractor shall keep the Owner informed about Work activities, progress, delays, and anticipated completion date. Should delays be caused by reasons beyond the control of the Contractor, an extension of the contract completion date may be requested. Permitting the change shall not serve as a waiver on the part of the Owner of any right under the contract. The Contractor shall be responsible for damages resulting from delays that were not beyond the Contractor's control.

C. When the Contractor considers that the Work is Substantially Complete, the Owner's Project Representative will conduct an inspection to verify completion of the Work and provide an electronic list of any incomplete or defective Work. When in the judgment of the Owner's Project Representative the Work is Substantially Complete, electronic notice will be provided to the Contractor and the Agency, a time will be fixed for completion of any remaining minor Punch List items, and responsibility will be established for operation, maintenance, and security.

8. CORRECTION OF THE WORK

A. Labor, materials, and equipment involved in the Work are subject to inspection at any time by the Owner. Labor, materials, and equipment that do not comply with contract requirements shall be replaced at the Contractor's expense. Rejected items shall be immediately removed from the site.

B. If the Contractor neglects to perform the Work in accordance with the Contract Documents, the Owner may, after ten days written notice to the Contractor, repair the deficiency. The Owner will then issue a change order to deduct from the amount owed the Contractor the cost of correcting the deficiency.

9. OWNER'S RIGHT TO TERMINATE CONTRACT

A. Should any provision of the contract be violated by the Contractor or any subcontractor, the Owner may serve written notice on the Contractor of its intention to terminate the contract and, unless the violation ceases and satisfactory corrections are made within ten days, the contract shall then terminate. The Owner will notify the contractor of the termination. The Owner may then take over and complete the Work by contract or otherwise and may take and use all materials on site necessary to complete the Work. The Contractor shall be liable for all excess costs involved in the completion.

B. The Owner shall also have the right to terminate this contract at any time without cause following the expiration of thirty days written notice to the Contractor. The Contractor shall be paid for all Work performed or expenses incurred prior to the date of termination. Expenses must be documented and shall not include lost profits. Materials not incorporated into the Work shall be turned over to the Owner.

10. CONTRACT SURETY

A. A Payment and Performance Bond will not be required for the project unless such a requirement is included in the project documents. However, the following provisions for assurance of payment and performance do apply.

1) All contracts involving $30,000 or more require that the Contractor maintain a list of all subcontractors and suppliers performing labor or furnishing materials under the contract.

2) For contracts between $10,000 and $100,000, payments will generally be limited to a single payment for all Work upon completion of the project. Exceptions may be made for seasonal Work or Work delayed by the Owner. The Contractor shall provide a wavier of lien for labor and materials provided for any partial payments authorized.

B. Prior to final payment, the Contractor shall furnish to the Owner a certification that all debts and claims have been paid or otherwise satisfied.

11. PAYMENTS TO THE CONTRACTOR AND BY THE CONTRACTOR

A. Requests for payment shall be in electronic form from the Contractor, or in the form of a "Request and Certification for Payment", as determined in the notice to proceed. Any partial payments may have 10% of the amount retained until final payment is made.

B. All requests for payment shall be submitted to the Owner's Project Representative. The Contractor shall furnish any records or other satisfactory evidence requested by the Owner to establish the sum requested in the request for payment represents the value of Work completed.

C. Payments will not be made for incomplete or deficient Work. The Contractor shall certify that its invoice or request for payment is true and accurate and that all sums are earned and payable.

D. The Contractor shall within seven calendar days following receipt of payment from the Owner, make payment to each and every person or entity who furnished goods or services for the progress of the Work on the project, the value of which were included in the Contractors invoice or "Request and Certification for Payment". Upon request of the Owner, the Contractor shall furnish satisfactory evidence of payment under this article.

E. In the event the Owner receives notice from any person, Contractor, subcontractor, or other third party, that the Contractor has failed to pay such person(s) for Work performed in accordance with the Contract Documents, the Contractor shall, at the request of the Owner, and in no more than 10 calendar days, provide all documentation the Owner believes necessary to determine whether such payment is due, or reasons for non-payment of disputed amounts. In the event the Owner determines the claim to be valid and payment is due, or in the absence of aforementioned documentation, the Owner may authorize direct payment of any unpaid bills, withholding from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such claims until satisfactory documentation is furnished that all liabilities have been fully discharged or reasons for non-payment of disputed amounts are provided by the Contractor. In no event shall these provisions be construed to impose any obligations upon the State to the Contractor.

F. Final Payment will not be made until:

1) Project is substantially complete and all equipment tests and punch list items have been satisfactorily completed.

2) A certification has been submitted that all debts and claims have been paid or otherwise have been satisfied.

3) An affidavit of compliance with wage rates has been submitted, if applicable.

4) All record drawings, written warranties and special guarantees required for the project have been submitted.

5) All maintenance and operating instructions, part lists, description of control cycles and wiring diagrams, on-site training, keys or special tools have been completed or submitted as required.

G. Final payment to the Contractor constitutes a waiver of all claims by the Owner except those arising from unsettled liens, faulty or defective Work appearing after Substantial Completion, failure of the Work to comply with the Contract Documents, or terms of any special guarantees required by the contract.

H. Acceptance of final payment constitutes a waiver of all claims by the Contractor.

I. The Contractor may not assign any part of this contract or any money due under this contract without the written consent of the Owner.

J. If the Contractor fails to submit a Request for Final Payment or make satisfactory arrangements with DSF within thirty (30) calendar days of notification, no further payments will be mad and the contract will be closed. The last Request for Certification for Payment will be considered the Final Payment under the terms and conditions of the contract.

12. MINIMUM HOURLY WAGE RATES AND APPRENTICE PROVISIONS

A. Minimum prevailing wage rate requirements will apply to this project if the cost exceeds thresholds established by the Department of Work Force Development for Work performed by a single occupation classification.

B. Wage rate requirements will be determined by the Owner and included in the Contract Documents when applicable. The Contractor shall comply with any wage rate requirements for the project and provide and affidavit of compliance prior to final payment, if applicable.

C. When Wage Rates apply to the contract, the Contractor agrees that in the performance of this Contract or in the performance of all subcontracts entered into by the Contractor, every effort will be made to employ apprentices in accordance with the maximum ratio of apprentices to journey workers established by the Department of Workforce Development in accordance with State of Wisconsin Executive Order No. 108, dated June 29, 2005.

D. Failure to comply with the conditions of this Article 34 may result in the Contractor becoming declared an "ineligible" Contractor, termination of the Contact, or withholding of payment.

13. NONDISCRIMINATION/AFFIRMATIVE ACTION

A. In connection with the Work under this contract, the Contractor shall not discriminate against any employe or applicant for employment because of age, race, religion, color, handicap, sex, physical condition, developmental disability as defined in Section 51.01 (5) Wisconsin Statutes, sexual orientation or national origin. This provision includes but is not limited to employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. Except with respect to sexual orientation, the Contractor shall take affirmative action to ensure equal employment opportunities.

B. The Contractor shall post in conspicuous places notices to be provided by the Owner setting forth the provisions of the non-discrimination clause.

C. Contracts with a value of thirty thousand dollars ($30,000) or more require the Contractor to submit a written affirmative action plan acceptable under Wisconsin Statutes and

Administrative Code. An exemption occurs from this requirement if the Contractor has a Work force of less than thirty (30) employees. Contractors are responsible for obtaining affirmative action compliance from their Subcontractors. Instructions on satisfying these requirements will be sent with the Notice to Proceed. Technical assistance regarding this Article 32 is available from the Wisconsin Office of Contract Compliance, telephone (608) 266-5462.

14. SUBSTANCE ABUSE PREVENTION

The State of Wisconsin recognizes and supports drug-free workplace programs as an important element in the national strategy to reduce the devastating effects of drug and alcohol abuse in our society. The State urges contractors, subcontractors, suppliers and vendors to establish and enforce drug-free workplace policies and programs.

The possession, use of, distribution or purchase of illegal drugs, or use of alcohol at work by any employee on State of Wisconsin construction job sites is strictly prohibited.

The terms of this Substance Abuse Statement covers all construction personnel who are working on State of Wisconsin job sites. This includes employees of all contractors, subcontractors, contractor suppliers, and their employees, who come to the job sites to do work.

The State is not responsible for any cost of substance abuse testing, rehabilitation or medical reviews related to substance abuse. The contractor further agrees to indemnify and hold the State harmless from any damages or other costs incurred which are related to the implementation or enforcement of any substance abuse policy or program.

15. SUBCONTRACTS

A. Subject to approval by the Owner, the Contractor may subcontract portions of the Work to be performed under this contract. However, this does not relieve the Contractor from responsibility or liability for execution of the Work.

B. Requests for approval of subcontractors shall be submitted and approved in writing before their employment on the project. The Owner may request that the Contractor provide information to substantiate the proposed subcontractor's qualifications or ability to perform the Work.

16. WARRANTIES

A. The Contractor warrants to the Owner that all materials, equipment, and supply used in the Work are free from liens, claims or encumbrances, of good quality, and new unless otherwise permitted by the Contract Documents. The Contractor also warrants that the Work will be free from defects and strictly conform to the requirements of the Contract Documents.

B. The Contractor shall remedy and repair all defective Work and materials and pay for any damage to other Work resulting therefrom, which may appear within the warrantee period, providing such defects and damages are not due to abuse or misuse by the Owner. The Owner will give notice of defects or damages with promptness.

C. The warrantee period shall be one year from the date of Substantial Completion, or where warrantees are required in sections of the specification that are in excess of one year, the longer terms shall apply.

17. CLAIMS

A. In the event a dispute arises, the Contractor shall present its written claim to the Owner's Project Representative. If the Project Representative rejects this claim, the Contractor may

then appeal in writing to the Administrator of the Division of State Facilities. The DSF Administrator will act on this appeal within 21 calendar days after its receipt and notify the Contractor accordingly. If no appeal is made, the Contractor shall waive it's right to pursue the claim any further.

B. If the Contractor's claim is rejected by the DSF Administrator, the Contractor may make its claim to the State Claims Board per Section 16.007 Wisconsin Statutes.

C. If the Contractor's claim is rejected by the State Claims Board, the Contractor may commence an action against the State under Section 775.01 Wisconsin Statutes. Venue for any judicial action shall be Dane County, Wisconsin.

D. DSF and the Contractor shall act in good faith to efficiently and fairly resolve claims and disputes arising under the contract. The Contractor shall proceed with the performance of the Work as directed by the Owner's Representative during the period of any claim or dispute.

18. INSURANCE

A. Insurance to be carried by the Contractor:

The Contractor shall not commence Work until the Contractor has obtained all the insurance required under this section and the Owner has approved such insurance. The Contractor shall not allow any subcontractor to commence Work until the insurance required of the subcontractor has been obtained and approved. The Contractor shall provide an insurance certificate showing coverage provided from a company licensed to do business in Wisconsin. The Contractor may either require each subcontractor to maintain insurance equal to the following requirements or insure them under the Contractor's policy.

1) Compensation Insurance: The Contractor shall maintain worker's compensation insurance as required by Wisconsin Statutes for all of the Contractor's employees engaged in Work.

2) Contractor's Commercial General Liability and Auto Liability Insurance: The Contractor shall maintain Commercial General Liability Insurance including coverage for Independent Contractors, against any claims that may occur in carrying out the Work under this contract. Minimum limits shall be $1,000,000 per occurrence, $1,000,000 General Aggregate (applies per project) $1,000,000 Personal Injury and $1,000,000 Completed Operations. The Contractor shall also maintain business auto coverage form insurance covering owned, non-owned, and hired automobiles. Minimum coverage shall be $1,000,000 for each accident limit. The above limits are minimum acceptable insurance limits and do not represent the coverage and limits necessary to protect the contractor. The limits should not be construed in any way to limit the contractor's liability to the State.

3) Scope of Insurance and Special Hazards: The Contractor's commercial general liability insurance shall provide adequate protection against damage claims which may arise from operations under this contract, whether such operations be by the insured or by anyone directly or indirectly employed by the insured, and also against any of the special hazards which may be encountered in the performance of this contract. The Contractor is responsible for determining the special hazards that must be insured for on this project. Special hazards may include loading and unloading, excavating, filling, drilling, blasting, explosions, demolition, underpinning, elevator, or hoist. Insurer must also document on the insurance certificate that they have been notified, when applicable, of the Contractor's involvement in asbestos abatement and that insurance coverage provided specifically covers that activity.

4) Builder's Risk (Property) Insurance: The Contractor shall procure and maintain during the life of this Contract and until interest in the property ceases (the policy shall allow for

partial occupancy) in a company or companies lawfully authorized to do business in the State of Wisconsin, property insurance in the amount of, at least, the initial Contract sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis. Such property Insurance shall be written on a Builder's Risk Form that shall include insurance for physical loss or damage to the Work, temporary buildings, and equipment or material consumed in the construction of the Work. This Builder's Risk Form shall include coverage for, but not limited to, the following perils: All Risk.

5) Remodeling, Maintenance and/or Repair; on approval by DSF, the Contractor shall procure and maintain during the life of this contract and until interest in the property ceases (this policy shall allow for partial occupancy) in a company or companies lawfully authorized to do business in the State of Wisconsin, and installation floater and extension endorsement or other such instrument, in the amount of the Contract sum as well as subsequent modifications thereto for the entire Work at the site on replacement cost basis. Such installation floater shall include the Contractor's cost of labor, physical loss or damage to the Work, temporary buildings, and equipment or material consumed in the construction of the Work.

B. Insurance to be carried by the Owner:

None.

DIVISION 1 - GENERAL REQUIREMENTS
Division Project No. **06K3E**

INDEX

1. GENERAL

All articles in these General Requirements are applicable to all Divisions and Sections of the Work included herein. The Conditions of the Contract, General and Supplementary General Conditions, and these General Requirements shall apply with equal force and effect to the Contractor and all Subcontractors engaged in this work.

Contractor or the Contractor's authorized representative must be present to accept delivery of all equipment and material shipments. DSF's representatives will not knowingly accept, unload or store anything delivered to the site for the Contractor's use. Inadvertent acceptance of delivered items by any representative or employee of the State shall not constitute acceptance or responsibility for any of the materials or equipment. It is the Contractor's responsibility to assume liability for equipment or material delivered to the job site.

2. SPECIAL SITE CONDITIONS

Confine all operations, equipment, apparatus and storage of materials, to the immediate area of work to the greatest possible extent. Contractor shall ascertain, observe and comply with all rules and regulations in effect on the project site, including but not limited to parking and traffic regulations, use of walks, security restrictions and hours of allowable ingress and egress. Any special traffic control during construction involving lane closures shall be in accordance with the federal standard, Manual of Uniform Traffic Control Devices.

The Contractor shall take all measures necessary to become acquainted with the location of underground service, utilities, structures, etc., which may be encountered or be affected by the Contractor's work, and shall be responsible for damage caused by neglect to provide proper precautions or protection. As a minimum to become acquainted with such underground appurtenances, the Contractor shall: 1) Observe existing conditions visible at the site immediately prior to commencement of work; 2) Review available site plans incorporated in the contract documents and/or provided by the DSF Project Representative; and 3) Obtain input from the "one-call system", the organization composed of all suppliers of utilities/services to or from the site.

Information pertaining to existing conditions that are described in the specifications or appear on the drawings is based on available records. While such data has been collected with reasonable care, there is no expressed or implied guarantee that conditions so indicated are entirely representative of those actually existing. This information is provided to inform the Contractor of known, existing conditions so that due diligence is taken by the Contractor to avoid damage. Where site observation or documents indicate existing underground utilities/services in close proximity (within four feet horizontally and/or four feet vertically) to necessary new construction work, the Contractor shall be responsible to test, probe or otherwise determine exact locations so as to prevent damage to such utilities/services.

Existing pipes, electrical work, and all other utilities encountered, which may interfere with new work, shall be re-routed, capped, cut off, or replaced by the Trades having jurisdiction, in accordance with the Contract Documents.

Foundations are designed for soil pressure indicated. Changes in the work due to revisions of foundations because of unsatisfactory soil conditions will be classed as additional work.

Any special security precautions for the project will be defined at the preconstruction meeting. In general, security requirements will include the following:

Work shall be conducted during normal working hours from 7:30 A.M. to 5:00 P.M. daily, Monday through Friday, in coordination with the User Agency and DSF's Project Representative.

All tools are to be inventoried each day. Do not leave tools unattended. Report any missing tools at once. Tools which must remain on the job after working hours shall be locked in a room designated by the Institution through DSF's Project Representative at the preconstruction meeting. Contact institutional representative indicated at the preconstruction meeting.

Contractors, through arrangement with DSF's Project Representative, may use a designated room for materials storage during construction.

Worker's vehicles may be parked in an area designated by DSF's Project Representative. Keys shall be removed and doors of vehicles locked when not in use.

DSF's Project Representative will designate an area in a building which can be used by workmen for eating lunch and for toilet needs. Toilets used by workmen shall be kept clean and sanitary at all times.

All buildings at this site will be occupied during the construction.

To insure the safety of persons at the Institution, the following safety measures should be observed:

Contractor shall instruct his workmen not to leave any openings in barricades, or to leave tools, equipment, or materials lying around in any area where persons may traverse. Surfaces of barricades, enclosures, etc., must be smooth with no protruding nails or other sharp projections or edges on side toward existing occupied areas, corridors, connecting links, etc.

Outdoor lanes for emergency exit from existing buildings which may lie within or adjacent to new construction area must be kept clear of obstructions at all times.

3. HAZARDOUS SUBSTANCES-ASBESTOS, LEAD AND PCB's

Airborne asbestos fibers, lead, and PCB compounds, if encountered, have been determined to be hazardous to one's health. Compliance with all possible applicable regulations is the Contractor's responsibility. Contractor shall not provide or install any product that contains any amount of asbestos or PCB. See General Requirements, Section 18. CLEANING AND WASTE DISPOSAL for disposal of hazardous waste, if encountered.

<u>Asbestos</u>

Removal of building materials identified as asbestos-containing materials (ACM) that will be disturbed by renovation work, including ACM thermal system insulation, ACM spray applied and trowel applied surfaces, cement-asbestos products, ACM flooring and associated ACM flooring mastics and friable miscellaneous ACM including but not limited to ceiling tile will be by DSF under separate contract.

Contractor's attention is directed to WAC NR 447, WAC HSS 159 and the Occupational Safety and Health Act (OSHA) in general, part 1926.1101--ASBESTOS in particular. Contractor is responsible for compliance with all applicable regulations when the work includes fastening to or coring through Asbestos Containing Materials (ACM) and disturbance of asbestos containing caulking and mastics. Unless otherwise indicated, all caulking, sealants, glazing compounds, gaskets, asphalt roofing materials and miscellaneous adhesives are assumed to contain asbestos and are considered to be Category I non-friable ACM as defined in NR 447. Waste

material containing Category I non-friable ACM is regulated as Construction and Demolition (C&D) waste and may be disposed of at a Department of Natural Resources (DNR) approved C &D waste landfill. If Contractor's work methods cause non-friable ACM to become friable, the Contractor is responsible for the disposal of the friable asbestos waste at a landfill specifically approved by DNR to accept friable asbestos. A copy of the signed waste manifest for the disposal of all friable asbestos waste shall be provided to DSF prior to request for final payment.

Lead Based Paint

Conform with OSHA and EPA recommended worker safety requirements when removing lead based paint or material bearing lead based paint or material contaminated with lead by the demolition process. Contractor's attention is directed to the Occupational Safety and Health Act (OSHA) in general and particularly to 29 CFR 1910 (LEAD STANDARD) and to CFR 1926 (LEAD EXPOSURE IN THE CONSTRUCTION INDUSTRY). For OSHA compliance and regulation interpretations, contractors may contact the area OSHA office for this project. [Milwaukee, telephone (414) 297-3315; Appleton, telephone (414) 734-4521; Eau Claire, telephone (715) 832-9019]. Dispose of refuse containing lead based paint or contaminated with lead by the demolition process in conformance with State of Wisconsin Hazardous Waste Regulations set forth by the Department of Natural Resources and in conformance with OSHA and EPA recommended worker safety requirements.

PCB'S

Contractor's attention is directed to Wisconsin Administrative Code, Chapter NR 157 relative to PCB's.

4. PROJECT MEETINGS

Project meetings will be held at the time designated by DSF. Contractor, when requested, shall attend these meetings. If the principal of the firm does not attend meetings, a responsible representative of the Contractor who can bind the Contractor to a decision at the meetings shall attend.

The Architect/Engineer or a representative thereof will write a report covering all items discussed and decisions reached and copy of such report distributed to all parties involved.

5. SLEEVES AND OPENINGS

Contractor shall furnish all sleeves required for their penetrations whether or not they responsible for providing the respective openings. Openings that are required and are not shown on the structural and/or architectural drawings shall be the responsibility of the contractor requiring the openings. The contractor shall install sleeves for these openings or cut openings as needed (including floor openings within chases).

6. CUTTING AND PATCHING

Cutting and patching required to access work in existing walls, in chases, above inaccessible ceilings, below floors, etc., shall be by the Contractor who requires the access, unless shown on the bid documents otherwise or noted otherwise. Where cutting and patching is required, the Contractor shall hire individuals skilled in such work to do cutting and patching. Holes cut in exterior walls and/or roofs shall be waterproofed. Do not pierce beams columns or other building elements without permission of DSF and then only as directed in writing.

Patching includes repairing openings to match adjacent construction and painting the surface to match existing. Painting means covering the entire wall where patching is to be done to nearest break point or corner unless indicated to be done by other trades.

7. MANUFACTURER'S DIRECTIONS

Contractor(s) shall apply, install, connect, erect, use, clean and condition manufactured articles, materials, and equipment as recommended by the manufacturer, unless specified to the contrary. The manufacturer's latest recommendations at the time of bidding shall be used.

8. LAYOUT
The Contractor shall lay out its work and be responsible for all lines, elevations and measurements of the building and other work executed under its Contract. The Contractor must exercise proper precaution to verify dimensions on the drawings before laying out work and will be held responsible for any error resulting from failure to exercise such precaution.

9. STAIRS AND SCAFFOLDS
The Contractor shall furnish and maintain equipment such as temporary stairs, scaffolds, fixed ladders, ramps, chutes, runways and the like as required for proper execution of work by all trades, and shall remove them on completion of the work.

10. HOISTS, ELEVATORS OR CRANES
The contractor shall provide and pay for its own hoist/crane or other apparatus necessary for unloading/setting or moving their equipment and materials. Existing elevators may be used on a limited basis with DSF's permission and agreement. Appropriate protection must be provided by the using contractor and that contractor shall be responsible for any structural, mechanical or finish damage to the elevator and its parts and to adjoining building finishes and components.

11. FENCE: NONE.

12. ROADWAY
The Contractor may use existing roadway(s) for delivery of materials. Contractor shall repair/restore roadway from any damage caused by material or equipment deliveries.

13. TOILETS
Contractor should arrange with state agency to use nearby existing toilet facilities. Toilets used by workmen shall be kept clean and sanitary at all times. Where existing toilet facilities are unavailable, the Contractor shall provide and maintain sanitary temporary toilets, located where directed by the Owner, in sufficient number required for the force employed. Toilets shall be self-contained chemical type.

14. FIRE PROTECTION
The Contractor shall provide adequate fire extinguishers and maintain them in working order during the entire construction period. Extinguishers shall be nonfreeze type such as A-B-C rated dry chemical, of not less than 10-pound capacity each.

15. WATCHPERSONS
Watchpersons will not be furnished by the State. The Contractor shall provide such precautionary measures, to include the furnishing of watchpersons if deemed necessary, to protect persons and property from damage or loss where the Contractor's work is involved.

16. STORAGE OF MATERIALS
Contractor shall confine equipment, apparatus, storage of materials and operations to limits indicated on the drawings or by specific direction of DSF's Project Representative and shall not bring material onto the site until they are needed for the progress of the work.

All materials affected by moisture shall be stored on platforms and protected from the weather.

All materials shall be stored in a manner that prevents release of hazardous material to the environment.

All hazardous materials, including motor fuels, shall be properly handled and contained to prevent spills or other releases. The Lead Contractor shall develop and maintain a contingency plan to provide emergency response, containment, and cleanup of spills of hazardous materials resulting from contract activities. All spills and releases shall be reported to DSF as soon as possible.

The State assumes no responsibility for materials stored in building or on the site. The Contractor assumes full responsibility for damage during the storage of materials...

17. PROTECTION OF FINISHED CONSTRUCTION

Contractor shall assume the responsibility for the protection of all finished construction under the Contract and shall repair and restore any and all damage of finished work to its original state.

Take all necessary precautions to protect the State's property as well as adjacent property, including trees, shrubs, buildings, sanitary and storm sewers, water piping, gas piping, electric conduit or cable, etc., from any and all damage which may result due to work on this project.

Provide, erect and maintain all required planking, barricades, guard rails, temporary walkways, etc., of sufficient size and strength necessary for protection of stored material and equipment; paved surfaces, walks, curbs, gutters and drives; streets adjacent to or within project area; adjoining property and all project work to prevent accidents to the public and the workmen at the job site.

Provide protection against rain, snow, wind, ice, storms, or heat to maintain all work, materials, apparatus, and fixtures, incorporated in the work or stored on the site, free from injury or damage. At the end of the day's work, cover all new work likely to be damaged. Remove snow and ice as necessary for safety and proper execution of the work.

Protect the building and foundations from damage at all times from rain, ground water and back-up from drains or sewers. Provide all equipment and enclosures as necessary to provide this protection.

Damaged property shall be repaired or replaced in order to return it to its original condition. Damaged lawns shall be replaced with sod.

18. CLEANING AND WASTE DISPOSAL

Contractor shall be responsible for all cleaning required within the technical sections of the specifications governing work under the Contractor's jurisdiction as well as for keeping all work areas, passageways, ramps, stairs and all other areas of the premises free of accumulation of surplus materials, rubbish, debris and scrap which may be caused by the Contractor's operations or that of the Subcontractors.

Remove rubbish, debris and scrap on a daily basis. Combustible waste shall be removed immediately or stored in fire resistive containers until disposed of in an approved manner. Spillages of oil, grease or other liquids which could cause a slippery or otherwise hazardous situation or stain a finished surface shall be cleaned up immediately.

No burning of rubbish or debris will be allowed at the site. Rubbish, debris and scrap shall not be thrown through any window or other opening, or dropped from any great height; it shall be

conducted to the ground, to waiting truck(s) or removable container(s) by means of approved chutes or other means of controlled conveyance.

Form and scrap lumber shall have all nails withdrawn or bent over; shall be neatly stacked, placed in trash bins, or removed from the premises.

Waste materials removed from the site shall be managed by the contractor and disposed of in accordance with all applicable laws, regulations, codes, rules, and standards. Materials that meet the definition of a hazardous waste (Wis. Admin. Code NR 600) shall be disposed through the State's hazardous waste service contract (State Bulletin #15-99145-00), unless otherwise directed in writing by DSF.

Dirt, soil, fingerprints, stains and the like, shall be completely removed from all exposed finished surfaces. Dust, dirt and other foreign matter shall be removed completely from all internal surfaces of all mechanical and electrical units, cabinets, ducts, pipes, etc.

If rubbish and debris is not removed, or if surfaces are not cleaned as specified above, DSF reserves the right to have said work done by others and the related cost(s) will be deducted from monies due the Contractor.

19. OPERATING AND MAINTENANCE MANUALS AND INSTRUCTIONS

Where noted in the technical specifications, the Contractor shall provide DSF with two (2) sets of the following, covering each and every item of equipment and devices furnished or erected by the Contractor prior to "Substantial Completion":

Catalog data or literature.
Manufacturer's operating instructions.
Manufacturer's maintenance instructions.
Installation instructions.

The correct model number shall be clearly designated where the literature covers more than one model number.

For items assembled by the Contractor for special functions, the Contractor shall write up and provide duplicate manuals of operating and maintenance instructions.

The manual shall include manufacturer's complete parts listing.

The manual shall contain narrative of the control cycle for the control equipment and temperature control record drawings.

20. TESTS AND ADJUSTMENTS

The complete installation consisting of the several parts and systems and all equipment installed according to the requirements of the Contract Documents, shall be ready in all respects for use by the User Agency at substantial completion and shall be subjected to a test at full operating conditions and pressures for normal conditions of use.

Contractor shall make all necessary adjustments and replacements affecting the work which is necessary to fulfill DSF's requirements and to comply with the directions and recommendations of the manufacturer of the several pieces of equipment, and to comply with all codes and regulations which may apply to the entire installation. Contractor shall also make all required adjustments to comply with all provisions of the drawings and specifications.

21. STORMWATER MANAGEMENT AND EROSION CONTROL

The Contractor shall maintain all project grounds, public streets and associated areas to control and prevent soil erosion and to control and prevent siltation into lakes, rivers and streams. Control the tracking of soil onto street and paved surfaces to a minimum and remove on a daily basis. Erosion control and storm water management practices shall be installed and maintained in accordance with the WDNR approved Technical Standards (or equivalent). The Wisconsin Department of Natural Resources Technical Standards for Construction Site Erosion & Sediment Control (Technical Standards) are available at: **http://dnr.wi.gov/org/water/wm/nps/stormwater/techstds.htm.** The contractor shall maintain and modify the erosion control measures until completion.

22. AIR QUALITY MANAGEMENT

In accordance with what the Department of Administration believes to be good air quality management practice on Ozone Action Days, all contractors shall reduce or limit emissions and particulate matter that adversely affect air quality.

23. CONSTRUCTION WASTE MANAGEMENT

In accordance with what the Department of Administration believes to be good management practice, all contractors shall reduce, reuse, salvage, and/or recycle construction waste to the extent that is feasible.

24. RECORD DRAWINGS

DSF will provide the Contractor with a suitable set of Contract Documents on which daily records of changes and deviations from contract shall be recorded. All buried or concealed piping, conduit, or similar items shall be located by dimensions and elevations on the record drawings.

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 AE prior to final payment.

SECTION 01 91 01
COMMISSIONING PROCESS
BASED ON DSF MASTER SPECIFICATION DATED 05/01/08

P A R T 1 - G E N E R A L

SCOPE

This section includes specifications for the implementation, tracking and verification of the commissioning process. Included are the following topics:

COMMISSIONED SYSTEMS

Division 03 - Concrete
Division 04 - Masonry
Division 07 - Thermal and Moisture Protection
Division 08 - Exterior Building Envelope
Division 11 - Equipment
Division 13 - Special Construction
Division 14 - Conveying Systems
Division 21 - Fire Suppression
Division 22 - Plumbing
Division 23 - HVAC
Division 26 - Electrical
Division 27 -Communications
Division 28 - Electronic Safety and Security
Division 33 - Utilities

REFERENCE

Applicable provisions of Division 1 govern work under this section. Note in particular:
- General Conditions, Article 15 – Quality Control & Inspection
- General Requirements, Article 32 – Operating and Maintenance Manuals and Instructions

DEFINITIONS

Commissioning (Cx): The process of ensuring that systems are designed, installed, functionally tested and performing in conformity with the Owner's Project Requirements and that the building operator has received complete equipment and systems documentation and training.

Commissioning Provider (CxP): The entity identified by the DSF Project Manager to lead, monitor, coordinate and report on project commissioning activities. The commissioning provider may be the project A/E (most common), an independent third party or DSF.

Construction Verification: A quality control verification process performed by the installer as building assemblies, components, equipment and systems are being installed which documents that the materials, installation procedures, interfaces with other trades, start-up, testing and operation are correct, complete, in compliance with contract documents and manufacturer's recommendations and are ready for functional performance testing.

Functional Performance Tests (FPT): Contractor testing of installed building assemblies, components, equipment, systems and interfaces which confirms correct performance through all operating modes and compliance with contract documents and manufacturer's recommendations.

SUBMITTALS

Reference the General Conditions of the Contract for submittal requirements.

P A R T 2 – P RO D U C T S

EQUIPMENT

Provide equipment required to perform startup, checkout and testing. Equipment to be calibrated within the past year and in accordance with the manufacturer's recommendations.

P A R T 3 – E X E C U T I O N

MEETINGS

Each contractor is required to attend meetings related to commissioning (pre-construction, construction progress, etc.) and have personnel requested by CxP in attendance to facilitate quality control and coordinate commissioning efforts.

The CxP will present an overview of the project's commissioning process at the pre-construction meeting. The commissioning team members will be identified and their responsibilities reviewed.

At subsequent meetings, contractors are to provide a review of project progress, a report on the status of issues, commissioning tasks and scheduling for future commissioning tasks.

SCHEDULING

Reference General Conditions Article 12 for Lead Contractor responsibilities for scheduling. Each contractor shall provide the Lead Contractor a detailed schedule and regular updates of commissioning tasks for incorporation into the project schedule.

ISSUES LIST

Each contractor is responsible for completing action items in a timely manner that are noted in the Issues List as their responsibility. Timely response and successful completion are a requirement to avoid withholding of payment.

CxP SITE VISITS

Commissioning is a team effort requiring the cooperation of all parties. Contractors are to proactively carry out their commissioning responsibilities and are to assist the CxP during site visits in performing commissioning tasks. This includes providing access to and demonstrating the installation, operation, and testing of commissioned systems; responding to CxP requests for information; carrying out proactive and corrective actions; and accurate reporting on system status and conditions.

CONSTRUCTION VERIFICATION

The construction verification checklists are a formalized means to provide individual workers the criteria for a successful installation, adherence to the construction documents and to easily track construction progress.

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 on the construction verification checklists. The contractor is responsible for successfully completing installations, documenting this on the construction verification checklist forms and correcting all deficiencies.

Contractor shall periodically review the construction verification schedule with the CxP allowing advance notice of activities of 5 business days so that the CxP may witness as deemed necessary. If CxP identifies more than a 10% discrepancy rate during confirmation of construction verification, the contractor shall correct all deficiencies and revalidate all items covered by that checklist and resubmit new checklists. The cost of reconfirmation of construction verification due to equipment or construction deficiencies is the responsibility of the contractor and subject to deductive change order at DSF's discretion. Correction of deficiencies and revalidation are the responsibility of the contractor and are not subject to time extensions or delay claims.

FUNCTIONAL PERFORMANCE TESTING

Contractor shall coordinate functional performance testing with DSF, the A/E, CxP and Agency and notify them 5 business days prior to testing so that they may witness and document the test results. 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.

Contractors are responsible for completion and coordination of their work with all trades prior to testing, preplanning testing procedures, insuring necessary staff and resources are on hand and expediting testing. This includes completion of testing and balancing by the HVAC 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.

CxP shall establish sampling protocol and at the time of testing select sample test locations for identical pieces of equipment. Where simulation of conditions or altering of setpoints or values is required to achieve an operating or failure mode for testing, the contractor must receive CxP approval.

With DSF's oversight, the CxP is responsible for witnessing functional performance testing and recording the results and deficiencies. 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.

Retesting is required when testing cannot be successfully completed. Deficiencies requiring retesting include:

- Incomplete work and/or coordination with others
- Inadequate preparation of systems for testing
- Inadequate preplanning
- Inadequate staff, equipment, tools or resources for testing
- Material, equipment or construction deficiencies
- Incomplete or failed test due to reasons under the Contractor's responsibility

The cost of retesting is the responsibility of the contractor and subject to deductive change order at DSF's discretion. Correction of deficiencies and retesting are the responsibility of the contractor and are not subject to time extensions or delay claims.

OPERATION AND MAINTENANCE (O&M) DATA

Reference Division 1 General Requirements.

AGENCY TRAINING

Provide agency training using final O&M data. Training sessions to include classroom and site presentations as appropriate. Demonstrate operation of systems and equipment. Review setpoints and operating parameters. Demonstrate preventive and routine maintenance procedures as well as common repairs. Videotape training

sessions providing reasonable video/audio quality and provide final record in labeled DVD format to agency along with a sign off sheet demonstrating receipt by the agency.

END OF SECTION

APPENDIX A – CONSTRUCTION VERIFICATION CHECKLISTS

Complete the following construction verification checklists for this project and submit for review and comment.

CV-23 07 00 - HVAC Ductwork Insulation
CV-23 09 14 - Control Wiring and Devices
CV-23 11 00 - Facilities Fuel Piping
CV-23 31 00 - Ductwork and Casings
CV-23 33 00 - Control Dampers
CV-23 33 00 -Louvers
CV-23 37 13 – Diffusers, Grilles and Registers
CV-23 54 00 - Gas Fired Furnaces
CV-23 72 00 - Air-to-Air Heat Exchangers-Fixed Plate

APPENDIX B – FUNCTIONAL PERFORMANCE TEST FORMS

Complete the following functional performance test procedures on this project. Coordinate with DSF, A/E and CxP so they may witness and document test results.

FPT-23 54 00 - Gas Fired Furnaces

FPT-23 72 00 - Air-to-Air Heat Exchangers-Fixed Core

SECTION 02 05 00
COMMON WORK RESULTS FOR EXISTING CONDITIONS
BASED ON DSF MASTER SPECIFICATION DATED 11/27/07

P A R T 1 - G E N E R A L

SCOPE

This section provides information common to two or more technical site work specification sections or items that are of a general nature, and not included in other sections. This section applies to ALL site work, as applicable. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Referenced Organizations
- Referenced Documents
- Quality Assurance
- Safety
- Permits
- Construction Limits
- Equipment & Materials Furnished by Others
- Provisions for Future Work
- Work by Others
- Submittals
- Off Site Storage
- Codes
- Certificates and Inspections

PART 2 - MATERIALS
- Barricades, Signs, and Warning Devices
- Temporary Plastic Barrier Fencing

PART 3 - EXECUTION
- Maintenance of Site and Building Access/Egress
- Continuity of Existing Traffic/Parking and Traffic Control
- Protection and Continuity of Existing Utilities
- Protection of Existing Work and Facilities
- Stormwater/Excavation Water Management

REFERENCED ORGANIZATIONS

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

Abbreviations of organizations referenced in these specifications are as follows:

AASHTO	American Association of State Highway and Transportation Officials
ACPA	American Concrete Pipe Association
ANSI	American National Standards Institute
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
FHA	Federal Highway Administration
EPA	Environmental Protection Agency
NEC	National Electric Code

NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
STI	Steel Tank Institute
UL	Underwriters Laboratories Inc.
WDNR	State of Wisconsin Department of Natural Resources
WISDOT	State of Wisconsin Department of Transportation

REFERENCED DOCUMENTS

Where reference is made to the "SSHSC", it shall mean the pertinent sections of the State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, current edition, and all supplemental and interim supplemental specifications. Where reference is made to the "SSSWC", it shall mean pertinent sections of the Standard Specifications for Sewer and Water Construction in Wisconsin, current edition. Where reference is made to the "BMPH", it shall mean the Wisconsin Construction Site Best Management Practice Handbook, current edition as published by the WDNR. Method of measurement and basis of payment sections in referenced documents shall not apply.

QUALITY ASSURANCE

Provide materials and products as required by individual specification sections. Refer to Section GC - General Conditions of the Contract regarding substitutions.

Provide quality assurance testing and reporting as required by individual specification sections.

SAFETY

Contractor is solely responsible for worksite safety.

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

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

PERMITS

Unless otherwise noted in the Contract Documents, Contractor shall be responsible for obtaining and paying for all permits necessary to complete the work.

CONSTRUCTION LIMITS

Construction Limits are indicated on the drawings. In the absence of such a designation on the drawings, confine work to the minimum area reasonably necessary to undertake the work as determined by the DSF Construction Representative. In no case shall construction activities extend beyond state property lines or construction easements.

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

SUBMITTALS
Refer also to Section GC - General Conditions of the Contract and Division 1.

Submit manufacturer's shop drawings, product data, samples, substitutions and operation and maintenance (O&M) data for approval as required by individual specification sections.

Unless otherwise noted, provide 6 copies of each submittal. Submit to project architect/engineer (A/E) unless otherwise directed by DSF Construction Representative at the Pre-Construction Meeting.

OFF SITE STORAGE
Refer to Division 1.

In general, the payments for materials stored off site will only be considered in instances where there is limited space available for storage on the site. Prior approval by the DSF Construction Representative, together with the execution of a Storage Agreement will be required.

CODES
Comply with the requirements of all applicable, local, state and federal codes.

CERTIFICATIONS AND INSPECTIONS
Refer to Section GC - General Conditions.

Obtain and pay for all required sampling, testing, inspections, and certifications except those expressly listed as provided by the A/E or other third party in the Contract Documents. Deliver originals of certificates and documents to the DSF Construction Representative within 3 days; provide copies to the A/E. Include copies of the certifications and documents in the O&M Manual.

P A R T 2 - M A T E R I A L S

BARRICADES, SIGNS, AND WARNING DEVICES
Traffic barricades, traffic signs, and warning devices shall meet the requirements of applicable OSHA standards and the FHA Manual of Uniform Traffic Control Devices (MUTCD).

TEMPORARY PLASTIC BARRIER FENCING
UV stabilized high-density polyethylene barrier fence free of holes tears and other defects. Provide 4’ tall fence in diamond or rectangular pattern. Fencing shall be “safety orange” color, unless otherwise noted.

Posts for temporary plastic barrier fencing shall be 5’ tall, minimum 12 gauge, painted metal posts.

P A R T 3 - E X E C U T I O N

MAINTENANCE OF SITE AND BUILDING ACCESS/EGRESS
Unless otherwise shown or directed, maintain existing access and egress to the facility throughout construction. Maintain ANSI A117 compliant access for disabled persons, delivery access, emergency vehicle access, and emergency egress. Do not interrupt access and egress without prior written approval from the DFS Construction Representative.

Refer also to Section GR - General Requirements.

Do not interrupt or change existing traffic, delivery, or parking without prior written approval from the DSF Construction Representative. When interruption is required, coordinate schedule with the Owner agency to minimize disruptions. When working in public right-of-way, obtain all necessary approvals and permits from applicable municipalities and WISDOT.

When Contractor's activities impede or obstruct traffic flow, Contractor shall provide traffic control devices, signs and flaggers in accordance with other Contract Documents and the current version of the MUTCD, or as shown on the Drawings.

PROTECTION AND CONTINUITY OF EXISTING UTILITIES

Verify the locations of any water, drainage, gas, sewer, electric, drainage, gas, sewer, electric, telephone/communication, fuel, steam lines or other utilities and site features which may be encountered in any excavations or other sitework. All lines shall be properly underpinned and supported to avoid disruption of service.

Do not interrupt or change existing utilities without prior written approval from the DSF Construction Representative, affected utilities and users. Notify all users impacted by outages a minimum of 48 hours in advance of outage. Notification shall be provided in writing and describe the nature and duration of outages and provide the name and number of Contractor's foreman or other contact.

Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of applicable codes and any specifications governing such removals.

PROTECTION OF EXISTING WORK AND FACILITIES

Verify the locations of, and protect, any signs, paved surfaces, buildings, structures, landscaping, streetlights, utilities, and all other such facilities that may be encountered or interfered with during the progress of the work. Take measures necessary to safeguard all existing work and facilities that are outside the limits of the work or items that are within the construction limits but are intended to remain. Report any damage to existing facilities to the DSF Construction Representative immediately. Correct and pay for all damages.

STORMWATER/EXCAVATION WATER MANAGEMENT

Control grading around structures, pitch ground to prevent water running into excavated areas.

Pits, trenches within building lines and other excavations shall be maintained free of water.

Provide trenching, pumping, other facilities required.

Notify Architect/Engineer if springs or running water are encountered in excavation; provide discharge by trenches, drains, pumping to point outside of excavation. Provide information to Architect/Engineer of points and areas that water will be discharged. At the Engineer's option, the Contractor shall drain the spring to the storm sewer system by the use of field tile.

Be responsible for control measures to prevent damage from flooding, erosion, and sedimentation to on-site and off-site areas.

END OF SECTION

SECTION 02 92 50
GRASS SEEDING

PART 1 GENERAL

WORK INCLUDED
Grass seeding as shown on the Drawings and specified herein including but not necessarily limited to the following:
Furnishing and mixing topsoil and additive materials as required for plant beds.
Furnishing topsoil for grass areas.
Finish grading of grassed areas including 4 inches topsoil on grassed areas.
Furnishing seed and seeding where indicated on the Drawings.
Protection, maintenance and replacement of new grass and earth surfaces.

QUALITY ASSURANCE
Qualification: Provide grass seeding work performed by a single firm specializing in grass seeding.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS: Submit the following:
Maintenance Instructions: Submit typewritten instructions recommending procedures to be established for the annual maintenance of landscape work. Submit at the beginning of the maintenance period. Submit instructions for watering, fertilizing and mowing grass areas ten (10) days prior to request for observation for final acceptance.

Warranty: Three (3) signed copies, of terms specified herein.

PROJECT/SITE CONDITIONS
Site Observation: Installer must examine the subgrade, verify the elevations, observe the conditions under which work is to be performed, and notify the Architect and Owner of unsatisfactory conditions. Proceeding with the work constitutes acceptance of existing or corrected conditions.

Utilities: Determine locations of underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required, to minimize possibility of damage to underground utilities. Protect grade stakes set by others until removal is mutually agreed upon by all parties concerned.

Scheduling: Proceed with and complete the grass seeding as rapidly as portions of the site become available, working within the seasonal limitations for each kind of landscape work required.

Excavation During Planting: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Architect and Owner before planting.

Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods. Planting seasons for seeded lawns are from August 15 to September 15 or from March 15 to April 1. On the full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

WARRANTY
Provide written warranty for seeded areas through one planting season beyond the project date.

Warranty all earth placed by this installer to be to specified grades at end of warranty period.

PART 2 PRODUCTS

MATERIALS

Topsoil:

Provide new topsoil as required to complete landscape work as shown on the Drawings.

Topsoil for landscape work is not available at the site.

Provide top soil which is fertile, friable, natural loam, surface soil, free of subsoil, clay lumps, brush, weeds and other litter and free of roots, stumps, stones larger than 2 inches in any dimension, and other extraneous or toxic matter harmful to plant growth; and not frozen or muddy.

Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches; do not obtain from bogs or marshes.

Acidity range pH5-7, not less than 3 percent humus as determined by loss on ignition of moisture free samples dried at 100 degrees Centigrade. The Architect reserves the right to reject topsoil in which more than 60 percent of material passing V.S.S. #100 sieve consists of clay as determined by the Bouyoucous Hydrometer by dried weights of materials. Analysis for organic matter and clay made in accordance with current methods of the Association of Official Agricultural Chemists. Provide analysis paid for by installer.

Topsoil Mixture for Tree Pits and All Plant Beds: Materials thoroughly mixed by hand or rotary mixer in the following proportions by volume: three (3) parts topsoil; one (1) part peat; one (1) part sand.

Soil Amendments:

Lime: Natural limestone containing not less than 85 percent of total carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

Commercial Fertilizer: Complete fertilizer of neutral character, with some elements derived from organic sources and containing the following percentages of available plant nutrients:

For Lawns: Provide fertilizer with not less than 4 percent phosphoric acid and not less than 2 percent potassium, and the percentage of nitrogen required to provide not less than 1 lb. of actual nitrogen per 1000 sq. ft. of lawn area. Provide nitrogen in a form that will be available to the lawn during the initial period of growth.

Peat for Soil Mix: Provide a natural residue of a native type formed by decomposition of reed peat or sedge peat, but not peat moss, from a fresh water site, conditioned in storage piles after excavation for at least six months, including one freezing and one thawing period, and when delivered from storage piles containing between 35 percent and 65 percent moisture by weight, shall be free from lumps, sticks, stones, weedy roots, or other foreign matter. Organic matter is not to be less than 90 percent on a dry weight basis (samples dried at 110 degrees Centigrade). Ash on dry basis is to be not more than 20 percent, shall be low in content of woody material and iron.

Sand: Clean, coarse, ungraded, meeting ASTM C 33 requirements for concrete sand.
Sulphur: In a form generally accepted for landscape use.

Grass Seed:

Clean, delivered in original unopened packages and bearing an analysis of the contents, guaranteed 95 percent pure and to have a minimum germination rate of 85 percent.

Mix seed in following proportions as a blend:
20 percent Merion Bluegrass
20 percent Common Kentucky Bluegrass
20 percent Delta Bluegrass
20 percent Park Bluegrass
20 percent Windsor Bluegrass
Or other proportions as approved by the Architect.

PART 3 EXECUTION

EXAMINATION
Examine the subgrade, and conditions, including elevations and extent of rubble, under which landscape work items are to be installed. Do not proceed with the work until unsatisfactory conditions have been corrected. Installation of grass seeding constitutes acceptance of conditions.

PREPARATION
Preparation for Seeding:
Applying Topsoil: Spread topsoil on whole area to be grassed to bring to finished elevations. Spread complete fertilizer uniformly at rate of 25 lbs. per 1000 sq. ft., Rototill or otherwise scarify whole area to a minimum depth of 5 inches and lightly compact at finished grade. Do not spread topsoil in a frozen or muddy condition.
Maintain surface to required finished grades and deposit whatever additional topsoil may be required to take care of any settlement or erosion up to the date of final acceptance. Rake the surfaces upon which additional topsoil is to be deposited or otherwise satisfactorily prepare surface to insure a proper bond.

Repair damage to topsoil, or damage of any other nature, caused by any of the installer's operations, his workmen, or equipment, or by washouts due to drainage diversion to areas within the entire site, outside or inside the area of the contract, at installer's own expense. Restore such affected areas to a condition equal to that which existed previous to time of damage.

Lime according to the requirements of topsoil being furnished. Add lime if required to bring soil pH to 6.5.

Preparation of Unchanged Grades for Seeding:
Where lawns are to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil amendments and initial fertilizers as specified; remove high areas and fill in depressions; till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.

Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of Owner's property; reuse over new clay fill.

Disposal of Excess Material: Legally disposed of off site all excess materials resulting from work described herein.

MAINTENANCE
Begin maintenance immediately after planting.

Maintain lawns for not less than 60 days to establish an acceptable lawn.

Maintain lawns by watering, fertilizing, weeding, mowing, trimming and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

Earth Berms: Maintain at grades and configurations shown on the Drawings. Correct settled or uneven areas to proper grades.

Arrangement may be made for maintenance, or portions of maintenance to be performed by an Owner approved subcontracted local maintenance company during the one year maintenance period and until final acceptance.

CLEAN-UP AND PROTECTION
Clean pavements of dirt and other seeding materials.

Protect grass seeded areas from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work.

END OF SECTION 02 92 50

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

WORK INCLUDED
Cast-in-place concrete as shown on the Drawings and specified herein, including formwork and reinforcement.

RELATED WORK
Section 01 00 00 - General Conditions of Contract
Section 05 50 00 - Metal Fabrications
Section 07 90 00 - Sealants
Section 09 90 00 - Painting

QUALITY ASSURANCE
Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown on the Drawings or specified:

Building Code Requirements for Reinforced Concrete, ACI 318 as published by the American Concrete Institute, current edition.

Specifications for Structural Concrete, ACI 301, as published by the American Concrete Institute, current edition.

Consolidation of Concrete, ACI 309, as published by the American Concrete Institute, current edition.

Cold Weather Concreting, ACI 306, as published by the American Concrete Institute, current edition.

Hot Weather Concreting. ACI 305, as published by the American Concrete Institute, current edition.

Measuring, Mixing, Transporting and Placing Concrete, ACI 304, as published by the American Concrete Institute, current edition.

Standard Practice For Selecting Proportions For Structural Lightweight Concrete, ACI 211.1, as published by The American Concrete Institute, current edition.

All applicable portions of the ACI Manual of Concrete Practice, current edition.

Workmanship: Correct all concrete work which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as acceptable to the Architect/Engineer, at no expense to the Owner and no extension of time.

Welding of reinforcing steel is not allowed.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS
Submit the following in accordance with Division 01:

Manufacturer's Literature: Material description and application or installation instructions for forming compound, admixtures, bonding agent, patching and surfacing compound, curing compound, vapor barrier, grout, waterstops, form ties, bar accessories, and sealer.
Shop Drawings: Submit fabrication and placing drawings for all reinforcing steel, conforming with the Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315, current edition.

Certificates: Furnish four (4) copies of the manufacturer's certificates for mill tests of reinforcing steel.

Mix Designs: Submit three (3) copies as specified in 2.03 this Section.

TESTING SERVICES
The Owner's Testing Laboratory will be responsible for conducting and interpreting tests, state in each report whether or not the test specimens conform to all requirements of the Contract Documents and specifically note any deviation therefrom.

DELIVERY, STORAGE AND HANDLING
Deliver, handle and store material at the job site in such a manner as to prevent damage. Provide packaged material in original containers with seals unbroken and labels intact until time of use. Wrapped or bundled materials are to bear the name of the manufacturer and the product. Immediately removed from the job site all damaged or otherwise unsuitable material, when so ascertained.

Properly label all bars with weatherproof tags to facilitate identification.

Store reinforcing steel on supports above ground level.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS
Euclid Chemical Company; Cleveland, OH 44110.
Master-Builders; Cleveland, OH 44180.
W. R. Grace; Cambridge, MA 02140.
Sonneborn Products, Inc.; Chicago Heights, IL 60411.
Larsen Products Corp.; Rockville, MD 20852.
W. R. Bonsal Company; Lillesville, NC 28091.
Dow Chemical U.S.A.; Midland, MI 48640.
W. R. Meadows; Elgin, IL 60606.
Vinylex Corporation; Knoxville, TN 37921.
Fortifiber Corporation; Los Angeles, CA 90023.
Sauereisen Cements Co.; Pittsburgh, PA 44056.
Sika Chemical Corp.; Lyndhurst, NJ 07071.
Dural International Corporation; Deer Park, NY 11729.
Carboline Company; St. Louis, MO.63144.

MATERIALS
Portland Cement: ASTM C 150, Type I normal portland cement; or Type III (Higher-early strength cement) if approved by the Architect/Engineer. Provide cement uniform in color and from a single source.

Aggregates for Normal Weight Concrete: Fine and coarse aggregates conforming to ASTM C 33.
Fine Aggregate: Natural or artificial, hard clean sand.
Coarse Aggregate: Crushed stone or gravel, Size 57 for all non-architectural concrete.
Curing and Sealing Compound: ASTM C 309, Type I or ID, Clear styrene acrylate type, 30 percent solids content minimum, submit certified test data from an independent testing laboratory indicating a

maximum moisture loss of 0.030 grams per sq. cm. when applied at a coverage rate of 300 sq. ft. per gallon, one of the following:

Super Rez Seal or Super Pliocure, Euclid Chemical Co.
Masterseal 66, Master Builders.
Kure-N-Seal 30, Sonneborn

Water: Clean, fresh, potable.
Admixtures: Concrete admixtures shall comply with ASTM C 494 (Water Reducing) or ASTM C 260 (Air Entraining), produced by recognized manufacturers, subject to Architect/ Engineer's review.

Air Entraining Admixture: Add only to normal portland cement concrete to meet requirements specified for air content.

a. Air Mix, Euclid Chemical
b. MB-VR, Master Builders
c. Darex, W. R. Grace
d. Sika AER, Sika Chemical

Calcium chloride shall not be used.

Bonding Agent: Epoxy type, 100 percent solids.

1. Euco Epoxy #452 (dry surface), #463 (dry or damp surface), Euclid Chemical
2. Sikadur Hi-Mod (dry or damp surface), Sika Chemical
3. Duralbond 102 (dry or damp surface), Dural International

Patching and Surfacing Compound: Epoxy type, 100 percent solids.

1. Euco Epoxy #456 Mortar (dry surface), #460 (dry or damp surface), Euclid Chemical
2. Sikadur Lo-Mod Mortar (dry or damp surface), Sika Chemical
3. Duraltex (dry or damp surface), Dural International

Non-Shrink, Non-Metallic Grout: Cement grout for bedding plates to receive heavy equipment, column base, elevator door sills, and for other locations noted on the Drawings. Provide mix and setting characteristics as recommended by the manufacturer for the purpose intended. Provide grout conforming to ASTM C 1107, Grade C and CRD-C-621-89A, Grade C, Corps of Engineers Specification for Non-Shrink Grout, one of the following:

1. Euco NS; Euclid Chemical Co.
2. Masterflow 713; Master Builders, Inc.
3. Five Start Grout: U.S. Grout Co.

Expansion Joint Filler: ASTM D 1751; non-extruding fiber with asphalt binder.I

Underfloor Moisture Barrier: Provide moisture barrier over prepared base material under all floor slabs on ground. Use only materials that are resistant to decay when tested in accordance with ASTM E 154, as follows:

1. Clear polyethylene sheet minimum 8 mil thickness.

Drainage Fill; Under Concrete Slabs on Ground: Washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve, 0 percent passing a No. 4 sieve.

Wood Form Sheathing:

Finish No. 1 (Concealed Below Grade Concrete): 3/4 inch exterior plywood, B-B Concrete Form Class II, PS-1
Finish No. 2 (exposed Non-Architectural Concrete): Same as for Finish No. 2

Form Ties: Internal disconnect, or snap type, leaving metal no closer than 1 inch from surface of concrete.

New-Billet Steel Bars: ASTM A 615, Grade 60, unless otherwise shown.

Welded Wire Fabric: ASTM A 185.

Bar Accessories: Provide bar supports and other accessories necessary to hold bars in proper position while concrete is being placed.

Chamfer Strips: 3/4 inch x 3/4 inch typical unless otherwise noted, extruded polyvinyl chloride or neoprene.

Slab-on-Grade Poly Fiber Reinforcement System: Synthetic Structural Fiber Reinforcement: Provide synthetic structural fibers complying with the following requirements:
Synthetic structural fibers shall meet the requirements of ASTM C 1116, Paragraph 4.1.3, Type III.
Synthetic structural fibers shall be monofilament, made of polypropylene or polypropylene/polyethylene blend.
Synthetic structural fibers shall have a minimum length of 1.50" (38 mm).
Specific gravity between 0.90 and 0.95
Synthetic structural fibers shall have an aspect ratio (length divided by the equivalent diameter of the fiber) between 60 and 100.
Dosage rate to be 6.0 lbs/cubic yard or as required to comply with ASTM C1018-97 Level III performance characteristics.
Synthetic structural fibers shall be:
Grace STRUX® 90/40 synthetic fiber
Novomesh® 950 synthetic fiber by SI Concrete Systems
Tuf-Strand SF by Euclid Chemical Company

PROPORTIONING
Provide concrete mix or mixes designed by the Contractor. When more than a single strength concrete is required, indicate the location of each type of concrete on the submitted Mix Designs.

Submit mix design or designs in writing and furnish the Testing Laboratory with necessary material to allow the Testing Laboratory to verify the mix design or designs a minimum of 35 days prior to placement of concrete, unless when Field Experience method is substituted, in which case, the mix design or designs must be submitted to the Architect/ Engineer a minimum of fourteen (14) days prior to placement of concrete.

Provide adequacy of a design based on Field Experience methods or verified by tests on a minimum of 6 cylinders; 2 tested at 3 days, 2 tested at 7 days and 2 at 28 days, in accordance with ASTM C 192, and ASTM C 39 and by slump test in accordance with ASTM C 143.

When previous Field Experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.

Submit copies of the mix design or designs and test results to the Architect/Engineer for review before concrete is placed. If there is more than one design, each design shall indicate where it is to be used.

Adjustment to Concrete Mixes:

If, at any time during construction, the concrete resulting from the reviewed mix design proves to be unsatisfactory for any reason, such as lack of workability; or insufficient strength, immediately notify the Testing Laboratory and the Architect/ Engineer. The laboratory will verify the deficiency with additional testing and modify the design, subject to the Architect/Engineer's review, until a satisfactory concrete is obtained.

Mix design adjustments may be requested when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as reviewed by the

Architect/Engineer. Laboratory test data for revised mix design and strength results must be submitted to the Architect/Engineer for review before incorporating in the Work.

Proportioned concrete to achieve an average strength of 500 psi higher than design strengths shown on the Drawings.

When specified water reducing admixture is used in accordance with manufacturer's recommendations, cement requirements may be reduced. Indicate in mix designs admixtures for review by Architect/Engineer.

Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

1. Sloping Surfaces: Not more than 3 inches.
2. Reinforced Foundation Systems: Not less than 3 inches and not more than 5 inches.
3. Slabs on Grade: Not less than 3 inches and not more than 5 inches.
4. All Other Concrete: Not less than 3 inches and not more than 5 inches.
5. The Architect/Engineer or Testing Laboratory will have the right to reject any concrete that arrives at job site in excess of specified slump. No water shall be added to design mix unless as directed in writing by Architect/Engineer's representative. Slump shall be determined in accordance with ASTM C 143.

Air-entrain all concrete exposed to weather. Make air-entrained concrete with an air-entraining admixture. Provide total air content of 6 percent $\pm$1 percent unless noted otherwise.

Water/Cement Ratio:

1. Provide all concrete subjected to freezing and thawing with a maximum water/cement ratio of 0.45.
2. Provide all concrete subjected to de-icers and/or required to be watertight with a maximum water/cement ratio of 0.45.

MIXING CONCRETE

Provide concrete mixing, measuring and delivery equipment certified by the National Ready Mixed Concrete Association. Methods are subject to Architect/Engineer's review and in accordance with ACI 304.

Ready-Mixed Concrete: ASTM C 94, and as herein specified.

a. Delete references to the above named standard for allowing additional water to be added to the batch for material with insufficient slump. The addition of water to the batch to increase slump is prohibited.
b. The ready-mixed concrete producer is to submit duplicate delivery tickets, one for the Contractor and one for the Architect/Engineer, with each load of concrete delivered to the job site.

Provide delivery tickets with the following information:

a. Date
b. Name of ready-mix concrete plant
c. Contractor
d. Job location
e. Type (Standard of (H.E.S.) and brand of cement
f. Cement content in bags per cubic yard of concrete
g. Truck number
h. Time dispatched and time unloaded
i. Amount of concrete in load in cubic yards
j. Admixtures in concrete, if any.
k. Type and maximum size of aggregate

PART 3 EXECUTION

CONSTRUCTION DETAILS FOR FORMWORK

Provide forms conforming to shape lines and dimensions shown on the Drawings, be designed to resist the pressure and weight of the concrete, be properly tied and braced or shored so as to maintain position and shape, and be sufficiently tight to prevent leakage of mortar. Design and construct forms to facilitate easy removal without damage to exposed surfaces, and to provide smooth concrete surfaces free of off-sets. Provide corners true to lines and profiled as detailed. Keep form joints which will be exposed to view to a minimum and locate symmetrically within each modular unit.

Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Coordinate size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
Before reinforcing steel is set, coat wood forms with an approved nonstaining form oil or wet with water (except in freezing weather). Coat metal forms with an approved non-staining rust preventive form oil. Do not use stained forms.

Provide temporary openings to facilitate cleaning and inspection immediately before depositing concrete.

All form material is subject to Architect/Engineer's review before construction of forms. Forms for exposed concrete may be reused only if the surfaces have not absorbed moisture and have not splintered, warped, discolored, stained, rusted or peeled; subject to Architect/Engineer's review.

Provide exposed corners square unless otherwise shown. Where corners are shown, chamfered, use polyvinyl chloride or neoprene extruded corner inserted in the forms. Do not chanfer corners that abut masonry walls. Install splices and joints in chamfer strips in accordance with the manufacturer's instructions.

Place bulkheads with shear key where end of day's work requires a joint in a wall, beam or slab. Extend reinforcing steel through the bulkhead. Key all joints for 1/2 of the member thickness unless otherwise shown or noted on the Drawings. Provide bulkheads not exceeding 45 ft. 0 in. between beam construction joints subject to reviewed by the Architect/Engineer.

FORM REMOVAL

Removal of forms and shoring shall be in accordance with ACI 318.

TOLERANCES

Design, construct and maintain forms and place concrete so as to ensure the completed concrete work will be within the tolerance limits set forth in ACI 347.

PLACING REINFORCEMENT

Place reinforcement according to the reviewed placement drawings. Use sufficient bar supports, ties, anchors and other accessories to hold all bars securely in place. Locate beam and column ties to clear cast-in reveals and shapes in finish surfaces.

Clean reinforcing steel of oil, grease, scale, rust or other coatings which may impair the bond.

Remove tie wire clippings from inside architectural concrete form work.

Reinforcing will be reviewed by the Architect/Engineer before concrete is placed.

PLACING CONCRETE

Coordinated with the work of the other trades to allow reasonable time to set sleeves, inserts and other accessories, which must be in position before concrete is placed. In general, place electrical conduits that do not exceed 2 inches in diameter (O.D.) between the upper and lower third of the thickness of the concrete in which it is embedded. Do not place conduits in concrete closer together than three (3) diameters on centers, except at points of crossing and at cabinet boxes.

Adjust reinforcement to fit the sleeves, inserts and openings, using additional bars where required around openings.

Correct all concrete work which does not conform to the requirements of the Contract Documents, including strength, tolerances and finishing, as directed by the Architect/ Engineer at the Contractor's expense, without extension of time therefore.

Do not place concrete until the forms and reinforcing for the whole unit to be placed have been completed, cleaned and examined by the Architect/Engineer. No reinforcing shall be "floated into position."

Provide construction joints between units for slab on fill in accordance with the typical details locations shown on the Drawings.
Provide adequate runways, chutes and other means of conveying concrete into place. Use chutes or tremies for placing concrete where a drop of more than 5 feet is required.

Place concrete immediately after mixing, and in no case more than 90 minutes after initial mixing. Provide ready mix plant ticket for each truck that indicates the time the concrete was batched, deliver to the Architect/Engineer's representative upon arriving at the job site. Provide a minimum mixing of 70 revolutions at mixing speed. Deposit in uniform horizontal layers not more than 24 inches deep, work around all reinforcing and in corners of forms. Properly spade and puddle by the use of rods, shovels and hand spades, and agitate by means of internal vibrators to obtain the densest concrete possible, without over-vibrating to the point where separation results. Continue depositing concrete continuously until the completion of a section or unit.

Roughen, clean and moisten construction joints before placing concrete. Apply bonding compound and place new concrete after bonding compound becomes tacky.

GRANULAR FILL UNDER SLAB

After the subgrade has been reviewed by the Testing Laboratory, place granular fill immediately below the concrete slabs, a minimum of 6 inches thick, unless otherwise shown on the Drawings, compacted by vibrating or rolling.

VAPOR BARRIER

Furnish and install vapor barrier hereinbefore-specified under interior concrete slabs on top of under slab fill. Lap all joints not less than 6 inches and seal joints with hot mastic, cold mastic, or tape in accordance with the vapor barrier manufacturer's printed installation instructions.

JOINTS

Expansion, contraction and construction joints shall be located as shown on the Drawings. Provide all joint fillers required for poured concrete. Refer to Section 07920 - Sealants for additional materials and requirements for sealed joints.

SLABS - GENERAL

General: Provide floor slabs level, with plane surfaces, unless otherwise indicated on the Drawings. Pitch surface to drains as shown on the Drawings. Determine top of slab elevations by the use of preset runners supported by adjustable chairs set at the proper elevation. The Architect/Engineer's Representative has the right to obtain check readings, by use of a surveyors level, to verify the elevations

of the runners and the supporting formwork. Organize the work such that these readings maybe obtained, before beginning concrete placement, and not cause any delay in the work.

When steel trowel finish is specified both power and hand troweling are required. Begin power troweling as soon as little or no cement past clings to the blades. Continue troweling until the surface is dense, smooth and free of all minor blemishes such as trowel marks.

If variations greater than the specified tolerances exist, the Architect/Engineer may direct the grinding of surfaces to bring them within the requirements at no additional cost to the Owner. Patching of low spots is not permitted. Perform grinding as soon as possible, preferably within 3 days, but not until the concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

Sprinkling of dry cement or a mixture of dry cement and sand on the surface of the fresh concrete to absorb water or to stiffen the mix is not permitted.

FINISHING SLABS

Finish "A" (For Exposed Concrete Floors): Steel trowel finish concrete floor surfaces, which are to remain exposed, receive resilient flooring, carpet, hardener or sealer. Use Final hand trowel to remove slight imperfections left by the troweling machines and to bring the surface to a dense, smooth polished final finish. Continue final hand troweling until a ringing sound is heard as the trowel passes over the surface.

Finish "B" (Interior or Exterior Ramps, Exterior Slabs, Platforms and Steps): Trowel slabs for this type finish to a smooth, dense surface and then finished with a fine-hair push broom, perpendicular to the direction of pedestrian or vehicular travel.

FINISHING OF FORMED SURFACES

General: Remove form and form tie-ins. Perform all patching as hereinafter-specified in Paragraph "Patching of Concrete" and in accordance with the reviewed mock-up procedures.

Types of Finishes:

Finish No. 1; Concealed Below Grade Concrete: Patch all form tie holes, aggregate pockets, honeycomb and defective areas as required with 1:2 portland cement-sand mortar.

Finish No. 2; Exposed Non-Architectural Concrete: Same as Finish No. 1; except fins and ridges shall also be removed.

CURING AND PROTECTION

Protect all concrete work, exterior and interior, from drying out by covering with waterproof paper, polyethylene sheeting, wet burlap or a coating of specified membrane curing compound. Curing methods are subject to Architect/Engineer's review. Perform curing as soon as possible after concrete placement and in any event within 12 hours.

If liquid membrane curing compound is used, furnish a written statement guaranteeing that the compound will not leave discoloration on concrete to be left exposed or affect the bond for paint or other applied finishes.

Provide curing and sealing compound on interior slabs with resilient flooring, carpet over cushion, or left exposed; and to exterior slabs, walks, and curbs.

In cold weather, do not mix or place concrete when the temperature is, or is predicted to be within the following 48 hours below 40 degrees F., unless proper provision has been made for heating and protecting concrete in accordance with ACI 306R.

EQUIPMENT BASES, CURBS AND FOUNDATIONS

Provide machine equipment bases and curbs and exterior light pole bases and foundations, as shown on the Drawings. Set anchor bolts for machines and equipment to template, at correct elevations, complying with certified diagrams or templates of the manufacturer furnishing machine and equipment.

INSPECTION AND TESTS

The Owner's Quality Control Testing Laboratory will perform concrete tests and submit test reports.

END SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

WORK INCLUDED
Brick masonry as shown on the Drawings and specified herein.

PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION
Masonry membrane/through wall flashing, ties, anchors and accessories for brick and concrete unit masonry are specified in Section 042 20 00 - Unit Masonry.

RELATED WORK
Genreal Conditions of the Contract
Section 03300 - Cast-In-Place Concrete
Section 05500 - Metal Fabrications

QUALITY ASSURANCE
Comply with all laws, ordinances, rules, regulations and orders of public authorities having jurisdiction over this part of the Work.

Provide copies of tests that have been performed in accordance with ASTM C 67; particularly for Initial Rate of Absorption and Efflorescence.

Comply with the applicable recommendations of the Technical Notes on Brick Construction, Brick Institute of America, (B.I.A.), current editions, in addition to the requirements specified herein.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

CONSTRUCTION TOLERANCES
Construct unit masonry within the following tolerances:

1. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
   a. 1/4 inch in 10 feet
   b. 3/8 inch in a story height not to exceed 20 feet
   c. 1/2 inch in 40 feet or more
2. Maximum variation from plumb for external corners, expansion joists and other conspicuous lines:
   a. 1/4 inch in any story or 20 feet maximum
   b. 1/2 inch in 40 feet or more
3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
   a. 1/4 inch in any bay or 20 feet
   b. 1/2 inch in 40 feet or more
4. Maximum variation from plan location of related portions of columns, walls and partitions:
   a. 1/2 inch in any bay or 20 feet
   b. 3/4 inch in 40 feet or more
5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on Drawings:
   a. Minus 1/4 inch

b. Plus 1/2 inch

SUBMITTALS
Submit the following in accordance with Division 01:

Manufacturer's Literature: Materials description and installation instructions for joint reinforcement, ties, anchors, insulation, isolating board, and all other specified accessories.

Samples:
Furnish five (5) bricks of each type proposed, through range of color.
Certification: Furnish test reports or other acceptable evidence to indicate compliance with requirements for face brick.

DELIVERY, HANDLING AND STORAGE
Deliver and handle materials in such a manner as to prevent damage. Store face brick and packaged material above ground on wood pallets or blocking and protect from the weather until used. Immediately removed from the job site all damaged or otherwise unsuitable material when so ascertained.

PROJECT/SITE CONDITIONS
Cold Weather Protection: During the cold weather perform brick work in accordance with the following:

Receive, store, and protect construction materials in ways that prevent water from entering the materials.

If climatic conditions warrant, measure temperatures of construction materials, frozen sand and wet masonry units must be thawed. Masonry units below 20 degrees F. must be heated above 20 degrees F. without overheating.
Heat sufficient mortar ingredients to produce mortar temperatures between 40 degrees F. and 120 degrees F. Produce consecutive batches of mortar with the same temperatures falling within this range. Provide mortar temperature after mixing and before use above 40 degrees F. maintainable either by auxiliary heaters under the mortar board or by more frequent mixing of mortar batches. Do not allow heated mortar on mortar boards to become excessively hot (greater than 120 degrees F.).

During below-normal temperatures, place masonry only on sound unfrozen foundations. Do not place masonry on snow or ice-covered surface.

At the end of each day, or during a shutdown, protect the top surface of all masonry moisture as rain, snow or sleet from entering the masonry. Provide protection that covers the top surface and extends a minimum of 2 feet down all sides of the masonry and secure in place to prevent blowing off.

Work Day Temperatures/Construction Requirements/Protection:

a. Above 40 F - use normal masonry procedures.
    1. Cover walls with plastic or canvas at end of work day to prevent water entering masonry.
b. 40 F - 32 F - heat mixing water to produce mortar temperatures between 40 degrees F. - 120 degrees F.
    1. Cover walls and materials to prevent wetting and freezing. Provide covers of sheet plastic or waterproof canvas.
c. 32 F - 25 F - Heat mixing water and sand to produce mortar temperatures between 40 degrees F. - 12- degrees F.
    1. With wind velocities over 15 mph provide wind breaks during the work day and cover walls and materials at the end of the work day to prevent

wetting and freezing. Maintain masonry above freezing for 16 hours using auxiliary heat or insulated blankets.

d. 25 F - 20 F - Maintain mortar on boards above 40 degrees F.

e. 20 F - 0 F and below - Heat mixing water and sand to produce mortar temperatures between 40 degrees F. - 120 degrees F.

1. Provide enclosures and supply sufficient heat to maintain masonry enclosure above 32 degrees F. for 24 hours.

Hot Weather Protection: During installation, when the air temperature exceeds 99 degrees F. in the shade, protect freshly laid masonry from direct exposure to wind and sun.

Repair masonry construction where required due to damaged or defective work and where required to accommodate work of other trades, in a manner so that patching is not visually apparent.

MOCK-UP INSTALLATION

Prior to the start of masonry work construct a mock-up installation of typical brick elements and materials as shown and indicated on the Drawings. Construct the mock-up installation at a location on the project site mutually agreed upon by the Architect, Owner and Contractor. Include in the mock-up all materials, details, accessories and techniques that will be used in the actual building construction. Notify the Architect and Owner prior to the start of mock-up construction.

The mock-up installation will be reviewed by the Architect. Make changes or corrections to the mock-up as directed by the Architect. After final review of the mock-up, retain and use as a standard of quality and workmanship for the actual masonry work.

PART 2 PRODUCTS

MATERIALS

Face Brick: ASTM C 216, Grade SW, Type FBX, Size: 2-1/4 inches x 3-5/8 inches x 7-5/8, inches.
Face Brick No. 1: “to be verified in field match existing.

Provide special shapes and sizes shown on the Drawings finish color and texture to match face brick.
Provide solid face brick for headers with ends matching face brick.
Provide solid brick for brick with bed faces exposed, match face brick.
The physical properties of all face brick used shall conform to the following specific requirements:

Test	Units	5 Bricks	Average of Individual
Compressive Strength		psi	8,900 min.6,000 min.
Modulus of Rupture		psi	900 min.800 min.
Water Absorption (24 hour cold)		%	6 max.8 max.
Water Absorption (5 hour boil)		%	8 max.10 max.
Rate of Absorption		grams per minute	
	per 30 square inches	5 min.	3 min.
Rate of Absorption		grams per minute	
	per 30 square inches	20 max.	25 max.
Efflorescense		----------	NoneNone
Must meet one of the following two requirements:			
C/B Ratio		0.75 max.	0.80 max.

Autoclave Expansion (age of 1 month) % 0.10 max.0.20 max.

Cement Mortar: Type N, natural, unless noted otherwise on the Drawings, refer to Section 04110.

Adjustable Masonry Anchors: Refer to Section 04220.

Dovetail Triangular Anchors/Ties: WireBond Magic Clip.

Membrane Flashing: asphalt coated copper.

Control Joints: Factory fabricated PVC Type PVC 654-4, solid section ASTM D 2287 not less than 85 Durometer ± 5, regular, tee or wide flange as shown or required by conditions of the installation.

Preformed Resilient Joint & Soffit Joint Filler: ASTM D 1056, expanded closed-cell neoprene, Type S, Class SCE 43.

Solid Wall Joint Reinforcement: Ladder or truss type fabricated from cold drawn steel wire (ASTM A 82), galvanized (ASTM A 153, Class B2, 1.5 oz.), minimum No. 9 gage deformed side rods with No. 9 gage weld connected cross-rods, diagonals at 8 inches or ladder ties at 15 inches o.c. Provide width 2 inches less than wall thickness. Provide prefabricated corners and tee sections for bonding intersecting walls, one of the following:

1. No.'s 220 and 120,Hohmann & Barnard, Inc., Hauppauge, NY 11788
2. Series WB302 and WB202, Wire-Bond, Charlotte, NC 28224
3. Dur-O-Wal Truss & Ladur, Dur-O-Wal Inc., Arlington Heights, IL 60004

Two-Piece Cavity Wall Joint Reinforcement Assembly:

1. Continuous (Concrete Unit Masonry) Ladder: Fabricate from cold-drawn steel wire ASTM A 82, galvanized ASTM A 153, Class B2 1.5 oz., consisting of two (2) minimum No. 9 gage deformed parallel side rods with weld connection to minimum No. 9 gage perpendicular cross-rods (no drip bend) spaced 15 to 16 inches on center and minimum 3/16 inch diameter wire eye sections welded to one side rod and perpendicular rod at 15 to 16 inches on center. Provide width of units to allow for 1/2 inch cover on both parallel side rods. Provide eye section which project thru the cavity wall insulation for insertion of the pintle ties that will hold the cavity wall insulation against the outside face of the inner wythe. Provide eye sections with not more than 0.02 to 0.05 inch lateral mechanical play between eye and pintlE leg. *Provide special curved units fabricated the same as above to the radii shown on the Drawings.*
2. Adjustable Wall Pintle (Face Brick) Ties: Fabricate from cold-drawn steel wire ASTM A 82, galvanized (ASTM A 153, Class B2 1.5 oz., consisting of minimum 3/16 horizontal rod without formed drip and two (2) minimum 3/16 inch diameter pintle legs. Provide pintle ties of sufficient length to project into the face brick wythe bed joint not less than 3 inches. Provide pintle ties with a maximum deflection of not less than 0.05 inch when tested at an axial load of 100 pounds in tension and compression.
3. Provide two-piece wall cavity wall reinforcement assemblies as manufactured by one of the following:
   a. Ladder Type No. 270, Hohmann & Barnard, Inc., Hauppauge, NY 11788.
   b. Series 800 Composite Hook & Eye, Wire-Bond, Charlotte, NC 28224
   c. Ladur-Eye, Dur-O-Wal, Inc., Arlington Heights, IL 60004

Corrugated Wall Ties: Hot dip galvanized 16 gauge steel, 7/8 inch wide x 7 inches long, on of the following:

1. No. CWT, Hohmann & Barnard, Inc.
2. No. 2000, Wire Bond
3. No. D/A CWT, Dur-O-Wal

Cavity Wall Insulation: Extruded polystyrene foam board conforming with ASTM C 578, Type IV; k factor 0.20 at 40 degrees F., compressive strength 25 psi minimum design value, ASTM D 1621, at 0.1 inch deformation, thickness as shown on the Drawings, one of the following:

1. Styrofoam SB, Dow Chemical U.S.A., Midland, MI 48674
2. Foamular, UC Industries, Inc., Parsippany, NJ 07054
3. Amofoam SB, Amoco Foam Products Company, Atlanta, GA 30099

Isolation Board: Asphalt-impregnated cellular board, 1/4 inch thick x 4 feet square Column Boxboard, Williams Products Inc., or other approved by Architect.

Cell Weep Vents: 3/8 inch thick, ultraviolet resistant polypropylene co-polymer cell vent, height and length as required by brick height and thickness (provide four [4] inch high vents for stone joints), one of the following:

1. No. DA 1006, Dur-O-Wal, Inc.
2. No. 3601, Wirebond, Charlotte, NC 28224
3. Quadro-Vent, Hohoman & Barnard, Inc., Hauppauge, NY 11788

PART 3 EXECUTION

PREPARATION

Examine all surfaces to receive the parts of the work specified herein. Verify all dimensions of in-place and subsequent construction. Application or installation of materials constitutes acceptance of the adjacent and underlying construction.

Verify that items provided by other sections of work are properly sized and located.

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.

GENERAL WORKMANSHIP

Provide all masonry construction aligned, plumb and true in required layout, making straight level courses, unless otherwise specifically indicated.

Tooth in masonry with existing to provide seamless pattern.

Construct masonry to full thickness as shown with masonry units of sizes as noted and specified, using whole units wherever possible. Cut masonry neatly by power-saw to obtain sharp edges without damage, for providing required bond pattern and proper fit at all adjoining items.

Build-in items furnished by other trades, and leave accurate openings necessary for subsequent installation of other work, in a manner to maintain required strength and appearance of masonry construction. Provide not less than 8 inches thickness of masonry between adjacent chases, openings and recesses. Fill solidly around conduit and sleeves passing through masonry, with mortar.

MORTAR BEDDING AND JOINTING

Lay brick masonry units with mortar of types and strengths specified and as noted on Drawings. Install each masonry units with full mortar coverage on all adjoining ends, backs and bearing surfaces, as required to provide completely solid bed joints and head joints. Do not slush mortar into joints between units after laying. Keep all voids clean and unobstructed of mortar or debris, including expansion joints, control joints, chases, cavities and similar spaces.

Lay face brick units with one-third (1/3) running stretcher bond pattern unless shown otherwise on the Drawings in straight level courses, all vertical joints evenly staggered, cross-bonded at all corners and outer faces of all units made perfectly even, unless otherwise specifically indicated on Drawings.

Lay all brick masonry units with solid mortar joints of uniform 3/8 inch width, unless otherwise shown on the Drawings. While setting mortar is still damp, firmly compact as required to obtain uniform concave-tooled joints at all exposed surfaces.

Provide continuous preformed resilient filler strips specified, minimum 3/4 inch thick, unless shown otherwise on the Drawings, only where shown between tops of walls and undersides of floor and roof construction. Provide continuous minimum 3/8 inch thick, compressible soft joint filler, unless shown otherwise on the Drawings, on the underside of lintels and shelf angles. Set filler and soft joint strips in joints as masonry is laid up with lengths of strips butted together and all strips firmly compressed.

For cavity walls, lay brick in wythe with cavity as shown on the Drawings. Build in membrane flashing. Install horizontal joint cavity wall reinforcement 16 inches o.c. vertically unless noted otherwise on the Drawings. Keep cavity clear of mortar by placing a board of proper width across a level of joint reinforcement ties and after masonry reaches the next level of ties, lifting the board and removing mortar droppings before installing the next level of reinforcement.

Bevel the back edge of the mortar bed on the cavity side of each wythe to minimize mortar droppings into the cavity.

Provide weep vents holes at 24 inch o.c. horizontally, unless otherwise shown on the Drawings, by inserting a plastic tube vents in bottom of head joints above membrane flashing. Keep weep holes vents and area above flashing free of mortar droppings.

Where shown or noted on Drawings at columns and beams provide flexible adjustable anchorage to steel framing. Where shown other than on Structural Drawings, weld steel rod anchors to steel framing to allow for insertion of triangular or web, ties as shown. Provide a maximum spacing of ties, 16 inches o.c. vertically and 32 inches o.c. horizontally. Provide and install triangular anchors for web anchors shown on Structural Drawings.

Install dovetail anchor/ties in cast-in-place dovetail slots spaced a maximum of 16 inches o.c. vertically. Remove slot insert completely before installing anchor/ties.

Provide threaded steel anchors where indicated to be built into masonry construction for attachment of work by other trades. Conform to requirements of ASTM A 307, and include nuts with hardened washers where required. Provide minimum 1/2 inch shank diameter by 10 inch length with pigtail end, where size and type are not indicated on drawings. Provide hot-dip galvanized anchors.

At steel columns and elsewhere as indicated on the Drawings, provide isolation board specified. Completely cover all surfaces of columns to be encased in masonry. Neatly fold and fit covering tightly against flange and web surfaces and secure against displacement by taping or tying in place.

Fill hollow metal frames in masonry walls solidly with grout. Perform grouting without clogging holes, boxes or spaces required for the proper installation or operation of hardware.

Build-in all loose steel lintels, provide minimum 8 inches bearing and bed lintels in mortar, unless otherwise shown or noted on the Drawings.

Install clay tile copings on walls set in a full bed of mortar. Overhang tile wall faces unless shown otherwise on the Drawings. Fill and point all joints flush with tile edges and contours of tile.

PLACEMENT OF JOINT REINFORCEMENT AND TIES
Provide joint reinforcement in horizontal joints of multi-wythe masonry construction at 16 inches o.c. vertically, unless otherwise noted or shown on the Drawings.

Provide additional joint reinforcement in joint immediately above lintels, immediately below sills and at all openings in walls and extend at least 2 feet beyond each side of opening.

Place units to provide continuous reinforcement, with manufacturer's standard corner and tee sections at all wall intersections; splice units together by lapping side bars a minimum of 6 inches at adjoining ends of lengths.

Stop reinforcement 2 inches away from both sides of vertical control and building expansion joints.

Install plastic snap-on drip rings on each cross rod of reinforcement installed in cavity wall construction.

Install corrugated masonry ties to join wythes together at ends of walls, control/expansion joints and other locations as shown on the Drawings, space 16 inches on center vertically.

Two-Piece Cavity Wall Ties: Install two-piece cavity wall reinforcement assemblies to provide continuous reinforcement of the concrete masonry inner wythe and pintle ties in the face brick outer wythe 15 to 16 inches on center horizontally.

1. Install pintle ties with legs down against the cavity wall insulation.
2. Install pintle ties with not more than 1/2 inch eccentricity of pintle tie legs.
3. Provide additional pintle ties within 8 inches of openings, lintels, vertical expansion joints and other discontinuities.

Veneer Anchor Ties: Install two-piece in-place anchor reinforcement assemblies to provide anchorage of masonry to in-place construction with anchor plates and pintle ties set in the face brick, spaced 24 inches on center horizontally and 16 inches on center vertically.

Install base plate anchor plate to the in-place construction with drilled-in-place expansion anchors with not less than 2 inches embedment.
Install pintle ties with legs down.
Install pintle ties with not more than 1/2 inch eccentricity of pintle tie legs.
Provide additional pintle ties within 8 inches of openings, lintels, vertical expansion joints and other discontinuities.

INSTALLATION OF CAVITY WALL INSULATION
Install rigid insulation boards progressively as the wall is built. At intervals before proceeding with the outer wythe, install boards with plastic snap-on drip/retainer rings specified herein. Press insulation firmly against inner wythe and between wall reinforcement. Butt boards tightly together and stagger all vertical joints from the proceeding row. Install snap-on drip/retainers on each cross rod so as to leave a clear uniform cavity between insulation and back of exterior brick wythe.

CONTROL/EXPANSION JOINTS
Provide vertical control and building expansion joints in masonry where shown on the Drawings. If not shown on the Drawings, comply with the recommendations of B.I.A. as reviewed by the Architect prior to construction of joint. Build in related items as the masonry work progresses. Completely rake out mortar or install temporary inserts in preparation for application of sealants and fillers or sheet metal fabrications.

CLEANING
Cut out any defective joints and holes in exposed masonry, repoint with mortar and tool.

Demonstrate cleaning procedure on sample wall area of 20 square feet in a location indicated by the Architect. Do not proceed with cleaning shall until the sample area has been reviewed by the Architect.

Clean initially with stiff fiber brushes and water. If a cleaning agent is required:

Submit written description of materials and methods for review by Architect prior to cleaning.

Follow brick manufacturer's recommendations.

Thoroughly wet surface of masonry on which no green efflorescence appears.

Scrub with acceptable cleaning agent.

Immediately rinse with clear water.

Do small sections at a time.

Work from top to bottom.

Protect all sash, metal lintels and other corrodible parts when masonry is cleaned with corrosive solutions.

Remove green efflorescence in accordance with brick manufacturer's recommendations.

At the conclusion of masonry work, remove all scaffolding and equipment used in the work, clean up all debris and refuse and surplus material and remove same from premises.

Clean exposed brick masonry surfaces as recommended by BIA Technical Notes 20 "Cleaning Clay Products Masonry". Procedure "B".

REPAIR AND POINTING

Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of caulking or sealant compounds.

END SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

WORK INCLUDED
Metal fabrications as shown on the Drawings and specified herein, including but not necessarily limited to the following:
Pipe handrails, guardrails and railings.
Loose Lintels.

RELATED WORK
Section 01 00 00 - General Conditions of Contract
Section 03 30 00 - Cast-In-Place Concrete
Section 04 20 00 - Unit Masonry

PERFORMANCE REQUIREMENTS
Design loads for the structural design and construction of the below listed fabrications are to satisfy applicable codes, but are to be not less than the minimum values specified herein.

Handrails: Design handrails and their anchors capable of withstanding a concentrated load of 200 pounds applied at any point in any direction on the handrail, also a uniform load of 50 pounds per lineal foot applied simultaneously in both vertical and horizontal directions.

Railings and Guardrails: Design railings and guardrails and their anchors capable of withstanding a concentrated load of 200 pounds applied at any point in any direction along the top railing member, also a uniform load of 50 pounds per lineal foot applied horizontally at the required railing or guardrail height and a simultaneous uniform load of 100 pounds per lineal foot applied vertically downward at the top or the railing or guardrail.

Design and fabricate stair and ramp railings, handrails and guardrails in accordance with ASTM E 985.

When conflicts exist between the above specified load requirements and the specified standard, provide fabrications designed to the stringent or greater requirement.

Testing performed according to ASTM E 894 and E 935.

Ladders: Comply with ANSI A14.3.

QUALITY ASSURANCE
Provide metal fabrications and associated items by a firm having the undivided responsibility for the structural design, fabrication and installation of those fabrications as shown on the Drawings and specified herein.

Comply with all laws, ordinances, rules, codes and regulations of governmental authorities having jurisdiction over the work.

Comply with AISC Manual, current edition.

Code of Standard Practice for Steel Buildings and Bridges.

Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings.

Specifications for Assembly of Structural Joints Using High Strength Steel Bolts as approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation.

General Requirements for Delivery of Rolled Steel Plated, Shapes, and Bars for Structural Use, ASTM A 6.

Provide welding complying with American Welding Society Structural Welding Code for Steel, AWS D1.1.

Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with the AWS, Standard Qualification Procedure.

Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months. Provide recertification of welders as required.

Comply with applicable portions of Metal Stairs and Pipe Railing Manuals, current edition, National Association of Architectural Metal Manufacturers (NAAMM).

REFERENCES
Industry Standards, Specifications and Codes: General:

Comply with all provisions of the following codes and standards except as modified herein.

All referenced codes and standards including all revisions and commentaries shall be the most currently adopted as of the date of these contract documents.

American Institute of Steel Construction (AISC):

Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design Code of Standard Practice for Steel Buildings and Bridges

Specification for Structural Joints Using ASTM A-325 and A-490 Bolts; approved by the Research Council on Structural Connections of the Engineering Foundation

Structural Steel Detailing

American Society for Testing and Materials (ASTM): Specific ASTM numbers are noted in later text.

American Welding Society (AWS):
D1.1 Structural Welding Code - Steel
D1.3 Structural Welding Code - Sheet Steel

SUBMITTALS
Manufacturer's Literature: Material description and application or installation instructions for products specified, including manufactured anchors, grout and shop coat paint.

Mill Test Reports: Submit certified test reports of structural steel, which constitutes evidence of compliance with the specified requirements. Include names and location of mills and shops and analysis of chemical and physical properties of steel.

Certificates: Manufacturer's certificates of bolts, nuts, and filler metal for welding which showing evidence of compliance with specified requirements.

Design Calculations: Provide for fabricated items requiring design calculations to substantiate design and installation conditions, prepared, sealed, and signed by a State of Wisconsin Licensed Structural Engineer. Submit design calculations for the following: Handrails and Railings
Shop Drawings: Layout and details of each fabricated metal item shown on the Drawings and specified herein. Indicate all dimensions, gages and finishes of metals, sizes, types and spacing of welds, fasteners and anchors.

Welder Certificates: Submit three (3) copies of Welding Certificates for each welder involved in the work.

DELIVERY STORAGE AND HANDLING
Deliver Fabrications, materials including accessories, anchors bolts, setting and bearing plates to the site at such intervals to insure uninterrupted progress of the work.

Store fabrications and materials to permit easy access for inspection and identification. Keep steel members off the ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration. Do not store materials on the structure in a manner that might cause distortion or damage to the members of the supporting structures. Repair or replace damaged materials or structures when so ascertained.

PART 2 PRODUCTS

MATERIALS
Structural Steel Shapes and Plates: ASTM A 36.

Steel Plates to be Bent or Formed Cold: ASTM A 283.

Hot Rolled, Rail Carbon Steel Bars and Shapes: ASTM A 499.

Structural Tubing: ASTM A 500 or A 501, Grade B.

Cold-Finished Steel Bars: ASTM A 108.

Steel Pipe: ASTM A 53, Grade B.

Cold-Rolled Structural Steel Sheet: ASTM A 611, Grade A, unless otherwise required by Performance Requirement design loading.

Support Channels: Minimum 14 Gauge cold-formed continuously slotted steel channels with inturned lips, ASTM A 570, hot-dipped galvanized (ASTM A 386 or A 153), size and series as shown on the Drawings, if not shown, as required to support and resist the imposed loads, with assembly and mounting hardware as required by conditions of the fabrication and installation, Unistrut, Unistrut Corporation, Wayne MI 48184 or other as approved by Architect.

Shop Coat Paint: Modified alkyd rust-inhibiting gray primer paint, one of the following:
Series 10-1009, Tnemec, Company, Inc., Kansas City, MO 64141
V13-R-78, The Valspar Corporation, Baltimore, MD 21230
M12, Benjamin Moore & Co., Montvale, NJ 07645
GP-818, Carboline Company, St. Louis, MO 63144

FASTENERS
General: When not shown on the Drawings, it is to be the Fabricating Contractor's responsibility to anchor and fasten the fabrications to the building structure or construction for the sizes and types of fabrications shown on the Drawings and specified herein as required for each condition and type of installation. This responsibility includes

determining the locations, quantities, capacity and design for anchors and fasteners used in the installation subject to review by the Architect. Show and describe all such anchors and fasteners on the shop drawings submitted to the Architect. Furnish all bolts, nuts, screws, clips, washers and other fasteners and accessories necessary to secure and assemble the specified fabrications.

Provide stainless steel fasteners and accessories on exterior installations and steel matching the fabrication material on interior installations.

Provide AISI 300 stainless steel unless noted otherwise.

Provide Phillip's flat head screws, countersunk, unless noted otherwise. Provide tamperproof screws in public areas.

Provide bolts for field connections only, with washers under heads and nuts bearing on wood, metal concrete and masonry. Provide beveled washers where bearing is on sloped surfaces.

Anchors:
Threaded-Type Concrete Inserts: Galvanized ferrous castings, internally threaded to receive minimum 3/4 inch diameter machine bolts; either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27; hot-dipped galvanized in accordance with ASTM A 153.

Wedge-Type Concrete Inserts: Galvanized box-type ferrous casting designed to accept 3/4 inch diameter bolts having special wedge shaped heads; either malleable iron complying with ASTM A 47 or cast steel complying with ASTM A 27; hot-dipped galvanized in accordance with ASTM A 153, refer to Drawings for sizes and types of inserts.

Provide carbon steel bolts having special wedge-shaped heads, nuts, washers and shims; all galvanized in accordance with ASTM A 153, refer to Drawings for sizes of bolts.

Slotted-Type Concrete Inserts: Galvanized 1/8 inch thick pressed steel plate complying with ASTM A 283; box-type welded construction with slot designed to receive a 3/4 inch diameter square head bolt, with knockout cover; hot-dip galvanized in accordance with ASTM A 123.

Masonry Anchor Devices: Expansion shields, complying with FS FF-S-325.

Bolts, Nuts & Washers:

Structural Bolts: Conform to ASTM A 325, heavy hex, high tension type, quenched and tempered, medium carbon steel. Direct tension indicator washers may be used at the Fabricator's option.
Nuts: Heavy hex, ASTM A 563, Grade DH.
Washers: ASTM F 436, Type I.

Anchor Bolts: ASTM A 307, Grade A, non-headed type unless otherwise noted or shown on the Drawings.

Expansion Bolts: Kwick Bolt II, Hilti Corporation, Tulsa, OK 74121, or other as approved by the Architect.

Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts, hexagon heads and nuts.

Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.

Bonding Material: ASTM C 881, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.

Washer and Nut: Zinc-coated steel.

Machine Screws: Cadmium plated steel complying with FS FF-S-92.

Toggle Bolts: Tumble-wing type, size as required by imposed loading and the conditions of the installation.

Wood Screws: Flat head carbon steel complying with FS FF-S-111.

Plain Washers: Round, carbon steel complying with FS FF-W-92.

Lock Washers: Helical spring type carbon steel complying with FS FF-W-84.

Welding Electrodes: AWS Specifications serial designation E-60 or E-70.

PRIMING AND PROTECTIVE COATING
Clean all ferrous metal in accordance with applicable requirements of SSPC-SP1 (Solvent Cleaning) followed by cleaning with applicable requirements of SSPC-SP2 (Hand Tool Cleaning).

Apply specified primer to all ferrous metal surfaces by brush or spray to a dry film thickness of 2 mils. Do not prime metal surfaces that are required to be spray fireproofed.

Galvanize products as shown or specified in accordance with ASTM A 123, unless noted otherwise.

Paint galvanized surfaces with one coat of specified primer by brush or spray application.

Paint miscellaneous metal work which is to be in contact with but not fully embedded in concrete or masonry with a heavy coat of bituminous paint; also coat dissimilar metals which are or will be in contact with one another with such paint. Do not extend coating onto surfaces that will be exposed to view.

FABRICATION - GENERAL
Fabricate and assemble all items in the shop and, if necessary, mark each item to ensure proper installation at the project site. Disassemble for shipment only to the extent required by shipping limitations.

Join all parts with hairline contact, flush and smooth with adjacent surfaces, using concealed welds and fasteners where possible. Where exposed fastenings are unavoidable, countersink screws and bolts. Grind exposed weld areas smooth to match and blend with finished surfaces.

Use hot-rolled steel bars, except where cold-rolled or cold finished, are shown or specified.

Fabricate to the thicknesses, sizes and shapes shown, or if not shown, as required to meet specified performance criteria and to produce work of adequate strength and durability, without objectional deflections. Use proven details of fabrication, as required to achieve proper assembly and alignment of the various components of the work.

Form exposed work true to line and level, with flush surfaces and accurate angles. Ease exposed edges to a radius of approximately 1/32 radius, unless otherwise shown on the Drawings. Miter exposed corner joints and machine fit to a hairline joint.

Weld corners and seams continuously and in accordance with the recommendations of AWS, AA and CDA. Grind exposed welds smooth and flush, to match and blend with adjoining surfaces.

Provide brackets, plates and straps with each assembly, as may be required for proper support and anchorage to the construction and for other work.
Cut, reinforce, drill and tap metal work as may be required to receive other items of work. Provide drilled holes for nailing items or fabrications to formwork for items or fabrications to be set in or embedded in concrete.

Complete the fabrication and assembly of units prior to chemical treatment or the application of coatings, so that untreated or uncoated edges will not be exposed.

FABRICATION - LOOSE LINTELS
Fabricate loose lintels shown and scheduled on the Drawings with accessories and anchors required for installation. Fabricate with not less than 8 inches bearing on each end.

FABRICATION - PIPE HANDRAILS, GUARDRAILS AND RAILINGS
Fabricate handrails, guardrails and railings of design and dimensions shown on the Drawings. Fabricate with flush welded joints, ground smooth and solid fittings for bends, wall returns, cap tees and crosses.

Close exposed ends of pipes by welding a round 3/16 inch thick steel plate over the opening or by use of a solid end fitting.

Provide toe plates at rails around openings and at the edges of open sided floors and landings. Fabricate as shown on the drawings, if not shown, fabricate 4 inches high x 1/8 inch thick welded to and between each vertical rail support.
Fabricate sleeves for setting handrail and guardrail support from galvanized steel, minimum 6 inches long, not less than 1/2 inch greater than the outside diameter of the vertical support. Provide steel plate closure at bottom of sleeve. Provide not less than two, 4 inch long x 3/8 diameter steel stud anchors welded to each side of the sleeve.

Fabricate removable handrail and guardrail sections with fittings and accessories to allow for easy removal and replacement to sections noted or shown on the Drawings.

Provide posts spaced not more than 5 feet on centers, unless otherwise shown on the Drawings.

MISCELLANEOUS METAL FABRICATIONS
Provide shop fabricated miscellaneous metal angles, plates, shapes, support framing, and assemblies as shown on the Drawings, including all accessories and anchors for each item or assembly.

Fabricate miscellaneous fabrications from welded structural steel unless shown or noted otherwise on the Drawings. Provide holes, cut outs, welded-on anchors, fittings and anchors as required to complete the installation of each fabrication and for the attachment or installation of other construction and assemblies.

PART 3 EXECUTION

INSPECTION
Field verify all dimensions and conditions prior to submittal of shop drawings and start of fabrication. Examine the existing construction areas, conditions and subsequent construction under which the metal fabrications and related items are to be installed. Do not proceed with installation or fabricated of items and associated construction until improper conditions have been corrected. Fabrication or installation of metal fabrications and associated construction constitutes acceptance of existing and surrounding construction.

PREPARATION
Coordinate and furnish anchorages, setting drawings, diagrams, templates, written instructions and directions for installation of anchors, embeds, inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery and storage of such items at the project site.

Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when permanent members are in place and final connections completed. Provide temporary guy lines and bracing to achieve proper alignment of fabrications and the structure as erection proceeds.

INSTALLATION - GENERAL
Provide anchorage devices and fasteners as required to anchor, secure or attach the metal fabrications to the in-place or subsequent construction, including but not necessarily limited to threaded inserts for concrete and masonry, toggle bolts, through bolts, lag bolts, wood screws, sleeved expansion anchors and other devices required to complete the installation of each fabricated item.

Perform cutting, drilling and fitting required for installation of each fabricated item. Set each fabrication or item accurately in location, alignment and elevation, plumb, level, true and free of rack as measured from established lines and levels. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

Fit exposed connections accurately together to form tight hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping limitations. Grind exposed joints smooth to blend with adjacent surfaces. Do not weld, cut or abrade the surfaces of exterior fabrications that have been galvanized and are intended for bolted or screwed field connections.

Comply with AWS Code for procedures for field welding and correcting of deficient work.

Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment and removal of paint on surfaces adjacent to field welds.

INSTALLATION - PIPE HANDRAILS, GUARDRAILS AND RAILINGS
Install and anchor handrails, guardrails and railings to supporting structure by welding wherever possible and by bolting elsewhere as reviewed by Architect. Support wall handrails with brackets as shown on Drawings. Maintain a minimum of 1-1/2 inches clearance between finish wall surface and the inside face of the hand rail. At termination return ends of railing to walls.

Existing Construction: Set railing standards by core drilling holes not less than six (6) inches deep and one (1) one inch greater than the outside diameter or edge of the post standard. Clean holes of all loose material, insert post standards and fill annular space with quick-setting, non-shrinking, non-metallic cement (grout).

New Construction: Install galvanized steel sleeves for embedded to receive railing standards where installed in new concrete or masonry. Set standards in sleeves and annular space between sleeve and support with quick-setting, non-shrinking, non-metallic cement.

TOUCH-UP OF SURFACES
Repair and refinish all damaged surfaces of fabrications that will effect the application and appearance of finish coatings. Materials and methods of surface repair are subject to review by the Architect prior to application. Repair and refinish damaged surfaces at no additional cost to the Owner.

After erection of metal fabrications, touch up all welds, bolts connections and steel surfaces where shop paint or galvanizing has been abraded or improperly applied. Clean surfaces and apply two coats of the same paint specified for shop coat or galvanized metal repair paint.

CERTIFICATION OF WELDERS

Provide welding operators employed to execute welding, previously qualified by test as prescribed in the American Welding Society's Standard Qualification Procedure or by such other tests as any governmental agencies having jurisdiction may prescribe. Provide welds made only by operators who are qualified to perform the type of work required, as evidenced by their passing the above prescribed tests. Tests completed earlier than twelve months prior to their employment on the work shall not be acceptable. Assume all costs in connection with operator certification.

END SECTION

SECTION 07 90 00
SEALANTS

PART 1 GENERAL

WORK INCLUDED
Sealing of joints as shown on the Drawings and specified herein, including back-up fillers and fire resistant joint sealers.

RELATED WORK
Section 01 00 00 – General Conditions of Contract
Section 08 11 00 - Metal Doors and Frames

QUALITY ASSURANCE
Provide fire rated sealants designed for the same fire-resistance rating as that required for the construction being sealed. (If Required).

Provide sealants that are listed in the U.L. Building Materials Directory for Fill, Void, or Cavity materials and Through-Penetration Firestop Systems for applicable construction type and penetrating type.

Provide fire-resistant sealants that have been tested in accordance with ASTM E 84, Methods for Fire Tests of Through-Penetration Fire Stops and U.L. 1479, Fire Test of Through Penetration Firestops.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS
Submit the following in accordance with General Conditions of the Contract:

Manufacturer's Literature: Materials description and installation instructions for each compound and filler.

Shop Drawings: Detailing materials, installation methods, and relationships to adjoining construction for each fire-resistant sealant system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each fire-resistant sealant configuration for construction and penetrating items.

Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular fire-resistant sealant, submit illustration approved by fire-resistant sealant manufacturer's fire protection engineer with modifications marked.

Certification: Submit three (3) copies of independent testing laboratory certification of compliance of products with fire resistance requirements.

Warranty: Three (3) signed copies.

DELIVERY, STORAGE AND HANDLING
Handle and store sealant material at the job site in such a manner as to prevent damage. Provide packaged material in original containers with seals unbroken and labels intact until time of use.

Provide wrapped or bundled material, bearing the name of the manufacturer and the product. Immediately removed from the job site damaged or otherwise unsuitable material, when so ascertained.

PROJECT/SITE CONDITIONS

Preinstallation Meeting: Meet with Installer, Architect, Sealant manufacturer's technical representative, if so requested, and other trades involved in coordination with sealant work at the Project Site. Review procedures and time schedule proposed for installation of sealants in coordination with other work. Review each major sealant application required on the Project.

Weather Conditions: 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 by ambient temperature variations, install elastomeric sealants only when temperatures are in the lower third of manufacturer's recommended installation temperature range, so that sealant will not be subjected to excessive elongation and bond stress at subsequent low temperatures. Coordinate time schedule with Contractor to avoid delay of Project.

PART 2 PRODUCTS

MATERIALS - GENERAL

Colors:Wherever sealant is not exposed to view, provide manufacturer's standard color which has the best overall performance characteristics for the application shown. Provide manufacturer's standard colors as selected by Architect for sealants exposed to view.

Hardness: Hardness specified are intended to indicate the general range necessary for overall performance. Consult the Manufacturer's technical representative to determine the actual hardness recommended for the conditions of installation and use. Except as otherwise indicated or recommended, provide compounds within the following ranges of harness (Shore A, fully cured, at 75 degrees F.):

5 to 20 for high percentage of movement and minimum exposure to weather and abrasion (including no exposure to vandalism.)

15 to 35 for moderate percentage of movement and moderate exposure to weather and abrasion.

30 to 60 for low percentage of movement and maximum exposure to weather and abrasion (including foot traffic on horizontal joints).

Modulus of Elasticity: For joints of movement, either thermal expansion or dynamic movement, provide elastomeric sealants which have the lowest modulus of elasticity which is consistent with the exposure to abrasion or vandalism. For horizontal joints subject to traffic provide sealants with high modulus of elasticity, as required to withstand indentation by stiletto heels. Comply with manufacturer's recommendations wherever no other requirements are indicated.

Compatibility: Investigate sealant's compatibility with the joint surfaces, joint fillers, paint finishes and other materials in the joint system. Provide only materials (manufacturer's recommended variation of the specified materials) which are known to be fully compatible with the actual installation condition and materials, as shown by manufacturer's published data or certification.

ACCEPTABLE MANUFACTURERS

Mameco International; Cleveland, OH 44128.
Harry S. Peterson Company; Bera, OH 44017.

Tremco; Cleveland, OH 44104.
Pecora Corp.; Harleysville, PA 19438.
Dow Corning Corp.; Auburn, MI 48611.
G E Silicones; Waterford, NY 12188.
Sonneborn Building Products; Minneapolis, MN 55435.

MATERIALS - SEALANTS AND FILLERS

Sealant S-1; One-Part Polyurethane, Non-Sag, FS TT-S-002300, Type II, Class A (±25 Percent Movement):

1. Dymonic, Tremco
2. Sonolastic NP1, Sonneborn

Joint Filler F-1; Closed Cell Expanded Polyethylene (Rod):

1. Ethafoam, Dow Chemical
2. Expand-O-Foam, Williams
3. Sonofoam Backer-Rod, Sonneborn
4. PRC Backer Rod, PRC

Joint Cleaner: Type recommended by the manufacturer of the sealing compound and as required by the specific joint surface and conditions.

Joint Primer and Sealer: Type recommended by the manufacturer of the sealing compound for the specific joint surface and conditions.

Bond Breaker: Polyethylene tape.

PART 3 EXECUTION

PREPARATION

Select only sealing compounds of manufacturers who agree to have a qualified representative visit the site at the beginning of the joint sealing work and periodically thereafter as necessary to ensure the proper installation of the sealing compounds.

Examine all surfaces to receive the parts of the work so specified herein. Application or installation of material constitutes acceptance of the substrate.

Clean surfaces and remove protective coatings which might fail in adhesion or interfere with bond of compound so that surfaces are free of deleterious substances which might impair the work. Except as otherwise approved by the manufacturer, do not apply elastomeric sealants to joint surfaces previously treated with lacquer, sealer, curing compound, water repellent or other similar coatings unless such coating have been entirely removed.

Prime surfaces in accordance with the instructions of the sealant manufacturer.

Install bond breakers in locations and of type recommended by the sealant manufacturer to prevent bond of sealant to surfaces where such bond might impair the performance of the sealant.

In all joints to receive sealant install bond breaker specified for Joint Filler F-1, unless otherwise recommended by sealant manufacturer.

INSTALLATION

Install all materials in accordance with the manufacturer's printed instructions. Unless otherwise directed conform with the following:

Do not install compounds below a temperature of 40 degrees F. unless the manufacturer specifically permits application of his materials at a lower temperature. If job conditions require the installation of compounds below 40 degrees F. (or below the minimum installation temperature recommended by the manufacturer), consult the manufacturer's representative and establish the minimum provisions required to ensure the satisfactory work.

Confine compounds to joint areas shown. Use masking tape to prevent staining of adjoining surfaces or spillage and migration of compound out of the joints. Tool surface to shape shown or, if none is shown, to slightly concave surface. Remove excess compound and clean adjoining surfaces as may be required to eliminate any indication or soiling or migration.

Use power driven equipment wherever possible to install compounds so as to ensure uniformity of application and the highest quality of workmanship.

For walk joints and similar horizontal traffic joints where sealing is indicated, use self-leveling or pourable grade compound. Fill to a level approximately 1/16 inch below surface of the walk or pavement.

Installation of Firestopping Sealants:
Install sealants to comply with U.L. System requirements using proven techniques. Install sealants to directly contact and fully wet the joint substrates, completely filling recesses and voids provided for each joint configuration or construction opening which produce uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability. Install mineral fiber joint filler in voids and other accessories as required by manufacturer and/or UL Design Number.

Tool sealants to form smooth, uniform beads, of flush configuration unless otherwise indicated on the Drawings, to eliminate air pockets and ensure contact and adhesion of the sealant with the side of the joint. Remove excess sealants from surfaces adjacent to the joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by the sealant manufacturer.

Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

APPLICATION SCHEDULE
Use S-1 in exterior and interior moving joints, in non-traffic surfaces and surfaces not subject to running or standing water (control joints, etc.).

CLEANING AND PROTECTION
Remove excess sealants and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by methods and materials recommended by the sealant manufacturer to eliminate evidence of spillage or excess without damage to adjoining surfaces or finishes.

The sealant installer is to advise Contractor of procedures required for curing and protection of sealant compounds during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

END SECTION

SECTION 08 11 00
HOLLOW STEEL DOORS AND FRAMES

PART 1 GENERAL

WORK INCLUDED
Hollow steel doors and frames (welded) as shown on the Drawings and specified herein.

RELATED WORK
Specified Elsewhere:
DSF Conditions of Contract
Section 04 21 00 - Brick Masonry
Section 07 90 00 - Sealants
Section 08 70 00 - Finish Hardware
Section 09 90 00 - Painting

QUALITY ASSURANCE
Products: Provide standard welded hollow steel doors and frames by a single firm specializing in the production of hollow steel work as evidenced by a minimum of ten years production experience.

Provide hollow steel doors and frames conforming to the applicable recommended practices contained in the following:

Hollow Metal Technical and Design Manual, current edition, as published by The National Association of Architectural Metal Manufacturer's and except as hereafter modified.

Recommended Specifications, Standard Steel Doors and Frames - SDI- 100, current edition, as published by Steel Door Institute except as herein modified.

REFERENCES
Titles, designations, dates of issue or revisions of referenced standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS
Submit the following in accordance with General Conditions of Contract:

Product Data: Submit three (3) copies of manufacturer's data for fabrication and installation instructions.

Shop Drawings: Submit shop drawings for the fabrication and installation. Include details of each frame type, elevations of door design types, conditions at openings, details of anchorage to construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections.

Provide a schedule of doors and frames using same reference numbers for details and openings as those on the Contract Document Drawings. Indicate all fire-rated doors and frames, welded and knockdown frames.

Certification: When door assemblies required to be fire-rated that exceed manufacturer's capabilities or U.L. design maximum sizes, submit three (3) copies of Door and Frame Manufacturer's Label Certification that each door and frame assembly has been constructed to conform to design, materials and construction equivalent to the requirements for labeled assemblies or products or units tested in accordance with ASTM E 152 Standards.

DELIVERY, STORAGE AND HANDLING
Inspection: Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided the finish items are equal in all respects to new work; otherwise, remove and replace damaged items as directed.

Storage: Store at the building site under cover. Place units on at least 4 inch high wood sills or on floors in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters, which could create a humidity

chamber. If the cardboard wrapper on the door becomes wet, remove the carton immediately. Provide a 1/4 inch space between stacked doors to promote air circulation.

PART 2 PRODUCTS

MATERIALS

Hot-Rolled Steel Sheets and Strips: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526 and ASTM A 525, G60 zinc coating, mill phosphatized.

Structural Steel Shapes: ASTM A 36.

Steel Bars: ASTM A 108.

Steel Plate: ASTM A 283.

Supports and Anchors: Fabricate of not less than 0.053 inch thick sheet metal. Galvanized after fabrication for units to be built into exterior walls, complying with ASTM A 153, Class B.

Shop Applied Paint: For steel surfaces, use rust inhibitive enamel or paint, either air drying or baking, suitable as a base for finish paints, complying with ANSI A224.1 Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces.

FABRICATION - GENERAL

Fabricate hollow metal units to be rigid, neat in appearance and free from defects, warp or buckle. Accurately form metal to required sizes and profiles. Wherever practicable, fit and assemble units in the manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at the Project Site. Weld exposed joints continuously, grind, dress and make smooth, flush and invisible.

Prepare hollow metal units to receive finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A115 Specifications for Door and Frame Preparation for Hardware, current edition.

Locate finish hardware as shown on final shop drawings or, if not shown, in accordance with Recommended Locations for Builder's Hardware, published by National Builders' Hardware Association, current edition.

DOOR FABRICATION

Provide full flush design doors, seamless hollow construction. Bevel both vertical edges 1/8 inch in 2 inches.

Fabricate of two (2) outer hot or cold-rolled, stretcher-leveled steel sheets. Construct doors with smooth, flush surfaces, without visible joints or seams on exposed faces or stile edges.

Reinforce inside with vertical, hot-rolled, not less than 0.026 inch thick steel channel shaped sections or interlocking Z-shaped steel sections. Space vertical reinforcing 6 inches o.c. and extend full door height. Spot weld at not more than 5 inches o.c. to both face sheets.

Continuous truss form inner core of 0.013 inch thick sheet metal reinforcing may be provided as inner reinforcement in lieu of above. Spot weld truss form reinforcement 3 inch o.c. vertically and horizontally over entire surface of both sides.

Interior Doors:
Reinforce tops and bottoms of interior doors with 0.042 inch thick horizontal steel channels welded continuously to the outer sheets.

Provide not less than 0.042 inch thick steel faces.
Provide sound insulation filler of fiberboard, mineral wool board or other non-combustible material solidly packed full door height to fill the voids between inner core reinforcing members, if not truss core.

Provide truss core for doors exceeding 3 feet x 7 feet in size.

Exterior Doors: Reinforce tops and bottoms of exterior doors with 0.053 inch thick, horizontal galvanized steel channels welded continuously to the outer sheets. Close top and bottom edges to provide weather seal, as integral part of door construction or by addition of inverted steel channels. Provide not less than 0.053 inch thick galvanized steel face. Insulate doors with a foamed-in-place urethane core that achieves a "U" value of 0.09.

Reinforce doors with rigid tubular frames where stiles and rails are less than 8 inches wide. Form tubular frames with 0.053 inch thick galvanized steel, welded to outer sheets.

Finish Hardware Reinforcement: Unless otherwise indicated herein, reinforce doors for scheduled finish hardware, as follows:

Hinges: Steel plate not less than 3/16 inch thick x 1-1/2 inches wide x 6 inches longer than hinge, secured by not less than 6 spot-welds.

Mortise Locksets and Dead Bolts: Not less than 0.067 inch thick steel sheet, secured with not less than 2 spot-welds.

Cylindrical Locks: Not less than 0.093 inch thick steel sheet, secured with not less than 2 spot-welds.

Flush Bolts: Not less than 0.093 inch thick steel sheet, secured with not less than 2 spot-welds.

Surface-Applied Closers: Not less than 0.093 inch thick steel sheet, secured with not less than 6 spot-welds.

Push Plates and Bars: Not less than 0.053 inch thick steel sheet (except when through bolts are shown or specified), secured with not less than 2 spot-welds

Surface Panic Devices: 0.067 inch thick sheet steel (except when through bolts are shown or specified), secured with not less than 2 spot-welds.

FRAME FABRICATION

General: Fabricate frames unless noted otherwise of full welded unit construction, with corners full mitered, reinforced, continuously welded full depth and width of frame including stops.Fabricate apartment unit interior frames as knockdown frames. Knockdown frames will not be acceptable as alternates for welded frames. Indicate knockdown frames on submitted shop drawings. Form frames of either cold or hot-rolled sheet steel. Provide not less than 0.067 inch thick galvanized steel for exterior openings up to and including 4 feet wide. Not less than 0.053 inch thick steel for interior openings, including 4 feet wide. For openings over 4 feet wide, increase thickness by at least 2 standard thickness.

Welded Frame Corner Joints:
Frame members shall be stamped in the flats to a predetermined pattern, designed to provide mitered faces or trims and mitered stops.

After fabricating head and jamb members, fit frames together engaging projecting tabs into corresponding slots in the head.

Tightly close contact edges so that trim and faces are aligned straight, level and true.Secure interlocking tabs where they pass thru head slots by welding. Weld all back bends together. Continuously weld mitered trim joint one each side inside the frame section. Dress and finish exposed joints to produce invisible connections. Weld head and jamb together along their intersecting depth and width inside the frame. Weld jambs to head overhang along the length of each rabbet, inside the frame completely welding the full joint perimeter. Grind all welds on exposed surfaces smooth and flush with adjoining surfaces.

Window Frames, Borrowed Lites, Mullions and Transom Bars: Provide closed or tubular mullions and transom bars. Fasten mullions and transom bars at crossings and to jambs by butt welding. Reinforce joints between frame members with concealed clip angles or sleeves same metal and thickness as frame. Where installed in masonry, leave vertical mullions in frames open at the top so they can be filled with grout. Provide steel channel stiffeners on interior of closed mullion sections. Provide anchors for window and side lites frames same as for doors. Provide concealed sleeves for frames to be shipped in one piece. Weld and grind smooth all field connections.

Welded Frame Jamb Anchors: Furnish jamb anchors as required to secure frames to adjacent construction and as required by fire-rated assemblies, formed of not less than No. 18 gauge galvanized steel unless noted otherwise.

Masonry Construction: Adjustable, flat or corrugated or perforated, T-shaped to suit frame size with leg not less than 2 back wide, by 10 inches long. Furnish at least 3 anchors per jamb up to 7 feet - 6 inches height; 4 anchors up to 8 feet jamb height; one additional anchor for each 24 inches or fraction thereof over 8 feet height.

Metal Stud Partitions: Insert type with notched clip to engage metal stud, welded to back of frames. Provide at least 4 anchors for each jamb for frames up to 7 feet - 6 inches in height; 5 anchors up to 8 feet jamb height; one additional anchor for each 24 inches or fraction thereof over 8 feet height.

In-Place Concrete or Masonry: Anchor frame jambs with minimum 3/8 inch concealed bolts into expansion shields or inserts at 6 inches from top and bottom and 26 inches o.c., unless otherwise shown. Reinforce frames at anchor locations. Apply removable stop to cover anchor bolts, unless otherwise indicated.

Floor Anchors: Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 0.067 inch thick galvanized steel sheet; clip type anchors, with 2 holes to receive fasteners, welded to bottom of jambs.

Structural Reinforcing Members: Provide structural reinforcing members as a part of frame assembly, where indicated at mullions, transoms or other locations which are to be built into frame.

Head Reinforcing: For frames over 4 feet wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 0.093 inch thick for full width of openings, welded to back of frame at head, except where not allowable for label requirements.

Finish Hardware Reinforcement: Unless otherwise indicated herein, reinforce frames for scheduled finish hardware, as follows: Hinges and Pivots: Steel plate not less than 3/16 inch thick x 1-1/2 inches wide x 6 inches longer than hinge, secured by not less than 6 spot-welds. Strike Plate Clips: Steel plate not less than 3/16 inch thick x 1-1/2 inches wide x 3 inch long. Surface-Applied Closers: Not less than 0.093 inch thick steel sheet, secured with not less than 6 spot-welds.

Concealed Closers: Removable steel access plate, not less than 0.093 inch thick internal reinforcement of size and shape required, and enclosing housing to keep closer pocket free of mortar or other materials.

Spreader Bars: Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.

Rubber Door Silencers: Drill stop to receive 3 silencers on single door frames and 4 silencers on double door frames. Install plastic lugs to keep holes clear during construction.

Plaster Guards: Provide 0.016 inch thick gauge steel plaster guards or dust cover boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware installation.

STOPS AND MOLDINGS

Provide stops and moldings around openings in hollow metal door and window units and for frames to receive lights where indicated.

Form fixed stops and moldings integral with frame. Provide fixed stops on outside of hollow metal units exposed to exterior and on corridor side of interior units, unless otherwise indicated.

Provide removal stops and molds at other locations, formed of not less than No. 20 gauge steel sheets. Secure with countersunk machine screws spaced uniformly not more than 1/2 inch o.c. form corners with butted hairline joints.

Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

DOOR GRILLES AND LOUVERS

Provide and shop install louvers and grills of sizes and at locations shown on the Drawings. Provide fire rated units in label doors. Label Doors: Model No. FD 264, Airolite Co., or other approved by Architect. Non-Label Doors: Model No. 685, B molding, Airolite Co., or other approved by Architect.

SHOP PAINTING

Clean surfaces of fabricated units of mill scale, rust, oil, grease, dirt and other foreign matter.

Pretreat cleaned surface in accordance with SSPC-PT-2, PT3 or PT4. Verify compatibility of primer with galvanized surfaces. Provider primer on galvanized surfaces that will not effect finish paint materials.

PART 3 EXECUTION

INSTALLATION

General: Install hollow metal units and accessories in accordance with the final reviewed shop drawings, manufacturer's data, and as herein specified.

Setting Masonry Anchorage Devices: Provide masonry anchorage devices where required for securing hollow metal frame to in-place concrete or masonry construction. Set anchorage devices opposite each anchor location in accordance with details on final shop drawings, fire-rated assembly requirements and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed and free from dust and debris.

Floor Anchors: Floor anchors may be set with powder-actuated fasteners instead of masonry anchorage devices and machine screws, if so approved by the Architect.

Placing Frames: Set frames accurately in position, plumbed, aligned and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.

In masonry construction, building-in of anchors and grouting of frames is included in the Section 04220 - Concrete Unit Masonry, of these Specifications.

At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage device.

Make field splices in frames as detailed on final shop drawing, welded and finished to match factory work.

Remove spreader bars only after frames or bucks have been properly set and secured.

Install knockdown frames in accordance with the manufacturer's printed installation instructions and the reviewed shop drawings.

Door Installation: Fit hollow metal doors accurately in their respective frames, with the following clearances:

a. Jambs and Head: 3/32 inch.
b. Meeting Edges, Pairs of Doors: 1/8 inch.
c. Bottom: 3/8 inch, where no threshold or carpet (except where scheduled as undercut).
d. Bottom: At threshold or carpet: 1/8 inch.

Place fire-rated doors with clearances as specified in NFPA Standard No. 80.

Finish hardware installation as specified under Section 06200, "Installation of Finish Hardware."

ADJUST AND CLEAN

Final Adjustment: Check and readjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.

END SECTION

SECTION 08 70 00
FINISH HARDWARE

PART 1 GENERAL

WORK INCLUDED
Finish hardware as shown on the Drawings and specified herein.

RELATED WORK
DSF General Conditions of Contract

Section 08 11 00 - Hollow Steel Doors & Frames
Section 09 90 00 - Painting

QUALITY ASSURANCE
The supplier of the finish hardware is to be a firm technically qualified and experienced in outfitting structures with finish hardware. Refinements such as butt knuckle, clearance, strike lip lengths and adjustments, beveling of lock faces, handing of doors and centering of backsets will be expected and is to be indicated in the submitted hardware schedule.

The supplier is responsible for thoroughly detailing the entire project to assure that the items specified will properly function in the indicated locations. Should the items specified not work properly, it is the responsibility of the supplier to furnish suitable items of comparable quality as approved by the Architect/Engineer to those being furnished throughout the project at no additional cost to the Owner.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

UNDERWRITERS' LABORATORY REQUIREMENTS

Furnish hardware in accordance with NFPA Standard No. 80 and 101 for openings specified, shown or scheduled to receive fire-rated UL labels. In case of conflict between type of hardware specified and type required for fire protection, furnish type required by NFPA and UL at no additional cost to the Owner.

Furnish hardware of type approved by UL for usage with the types and sizes of fire doors and frames required. Unless otherwise shown on the Drawings or specified, arrange fire doors to remain in the normally closed position by furnishing each unit with an automatic closing device. Furnish active latch bolts of UL approved throw.

Provide exit hardware for fire-rated openings bearing UL markings.

SUBMITTALS
Submit the following in accordance with General Conditions of Contract:

Manufacturer's Literature: Materials description, specifications, installation and maintenance instructions; catalog cut sheets for all items scheduled.

Samples: One (1) lockset of each design and finish scheduled in the reviewed hardware schedule. Samples will be returned at the completion of the work.

Hardware Schedule: Provide hardware schedule containing a complete listing of all finish hardware items required for the project, whether or not specifically named in the Specifications or indicated on the Drawings. The Architect/Engineer's review of the schedule is not to be construed to relieve the Contractor of responsibility for errors or omission in the schedule, nor of the responsibility to completely equip the project with finish hardware.

Include in the schedule each door location, hand of door, complete listing of each set item, finish, manufacturer of each item and keying information. Use same reference numbers and letters for doors and sets as those on the Contract Documents.

Written notification that required templates and a copy of the final reviewed hardware schedule have been sent to the hollow metal door and frame manufacturers for use in fabrication.

DELIVERY, STORAGE AND HANDLING

Handle finish hardware in such a manner as to prevent damage. Store in a clean, dry, secure place.

Package each set of hardware items together in sets, identified with set numbers in accordance with the final reviewed hardware schedule. Package each item of hardware separately and labeled separately. Include in each package appropriate fastening installation instructions and templates. Deliver a complete schedule with shipped hardware.

Should marking of any item become separated from the item, return the item to the supplier for marking.

Immediately remove from the job site all damaged or otherwise unsuitable items when so ascertained and replace with an identical item at no additional cost to the Owner.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS
Hager Hinge Co.; St. Louis, MO 63104
The Stanley Works; New Britain, CT 06050
Lawrence Brothers, Inc.; Sterling IL 61081
Sargent & Company; New Haven, CT 06509
LCN Closers Div. of Schlage Lock Co.; Princeton, IL 61356
Norton Marketing Department, Eaton Corporation; Charlotte, NC 28212
Brookline Industries, Inc.; Chicago, IL 60637
Schlage Lock Co.; San Francisco, CA 94119
Yale Architectural Hardware; Charlotte, NC 28229
Dor-O-Matic; Chicago, IL 60656
Zero International, Inc.; Bronx, NY 10455
Von Duprin, Inc., Indianapolis, IN 46206
Corbin/Ruswin Berlin, CT 06037
Best Lock Corporation, Indianapolis, IN 46250
Dorma Door Controls Inc., Reamstown, PA 17567
Simplex, West Nyack, NY 10944
Security Door Contorls, West Lake, CA 91362

MATERIALS
Materials and equipment are contained in the Hardware Schedule.

Unless otherwise specified, provide various items of hardware with color and finish matching the finish specified for locksets and latchsets.

Provide finishes of the same designation, that come from two or more sources, which match when the items are viewed at arms length and approximately two feet apart.

Provide hue of color of each finish matching whether or not the base metal is cast, forged or stamped, or when plating is applied over steel, brass or bronze.

Provide manufacturer's standard painted finish over bonderized and prime coated metal surfaces where required; the lacquer or enamel matching the finish of the locksets and latchsets unless otherwise specified.
Hardware Finishes: Provide locksets and latchsets with satin finish. Provide all other hardware with matching finish unless noted otherwise.

TEMPLATES
Fabricate locks, hinges, closers and other hardware, to be mounted on hollow metal doors and frames to templates; furnish with machine screws. Furnish templates to hollow metal door and frame manufacturers and other manufacturers requiring such templates.

FASTENINGS
Furnish hardware with screws, through bolts and other fastenings suitable to assure permanent anchorage. Where exposed, provide fastenings of countersunk oval-head type, (except use flat-head for hinges), and matching finish of hardware being attached. Provide concealed fastenings wherever possible. Do not attach hardware with self-tapping or sheet metal screws. Secure door closers and arms, door holders and holder arms and door stops to doors with plated head sex bolts with smooth head to exterior. Fasten floor type stops and holders to the floor with machine screws into expansion shields.

ACCEPTABLE MANUFACTURERS
Proprietary names used to designate hardware in the schedule are not intended to imply that products of the manufacturer are required to the exclusion of equivalent products of other herein named or listed manufacturers. The Architect/Engineer is to be informed in writing of all hardware manufacturers used on the project prior to submitting the hardware schedule.

PRINCIPAL HARDWARE
Finish: Brushed aluminum for all hardware unless noted otherwise.

Mortise Locksets: Schlage, L9453P, 06 lever, finish 626

Hinges (Butts): Provide all doors (except those noted otherwise) with full bearing butts, two bearing, with all interior butts; FBB 4-1/2 inch x 4-1/2 inch, and all exterior door butts; FBB, NRP, 4-1/2 inch x 4-1/2 inch. Provide hinges and models as manufactured by one of the following: Hager: Stainless Steel with Security Pins at exit doors: 1279

Door Closers: Provide closers of full rack and pinion-type enclosed in metal case. Provide closers of size recommended by manufacturer for size of door, location and frequency of operation of each door. Provide products manufactured by one of the following:

LCN, Model 1070, Finish LCN 1 Aluminum, Self-Closer with non-hold open arm hinge per ADA requirements.

Exit Devices: Provide touch pad design exit device series as manufactured by one of the following
1. Von Duprin, Series 99
2. Yale, 7100 Series

3. Monarch, 18 Series

Door Stops and Wall Bumpers: H.B. Ives, Glynn-Johnson or Trimco.

Thresholds: Zero Intl. #30 Aluminum w/ #25 extruded aluminum angle per ADA requirements.

Removable Lock Cores: Lockset manufacturer's standard.

Seals: Stanley, Reese, Pemko or Zero.

Door Silencers: Furnish three or four as required for frame.

Flush Bolts: H.B. Ives, Glynn-Johnson or Trimco

Dead Bolts: Schlage, Yale or Adams Rite.
Push and Pulls: Hager, Rockwood or Trimco.
Kick and Mop Plates: Hager, Rockwood or Trimco.

PART 3 EXECUTION

INSPECTION
Examine and verify all conditions of hardware installations. Installation of finish hardware and related items constitute acceptance of the existing conditions.

PRE-INSTALLATION ORIENTATION
After delivery of hardware and prior to its installation, meet with the installer and manufacturers. Compare approved samples with actual hardware delivered to assure acceptability. Review catalogs, brochures, installation instructions and the final hardware schedule. Rehearse installation procedures and workmanship, with special techniques of installation.

INSTALLATION
Install Finish hardware plumb, level and true to line, in accordance with the manufacturer's product data and instructions.

Install finish hardware using supplied templates for each item. Cut and fit substrate to avoid substrate damage and weakening. Cover cut-outs with hardware item. Mortise work in correct locations and size, without gouging, splintering or causing irregularities in the finished work.

Where cutting and fitting is required on substrates to be painted or stained, install, fit and adjust hardware prior to finishing work. Remove finish hardware and place in original packaging. Reinstall hardware after finishing.

Attach thresholds to concrete surfaces using drilled-in lead expansion shields and countersunk flat-head bronze or stainless steel screws. Set thresholds in a continuous bed of exterior sealant.

MOUNTING HEIGHTS OF HARDWARE
Install finish hardware in accordance with DHI Publication, Recommended Locations for Architectural Hardware for Standard Steel Doors, current edition; NWDA Industry Standard I.S.7, Hardware Locations for Wood Doors, current edition and the following:

1. Lock Sets and Latches: 40-5/16 in. to center of knobs from floor.
2. Hinges: 10 in. to bottom of lowest hinge from floor; 5 in. to top of upper hinge from top of door; space other hinges equally between lower and upper hinges.
3. Door Pulls: 45 in. finish floor to center of pull; centerline in 5 in. from edge of door.

4. Dead Locks: 60 in. finish floor to center of cylinder; 44 in. at apartment entrance doors.
5. Push plates: 48 in. finish floor to center of plate; center centerline in 5 in. from edge of door.

Where standards or specified heights conflict, consult the Architect/Engineer for interpretation prior to mounting hardware.

KEYS AND KEYING
Furnish 4 nickel silver keys from each lock and 6 master keys for permanent keying.

Furnish a key cabinet conforming with FS AA-C-30D with 75 percent expandable capacity.

During construction period provide temporary construction cylinders for all exterior door locks. Furnish 10 keys for such cylinders.

The Hardware Supplier is to coordinate with the Owner's representative prior to submitting the Hardware Schedule, for keying requirements of the building.

Upon completion of the building install the permanent cylinders in the exterior door locks in the presence of the Owner's Representative.

FINAL ADJUSTMENTS
Immediately prior to acceptance of the building by the Owner, lubricate hardware with graphite or special oil, test and adjust moving parts. Clean hardware to remove dust and stains.

Instruct Owner's designated personnel in adjustment and maintenance of hardware and finishes during hardware adjustment. Furnish special tools to the Owner's Representative as required to adjust and maintain hardware.

After building is in use, make final adjustments of hardware to compensate for air movement and other conditions so that all items operate properly.

HARDWARE SCHEDULE
Passage Set: Schlage Saturn-S-Series, S10D, Finish 626
Storeroom: Schlage Saturn-S-Series, S70PD, Finish 626
Entrance: Schlage Saturn- S-Series, S51PD, Finish 626
Privacy: Schlage Saturn- S-Series, S40D, Finish 626
Office: Schlage Saturn-S-Series, S40D, Finish 626

END SECTION

SECTION 09 26 00
GYPSUM WALLBOARD SYSTEMS

WORK INCLUDED
Gypsum wallboard systems as shown on the Drawings and specified herein including accessories, joint treatment and finishing.

RELATED WORK
Section 07920 - Sealants
Section 08110 - Hollow Steel Doors and Frames
Section 09510 - Acoustical Ceilings and Suspension Systems
Section 09900 - Painting

QUALITY ASSURANCE
Provide gypsum wallboard construction complying with all laws, ordinances, rules, regulations and orders of public authorities having jurisdiction over this part of the Work.

Provide primary materials from a single manufacturer unless otherwise approved, in writing by the Architect, to insure total unit responsibility.

Install steel framing members to receive gypsum wallboard complying with ASTM C 645, ASTM C 754 and ASTM C 1002.

Provide installation of gypsum wallboard systems construction complying with the manufacturer's current printed instructions and specifications and the Recommended Specifications for the Application and Finishing of Gypsum Wall Board, Standard GA 216, Installation of Screw-Type Steel Framing Members to Receive Gypsum Wallboard, Standard GA 203, and Fire Resistance Design Manual, Standard GA 600, current editions of the Gypsum Association, except as herein modified and as approved by the manufacturer.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

CONSTRUCTION TOLERANCES
Provide gypsum wallboard construction within the following tolerances:

The maximum allowable variation from finish plane in vertical and horizontal lines and surfaces of walls and ceilings is not to be greater than 1/8 inch from plane of fastening faces of adjacent stud, framing, furring or suspension members.

SUBMITTALS
Submit the following in accordance with General Conditions of Contract:

Manufacturer's Literature: Materials description and recommended installation instructions for systems and all materials specified and used.
Samples:
Two (2) 12 inch long samples of corner bead, end bead, reglets, moldings and control joint trim.

One small sample of electrical box pad.

DELIVERY, STORAGE AND HANDLING
Deliver materials to the job in their original unopened containers or bundles; stored in a place providing protection from damage and exposure to the elements. Immediately removed from the job site, damaged or otherwise unsuitable material, when so ascertained.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS
United States Gypsum Co.; Chicago, IL 60680.
Gold Bond Building Products, Div. of National Gypsum Co.; Buffalo, NY 14202.
Georgia-Pacific Corp.; Portland, OR 97204.
Chicago Metallic Corporation, Chicago, IL 60638.
National Rolling Mills, Malvern, PA 19355.
Eastern Products, Division of Armstrong World Industries, Inc., Baltimore, MD. 21219.
Fry Reglet Corp.; Alhambra, CA 91803.
Modulars Incorporated, Hamilton, OH 45012.
Fin Pan Inc., Hamilton, OH 45012.
Owens Corning Fiberglas Corp., Toledo, OH 43659.
Schuller Building Products, Denver, CO 80217.
Harry A. Lowery & Associates, Inc., Sun Valley, CA 91352.

MATERIALS
Gypsum Wallboard: FS SS-L-30 and ASTM C 36; tapered with beveled or radial-edge for all finished joints, thickness as shown on the Drawings: Regular.

Wallboard Steel Studs and Runners: Light-gage screw type, "Cee" shaped studs 25 gage unless otherwise indicated, comply with ASTM C 645, sizes as shown on the Drawings.

Deflection Track: Manufacturer's top runner complying with the requirements of ASTM C 645 and with 2-inch deep flanges.

Metal Resilient Furring Channels: 25 gage, electro-galvanized steel, 1/2 inch deep x 2-1/2 inches long, 200 lbs. per 1000 lin. ft., RC-1, USG or other as approved by the Architect.

Screws:
Metal Studs: Type S and S-12 bugle head and pan head, sized to suit thickness, zinc plated for exterior use, complying with ASTM C 1002 and ASTM C 954.

Hangers: Minimum eight (8) gage annealed, galvanized wire.

Accessories:
Metal corner reinforcements, casing beads and trim, fabricated from 26 gage galvanized sheet steel with perforated flanges, designed to receive joint compound.

Control Joints: Roll-formed zinc or extruded vinyl as standard with the wallboard manufacturer.

Joint Treatment Materials: ASTM C 475.

Fiberglass:
Sound Attenuation Batts, Owens Corning Fiberglas Corp.
Fiber Glass Sound Control Batts, Schuller Building Products

Sealants: Refer to Section 07 92 00.

SYSTEMS
Steel Framed Gypsum Wallboard:
Gypsum Wallboard, U.S. Gypsum
Gypsum Wallboard Construction, Gold Bond
Gypsum Wallboard, Georgia-Pacific

EXECUTION

PREPARATION
When the outside temperature is below 55 degrees F., provide heat and maintain in all areas where the work of this Section is to be performed. Provide heat continuously and uniformly at 55 degrees F. from one week prior to start of installation until dry wall application and joint treatment is completed. Do not start installation until windows are glazed and doors installed or openings temporarily closed. Provide ventilation to remove excess moisture during joint treatment.

INSTALLATION OF SINGLE LAYER WALLBOARD (METAL STUD PARTITIONS)
Install supplementary framing, solid blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings, woodwork, accessories and similar work.
Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip (deflection track) or cushioned type (closed-cell vinyl foam adhesive-backed strips) joint to attain lateral support and avoid axial loading.

Extended stud system to structural support or substrate above, except where otherwise shown on the Drawings.

Install runner tracks where gypsum wallboard stud system abuts other work, except as otherwise indicated. Align metal floor runners accurately according to partition layouts and secured to concrete slabs with concrete stub nails or power driven anchors, spaced in 24 inches o.c. Secure top runners to substrate with stub nails or power driven anchors spaced 24 inches o.c. Where ceilings consist of lay-in panels with walls indicated to underside of ceiling, attach partition runners to exposed ceiling runners with self-tapping screws.

Install metal studs not to exceed 24 inches o.c. and as shown on the Drawings into floor and ceiling runners and secured to runners with screws. Fasten studs at door and window frames, partition intersections and corners.

Locate studs within 2 inches of all doorframe jambs and anchor to jamb and head anchor clips of each frame by screw attachment. Over frames, a cut-to-length stud extending from doorframe header to ceiling runner and position over vertical joints over doorframe. Spot grout all frames at jamb anchor clips, after stud and before gypsum wallboard is installed.

Fill fire rated door frames including elevator door frames solid with grout as shown on the Drawings, if not shown as required to comply with U.L. rating of opening assembly.

Secure jamb studs to frames in openings with screws either directly to frames or to special frame-support brackets; and install runner track sections (for jack studs) above and below openings, secured to jamb studs.

Space jack studs same as partition studs and screw to runner tracks above and below.

Install two (2) studs at each jamb of each opening over 2 feet-0 inches wide.

Install two (2) No. 20 gage studs at all door openings for 3 feet wide x 7 feet high and larger for solid core wood and hollow steel doors.

Install horizontal stiffeners 6 inches above and 6 inches below each opening more than 3 feet wide, and extend 2 regular stud spaces beyond each jamb.

Install and attach to studs horizontal stiffeners (3/4 inch cold-rolled channels) in stud system faced on one side only; space 4 feet - 6 inches o.c. Provide not less than two rows of stiffeners spaced at third points of stud span.

Install extra stud, furring members and angle runners at terminations of dry wall work, and at openings and where required for support of other work occurring in the dry wall work.

Install sheet metal strapping, studs, hat-shaped channels or stud runners in walls where shown on the Drawings or as required by the conditions of the installation, minimum same gage as stud framing, for the support and attachment of other work. Attach to stud framing with not less than three (3) screws per stud.

Install sound attenuation blankets, where shown on the Drawings, pressure-fit between studs. Fill all voids. openings and gaps, butt joints of blankets and support and secure in accordance with manufacturer's recommendation when not self supporting.

Except as otherwise required for compliance with fire-resistance ratings noted on the Drawings apply single layer wallboard face out with long dimension horizontal (perpendicular to studs). Install with all abutting ends and edges occurring over stud flanges. Position joints on opposite sides of a partition on different studs. Attach with 1 inch screws spaced 12 inches o.c. in field of board and 8 inches o.c. along vertical edges.

Install water resistant wallboard on all toilet room walls, bath room walls and where shown or noted on the Drawings. Where walls consist of multiple layers, provide water resistant wallboard for all layers.

Install exterior grade board on soffits and ceilings in toilet and wet areas (do not use water resistant board for such areas).

INSTALLATION OF TRIM AND ACCESSORIES
Install metal corner beads on all exterior corners, attached with suitable fasteners spaced 9 inches o.c. on both sides, and in single lengths unless corner exceeds standard stock lengths.

Install metal trim installed over face-layer wallboard, attached with suitable fasteners spaced 9 inches o.c. and in single lengths unless application length exceeds standard stock lengths

Install vinyl trim over face layer of wallboard where shown or noted on the Drawings. Attach to substrate with 3/8 inch Type S Pan Head screws and insert panel in place. Install friction fit trim in accordance with the manufacturer's printed installation instructions.

Install control joints where indicated on the Drawings and required by conditions of the installation. Attach to face-layer wallboard with 9/16 inch "G" staples spaced 6 inches o.c. in each flange and in single lengths unless application length exceeds standard stock lengths. Provide a maximum control joint spacing of not more than 30 feet o.c. horizontally and vertically for walls, ceilings and soffits.

Apply wallboard screws with an electric driver. Drive screws not less than 3/8 inch from edges or ends of panels to provide a uniform dimple not over 1/32 inch deep.

Wallboard:
Single-Layer: Apply single layer of 5/8 inch fire-rated gypsum wallboard to studs with 1 inch screws spaced 12 inches o.c. in field and along the edges.

Install control joints in wallboard face 30 feet o.c. maximum.

Install water resistant wallboard and tile backer board as specified for single layer wallboard, Article 3.02, L and 3.03.

Sealant: Seal shaft walls with acoustical sealant specified wherever the wall is enclosing shafts where positive or negative air pressure exists. Seal perimeter of wall and at any other place where voids create the possibility of moving air causing dust accumulation, noise or smoke leakage.

Framing for Openings: Frame doors, borrowed lights and duct opening with "J" track use adequate structural support for opening over 48 inches wide. For openings up to 48 inches wide, use vertical "J" track on either side of opening. For head and sill of openings, place "J" tack horizontally across openings. Cut "J" track 12 inches longer than openings. Then cut flanges and fold track to nest over "J" track and fasten webs of flanges with two 3/8 inch Type "S" or 1/2 inch. Type "S-12" pan head screws per connection, when nesting "J" track to "J" track so it will fit over vertical "J" track.

Provide 5/8 inch gypsum dry wall splays on top of exposed floor beams and on ledge at foundation wall top and on sides of new elevator shafts. Securely anchor in place.

Install access panels where shown on the Drawings. Refer to Section 08305 - Access Doors. Also install all other access panels in gypsum dry wall partitions and ceilings, furnished by mechanical and electrical contractors requiring them.

JOINT TREATMENT AND FINISHING

Mix joint treatment compounds according to manufacturer's printed directions and applied as follows:

Fill all "V" grooves formed by abutting beveled or eased radial edges of wallboard flush with plane of taper with pre-fill compound. Wipe clean excess compound beyond the "V" groove, leaving a flat joint for taping.

If joints have been formed by beveled or eased radial edges, allow pre-fill compound to harden. Apply a thin uniform layer of taping compound to all joints and angles to be reinforced. Apply reinforcing tape immediately, centered over joint, seated into compound. Follow immediately with a skim coat and this coat is to not function as a fill or second coat. Fold tape and embed in all angles to provide a true angle.

After taping compound has hardened, apply topping compound, filling board taper flush with surface. Apply fill coat to cover tape and feather out slightly beyond taper. On joints with no taper, apply fill coat to cover tape and feather out at least 4 inches on either side of tape. No fill coat is necessary on interior angles.

After topping compound is dry, spread a finishing coat of topping compound evenly over and extending slightly beyond fill coat on all joints and feathered to a smooth, uniform finish. Over tapered edges, do not allow finished joint to protrude beyond plane of surface. To all taped angles apply a finish coat to cover tape and taping compound, and provide a true angle. Where necessary, sand between coats and after final application of compound to provide a smooth surface, ready for painting or papering.

Apply taping compound to all fastener depressions, followed, when hardened, by at least two (2) coats of topping compound, leaving all depressions level with plane of surface.
Apply taping compound to all bead and trim and feather out from ground to plane of surface. When hardened, followed this by two (2) coats of topping compound applied separately and allow to dry between coats. Extend each coat slightly beyond previous coat. Feather the finish coat from ground to plane of surface and sanded as necessary to provide flat, smooth surface ready for decoration.

Apply minimum 6 inch long piece of tape diagonally across and above each corner of door openings and other openings, on both sides of the opening. Finish over tape as above.

Finish wall joints above ceilings as specified above in "1. & 2.", including one coat finishing of all fasteners. Also finish in accordance with the U.L. Design No's. shown or noted on the Drawings for fire-rated construction.

Do not apply fill and finish coats to wall joints above ceilings unless noted or specified otherwise.

CLEANING AND PROTECTION

Take precautions to minimize spattering of joint treatment compounds and other materials on other work. Remove all joint treatment compounds promptly from doors, frames, glass and all other finishes and surfaces that could be stained or marred by these materials. Clean floors of all gypsum wallboard materials and treatment compounds upon completion of the gypsum wallboard work. At completion of work, remove all unused materials, scraps, containers and equipment. Remove all dust accumulated during finishing operations, leave areas broom clean, ready for painting, wall covering, ceramic tile or other finishes.

Provide temporary protection of finish surfaces in areas of high traffic and susceptible to damage from work of others. Maintain protection throughout the construction period so that the work will be without damage or deterioration at the time of substantial completion. Repair or replace any damaged work at no additional cost to the Owner. Remove temporary protection at completion work or when required for completion of other work.

END SECTION

SECTION 09 80 00
ACOUSTICAL CEILINGS AND SUSPENSION SYSTEMS

PART 1 GENERAL

WORK INCLUDED
Acoustical panels and suspension systems as shown on the Drawings and specified herein.

RELATED WORK
Section 01 – General Conditions of Contract
Section 07 90 00 – Sealants

QUALITY ASSURANCE
General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."

Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS
Submit the following in accordance with General Conditions of Contract:

Manufacturer's Literature: Materials description and installation and maintenance instructions, including inserts into concrete planks.

Shop Drawings: Layout and details of acoustical ceilings. Show locations of all items that are to be coordinated with, located in or supported by the ceilings.

Samples: Three (3) full size acoustical units for each type of unit and three (3) 1 ft.-0 inch lengths of each suspension system component with manufacturer's standard color selections.

DELIVERY, STORAGE AND HANDLING

Deliver unopened materials to the project site in manufacturer’s unopened containers, clearly indicating manufacturer's name, brand, type, style, size, color, texture and other identifying information.

Store materials in a dry location, off the ground and in a manner to prevent damage, deterioration and intrusion of foreign matter. Replace materials that have been damaged or are otherwise unsuitable. When ascertained, immediately remove all damaged or otherwise unsuitable material from the job site.

PROJECT/SITE CONDITIONS
Environmental Requirements: Do not install acoustical ceilings until space has been enclosed and is weathertight, and until wet work in the space has been completed and is nominally dry, and until work above ceilings has been completed, and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

Sequencing: Coordinate with the work of all trades above the ceiling and penetrating or supported by it. Do not start work until all appropriate work above the ceiling is complete.

Coordination: Coordinate with Electrical, HVAC and Fire Protection Trades to ensure edge configuration of light fixture, air diffusers and sprinkler heads to penetrate or to lay in ceilings are proper for the system and provide system layout that accommodates lighting pattern.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS
United States Gypsum, Chicago, IL 60606.
Armstrong World Industries, Inc., Des Plaines, IL 60018.
The Celotex Corporation, Tampa, FL 33622.
Chicago Metallic, Chicago, IL 60638.

CEILING PANELS
Type 1: Acoustical Panels (24 inch x 24 inch, Lay-in): Mineral Fiber Acoustical Panels; nominal 24 inch x 24 inch units not less than 5/8 inch thick, with square edges, factory-applied washable white finish and flame spread not greater than 25, USG Radar Panels, as manufactured by United States Gypsum, or comparable products of Celotex or Armstrong, as approved by the Architect.

CEILING SUSPENSION SYSTEM MATERIALS
General: Comply with ASTM C 635 intermediate duty and heavy duty, as applicable to the type of suspension system required for the type of ceiling units indicated. Coordinate with other work supported by or penetrating through the ceiling, including light fixtures, HVAC equipment sprinklers and partition system.

Attachment Devices: Size for 5 times the design load indicated in ASTM C 635, Table 1, direct hung. Coordinate types of devices compatible with floor construction.

Hanger Wires: Galvanized carbon steel, ASTM A 641, soft tempered, pre-stretched, yield-stress load of at least three (3) times design load, but not less than No. 12 gauge (0.016 inch).

Edge Molding: Zinc-coated steel or aluminum, configurations shown on the Drawings, or if not shown manufacturer's standard for system with baked enamel finish to match suspension systems.

Exposed Grid Suspension Systems (24 inch x 24 inch, lay-in): Direct hung, intermediate duty, double web, snap grid, exposed main runners, cross runners and accessories, with exposed cross runners and wall trim coped to lay flush with main runners with factory applied baked enamel (white) finish, one of the following: Donn DX (USG)

Cold-Rolled Intermediate Support Channels: 1-1/2 inch, minimum 475 lbs. per 1000 lin. ft.

PART 3 EXECUTION

INSPECTION
Examine all surfaces to receive the parts of the work specified herein. Verify all dimensions of in-place and subsequent construction. Application or installation of materials constitutes acceptance of the supporting construction.

INSTALLATION OF MECHANICAL GRID SUSPENSION SYSTEM
Install suspension system in accordance with ASTM C 636 and current AIMA recommended procedures.

System Installation: Unless otherwise shown on the Drawings or required by the systems manufacturer's printed installation instructions, install hangers 4 ft. o.c. in rows 4 ft. apart. Furnishing inserts and support framing and directing placement of inserts and framing is the responsibility of the acoustical ceilings installer. Where

supporting construction is steel, wrap the wire hanger around or through the steel member or attach by other secure methods. Wrap hanger around carrying channel, or if directly suspended, insert through hole in main tee and secure hanger with at least three (3) turns around itself.. Coordinate spacing of hangers, carrying channels, runners, and molding with the location of electrical fixtures and other items occurring in or on ceilings. Provide additional hangers at corners of light fixtures at midpoint of cross tees adjacent to light fixtures and duct outlets and adjacent to main tee splices. Install edge trim moldings where indicated on the Drawings and elsewhere as needed to conceal edges of acoustical units which would otherwise be exposed to view after completion of the work.

INSTALLATION OF PANELS

Install acoustical panels in coordination with suspension system with edges concealed by support of suspension members and faces flush with grid webs. Arrange acoustical units and orient directionally patterned units in the configurations shown on the reflected ceiling plans and as directed by the Architect.

Scribe or cut panels to fit accurately at penetrations.

Use procedures that will minimize damage or soiling of the units during installation. Replace units that are damaged or cannot be adequately cleaned, as directed by the Architect at no additional cost to the Owner.

Provide ceiling panel manufacturer's standard hold-down (retention) clips where shown or noted on the Drawings, or where required by conditions of the installation.

CLEANING AND PROTECTION

Upon completion of the Work remove all unused materials, debris, containers and equipment form the project site. Clean and repair floors, walls and other surfaces that have been stained, marred or otherwise damaged by work under this Section.

Protect acoustical ceilings during the construction period so that they will be without any indication of deterioration or damage at the time of acceptance by Owner.

END SECTION

SECTION 09 90 00
PAINTING

PART 1 GENERAL

WORK INCLUDED
Painting, coatings and finishing as shown on the Drawings and specified herein, including but not necessarily limited to the following:

Painting and finishing of exterior and interior exposed items and surfaces as specified herein and scheduled and noted on the Drawings.

Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under other Sections, except as otherwise specified.

"Paint" as used herein means all coating system materials, including primers, emulsions, enamels, sealers and fillers and other applied materials whether used as prime, intermediate or finish coats.

Paint all exposed surfaces except where the natural finish of the material is obviously intended and specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these the same as adjacent similar materials or areas.

Painting required on the job, including patch painting for Mechanical and Electrical Trades.

RELATED WORK
DSF General Conditions of Contract
Section 08 11 00 - Hollow Steel Doors and Frames
Section 08 70 00 - Finish Hardware

PAINTING NOT INCLUDED
General: The following categories of work are not included as part of the painter applied finish work or are included in other Sections of these Specifications, unless otherwise shown or specified.

Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under the various Sections for structural steel, metal fabrications, ornamental metal fabrications, hollow metal work and similar items.

Pre-Finished Items: Unless otherwise indicated, do not include painting when factory finishing or installer finishing is specified for such items as (but not limited to) toilet enclosures, acoustic materials and casework.

Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings and in concealed areas and inaccessible areas, furred areas, spaces and duct shafts.

Finished Metal Surfaces: Metal surfaces of anodized aluminum, aluminum paint finish system, stainless steel, chromium-plated, copper, bronze and similar finished materials will not required finish painting, except as otherwise indicated.

Operating Parts and Labels: Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated. Do not paint over any code required labels, such as UL name or nomenclature plates.

QUALITY ASSURANCE

Provide all materials used on this part of the Work as hereinafter specified. No claims as to the suitability of any materials specified, or the applicator's inability to produce first class finishes with these materials will be considered unless such claims are made in writing prior to the start of the painting work.

REFERENCES
Titles, designations, dates of issue or revisions of reference standards are those in effect on the date of this Specification Project Manual, unless otherwise specified herein.

SUBMITTALS
Submit the following in accordance with General Conditions of Contract.

Manufacturer's Literature: Materials description, installation and maintenance instructions for each type of paint.

Samples: Architect/Engineer's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor. Provide a listing of the material and application for each coat of each finished sample, include color sample chips from manufacturer.

Prior to beginning painting work, Contractor will be furnished sample color chips and copies of Color Schedule for all surfaces to be painted. The Architect/Engineer will select colors.

On each actual wall surface, ceiling and other building components of each paint system. On at least 100 sq. ft. of surface as directed, provide full coat finish samples of required sheen, color and texture. Simulate finished lighting conditions for review of in-place work.

DELIVERY, STORAGE AND HANDLING
Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label.

Provide labels on each container with the following information:
Name of title of material
Manufacturer's stock number
Manufacturer's name
Contents by volume, for major pigment and vehicle constituents
Thinning instructions
Application instructions

PROJECT/SITE CONDITIONS
Existing Conditions:Starting of painting work will constitute the applicator's acceptance of the surfaces and conditions within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces or conditions otherwise detrimental to the formation of a durable paint film.

Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damages by cleaning, repairing or replacing and repainting.

Provide "Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

During the progress of the work, remove from the project daily all discarded paint materials, rubbish, cans and rags.

Upon completion of painting work, clean all window glass and other paint spattered surface. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

PART 2 PRODUCTS

COLORS AND FINISHES

Prior to beginning of work, sample color chips for surfaces to be painted will be furnished by the Architect/Engineer. Match the colors of the chips and submit samples to the Architect/Engineer as specified herein, before proceeding with the work.

Final acceptance of colors will be from samples applied on the job.

Proprietary names used to designate colors or materials are not intended to imply that products of the manufacturers are required to the exclusion of equivalent products of other named manufacturers, but the Architect/Engineer is to be informed in writing of all manufacturers and materials used on the job for various colors and finishes.

PAINT COORDINATION

Provide finish coats which are compatible with prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Upon request from other trades, furnish information on characteristics of specified finish materials, to ensure compatible prime coats as used. Provide barrier coats over incompatible primers or remove and reprime as required for specified finish coat.

PAINT MATERIALS

Provide the best quality grade of the various types of coatings as regularly manufactured by approved paint materials manufacturers. Materials not displaying the manufacturer's identification as a well known standard, best grade product will not be acceptable.

Provide undercoat paint compatible with and produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer and use only within recommended limits.

Provide paint manufactured by: Sherwin Williams, or approved equal.

Refer to the Paint Schedule at the end of this Section and building exterior, interior elevations and schedules on the Drawings.

PART 3 EXECUTION

SURFACE PREPARATION

General: Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified for each particular substrate condition.

Remove all 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. Remove, if necessary, for the complete painting of the items and adjacent surfaces.

Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning. Program the cleaning and painting so that contaminants from the cleaning process will not fall onto wet newly painted surfaces.

Cementitious Materials: Prepare cementitious surfaces to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils and by roughening as required to remove glaze. Determine the alkalinity and moisture content of the surface to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition before application of paint. Do not paint over surfaces where the moisture content exceeds that permitted in manufacturer's printed directions.

Wood: Clean wood surfaces to be painted of all dirt, oil or other foreign substance with scrapers, mineral spirits and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other paint manufacturer approved sealer, before application of the priming coat. After priming fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

Prime, stain or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, face, undersides and backsides of such wood. When transparent finish is required, use spar varnish for back priming.

Seal tops and bottoms of wood door with a heavy coat of varnish or equivalent sealer immediately upon delivery to the job.

Ferrous Metals: Clean ferrous surfaces that are not galvanized or shop coated of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning. Touch up shop applied prime coats wherever damaged or bare, where required by other Sections of these Specifications. Clean and touch up with the same type shop primer.

Galvanized Metal: Clean free of all oil and other surface contaminants with a non-petroleum base solvent recommended by paint manufacturer.

MATERIALS PREPARATION

Mix and prepare painting materials in accordance with manufacturer's directions.

Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

Stir materials before application to produce a mixture of uniform density and stir as required during the application of the materials. Do not stir surface film into the material. Remove the film and, if necessary, strain the material before using.

PAINT APPLICATION

Apply paint in accordance with the manufacturer's directions; use applicators and techniques best suited for the type of material being applied.

Apply additional coats when undercoats, stains or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind permanently fixed equipment of furniture with prime coat only.

Paint interior surfaces of ducts, where visible through registers or grilles with a flat, non-specular black paint.

Finish exterior doors on tops, bottoms, and side edges same as exterior faces, unless otherwise indicated.

Sand lightly between each succeeding enamel or varnish coat.

Omit first coat (primer) on metal surfaces that have been shop-primed and touch-up painted, unless otherwise indicated.
Prime all surfaces to receive vinyl, fabric, paper wall and other types of wall coverings, unless otherwise indicated.

Application Restrictions:
Do not apply water base paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 50 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.
Do not apply solvent thinned paints when the temperature of surfaces to be painted and the surrounding air temperatures are below 45 degrees F., unless otherwise permitted by the paint manufacturer's printed instructions.
Do not apply paint in snow, rain, fog or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the paint manufacturer's printed instructions. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified by the paint manufacturer during application of drying periods.

Minimum Coating Thickness: Provide the following minimum coating thicknesses unless herein noted otherwise:
Apply each material at not less than the manufacturer's recommended spreading rate to provide a total dry film thickness of not less than 3 mils for the entire coating system of prime and finish coats of 3 coat work.
Provide a total dry film thickness of not less than 2 mils for the entire coating system of prime and finish coat for 2 coat work.

Prime Coats:
Apply a prime coat to material which is required to be painted or finished and which has not been prime coated by others.
Re-coat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.
Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks or other surface imperfections.
Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.
Completed Work: Match reviewed samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.
Transparent (Clear) Finishes: Use multiple coats to produce glass smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes or other surface imperfections.

PAINT SCHEDULE
Exposed Structural Steel, Lintels, etc:

a. Touch-up primer coat with compatible primer
b. Intermediate Coat: Epoxy-Polyamide Coating, Series 66 Hi-Build Epoxoline (No Substitutions), Tnemec Company, Inc.

c. Finish Coat: High-Build Acrylic Polyurethane Enamel, Series 73 Endura-Shield III Semi-Gloss (No substitutions), Tnemec Company, Inc. One non-standard (custom) color for all fabrications.

Gypsum Wallboard (all other rooms):

a. One (1) coat
   1) P & L: Silver PVA Wall Primer
   2) Moore: Moorcraft Vinyl Latex Primer Sealer
   3) S-W: ProMar 400 Interior Latex wall Primer
b. Two (2) coats, latex fat wall paint, one of the following:
   1) P & L Pro-Hide Silver Latex Flat
   2) Moore: Moorcraft Vinyl Latex Flat
   3) S-W: ProMar 400 Interior Latex Flat

Metal Doors and metal door Frames:

a. One (1) coat, acrylic / latex primer, one of the following:
   1) P & L: Supreme 1 Acrylic Primer
   2) Moore: Moorecraft Vinyl Latex Enamel Underbody
   3) S-W: ProMar Classic Interior Latex Primer
b. Two (2) coats, latex semi-gloss paint, one of the following:
   1) P & L: Pro-Hide Silver Latex Semi-Gloss
   2) Moore: Moorcraft Latex Semi-Gloss
   3) S-W: ProMar 400 Interior Latex Semi-Glo

4. Concrete Block and Concrete:
   a. One (1) coat, P & L Primafil 200
   b. Two (2) coats, P & L Vitralite Enamel-Eggshell
5. Concrete Block (Scheduled for Epoxy):
   a. One (1) coat, P & L Primafil 200
   b. Two (2) coats, P & L Palgard Epoxy Coating Satin
6. Cedar Siding:
   a. One (1) coat, Sherwin Williams, A100 Block staining primer.
   b. Two (2)coats, Sherwin Williams, Solid Color Promar Stain Alkyd Base.

CLEAN UP

A. Just prior to final completion and acceptance, examine all painted and finished surfaces and retouch or refinish as necessary and required, to leave all surfaces in perfect condition.

B. Upon completion of work, remove all paint and finishing spots and overspray from floors, glass and other surfaces. Remove all rubbish, containers and accumulated material of whatever nature not caused by other trades from the project site and level work in a clean, orderly and acceptable condition.

END SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Continuity of Existing Services
- Protection of Finished Surfaces
- Sleeves and Openings
- Sealing and Firestopping
- Equipment Furnished By Others
- Submittals
- Off Site Storage
- Request and Certification for Payment
- Certificates and Inspections
- Operating and Maintenance Data
- Record Drawings

PART 2 - PRODUCTS
- Access Panels and Doors
- Identification
- Sealing and Firestopping

PART 3 - EXECUTION
- Demolition
- Excavation and Backfill
- Concrete Work
- Cutting and Patching
- Building Access
- Equipment Access
- Coordination
- Identification
- Lubrication
- Sleeves
- Sealing and Firestopping
- Agency Training

RELATED WORK
Section 01 91 01 – Commissioning Process
Section 23 05 13 - Common Motor Requirements for HVAC.
Section 23 33 00 - Air Duct Accessories.

REFERENCE
Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS
Abbreviations of standards organizations referenced in other sections are as follows:

AABC	Associated Air Balance Council
ABMA	American Boiler Manufacturers Association
ADC	Air Diffusion Council
AGA	American Gas Association
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
CGA	Compressed Gas Association
CTI	Cooling Tower Institute
EPA	Environmental Protection Agency
GAMA	Gas Appliance Manufacturers Association
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
MCA	Mechanical Contractors Association
MICA	Midwest Insulation Contractors Association
MSS	Manufacturer's Standardization Society of the Valve & Fitting Industry, Inc.
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association. Inc.
UL	Underwriters Laboratories Inc.
ASTM E814	Standard Test Method for Fire Tests of Through-Penetration Fire Stops
ASTM E84	Standard Test Method for Surface Burning Characteristics of Building Materials
UL1479	Fire Tests of Through-Penetration Firestops
UL723	Surface Burning Characteristics of Building Materials

QUALITY ASSURANCE

Refer to Division 1, General Conditions, Equals and Substitutions.

Where equipment or accessories are used which differ in arrangement, configuration, dimensions, ratings, or engineering parameters from those indicated on the contract documents, the contractor is responsible for all costs involved in integrating the equipment or accessories into the system and for obtaining the performance from the system into which these items are placed. This may include changes found necessary during the testing, adjusting, and balancing phase of the project.

PROTECTION OF FINISHED SURFACES

Refer to Division 1, General Requirements, Protection of Finished Surfaces.

Furnish one can of touch-up paint for each different color factory finish which is to be the final finished surface of the product. Deliver touch-up paint with other "loose and detachable parts" as covered in the General Requirements.

SLEEVES AND OPENINGS

Refer to Division 1, General Requirements, Sleeves and Openings.

SEALING AND 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.

SUBMITTALS

Refer to Division 1, General Conditions, Submittals.

Submit for all equipment and systems as indicated in the respective specification sections, marking each submittal with that specification section number. Mark general catalog sheets and drawings to indicate specific items being submitted and proper identification of equipment by name and/or number, as indicated in the contract documents.

Before submitting electrically powered equipment, verify that the electrical power and control requirements for the equipment are in agreement with the motor starter schedule on the electrical drawings. Include a statement on the shop drawing transmittal to the architect/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
- Division of State Facilities 1 copy
- A/E 1 copy

Not more than two weeks after award of contract but before any shop drawings are submittal, the contractor shall submit the following piping system data sheet for each piping service on the project. The approved piping system data sheet(s) will be made available to the DSF Project Representative for their use on this project.

Item	Pipe Size	[List each piping service]	Remarks
Pipe	2" & smaller		
	2.5" - 4"		
	5" & larger		
Fittings	2" & smaller		
	2.5" & larger		
Nipples			
Branch takeoffs	2" & smaller		
D=main, d=branch	2.5" & larger		
Gate valves	2" & smaller		
	2.5" & larger		
Ball valves	2" & smaller		
Hangers	Type, mfr & figure no.		
Hanger accessories			
Pipe identification			
List of specialties and accessories:			

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

OFF SITE STORAGE

Prior approval by DSF and the A/E will be needed. The contractor shall submit Storage Agreement Form AD-BDC-74 to DSF for consideration of off site materials storage.

Generally, ductwork, metal for making ductwork, duct lining, sleeves, pipe/pipe fittings and similar rough-in material will not be accepted for off site storage. For material that can be stored off site, no material will be accepted for off site storage unless shop drawings for that material have been approved.

REQUEST AND CERTIFICATION FOR PAYMENT

Within 10 days after Notice to Proceed, the successful bidder will submit to the DSF Project Representative in a form prescribed below and by the General Conditions of the Contract - Scheduling and Coordination of Work, Reports, Records and Data, Payments to Contractor, a cost breakdown of the proposed values for work performed which, if approved by DSF, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

In addition, if payment is requested for approved off-site stored material, then that material shall be listed as a line item in the request and certification for payment cost breakdown.

CERTIFICATES AND INSPECTIONS

Refer also to Division 1, General Conditions, Permits, Regulations, Utilities and Taxes.

Obtain and pay for all required State installation inspections except those provided by the Architect/Engineer in accordance with Wis Adm Code Section ILHR 50.12. Deliver originals of these certificates to the Division Project Representative. Include copies of the certificates in the Operating and Maintenance Instructions.

OPERATING AND MAINTENANCE INSTRUCTIONS

Refer to Division 1, General 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
- Temperature control record drawings and control sequences
- Parts lists for manufactured equipment
- Valve schedules
- Lubrication instructions, including list/frequency of lubrication done during construction
- Warranties
- Additional information as indicated in the technical specification sections

TRAINING OF OWNER PERSONNEL

Instruct user agency personnel in the proper operation and maintenance of systems and equipment provided as part of this project; video tape all training sessions. Include not less than _4___ hours of instruction, using the Operating and Maintenance manuals during this instruction. Demonstrate startup and shutdown procedures for all equipment. All training to be during normal working hours.

RECORD DRAWINGS

Refer to Division 1, General Requirements, Record Drawings.

In addition to the data indicated in the General Requirements, maintain temperature control record drawings on originals prepared by the installing contractor/subcontractor. Include copies of these record drawings with the Operating and Maintenance manuals.

P A R T 2 - P R O D U C T S

ACCESS PANELS AND DOORS

LAY-IN CEILINGS:

Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration provided under Section 09500 are sufficient; no additional access provisions are required unless specifically indicated.

IDENTIFICATION

STENCILS:

Not less than 1 inch high letters/numbers for marking pipe and equipment.

SNAP-ON PIPE MARKERS:

Cylindrical self-coiling plastic sheet that snaps over piping insulation and is held tightly in place without the use of adhesive, tape or straps. Not less than 1 inch high letters/numbers and flow direction arrows for piping marking. W. H. Brady, Seton, Marking Services, or equal.

ENGRAVED NAME PLATES:

White letters on a black background, 1/16 inch thick plastic laminate, beveled edges, screw mounting, Setonply Style 2060 by Seton Name Plate Company or Emedolite- Style EIP by EMED Co., or equal by Marking Services, or W. H. Brady.

VALVE TAGS:

Round brass tags with 1/2 inch numbers, 1/4 inch system identification abbreviation, 1-1/4 inch minimum diameter, with brass jack chains or brass "S" hooks around the valve stem, available from EMED Co., Seton Name Plate Company, Marking Services, or W. H. Brady.

SEALING AND FIRESTOPPING

FIRE AND/OR SMOKE RATED PENETRATIONS:

Manufacturers:

3M, Hilti, Rectorseal, STI/SpecSeal, Tremco, or approved equal.

All firestopping systems shall be provided by the same manufacturer.

Submittals:
Contractor shall submit product data for each firestop system. Submittals shall include product characteristics, performance and limitation criteria, test data, MSDS sheets, installation details and procedures for each method of installation applicable to this project. For non-standard conditions where no UL tested system exists, submit manufacturer's drawings for UL system with known performance for which an engineering judgement can be based upon.

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 partitions, floors and exterior walls above grade, use urethane caulk in annular space between pipe insulation and sleeve. For non-rated drywall, plaster or wood partitions where sleeve is not required use urethane caulk in annular space between pipe insulation and wall material.

Duct Penetrations:
Annular space between duct (with or without insulation) and the non-rated partition or floor opening shall not be larger than 2". Where existing openings have an annular space larger than 2", the space shall be patched to match existing construction to within 2" around the duct.

Where shown or specified, pack annular space with fiberglass batt insulation or mineral wool insulation. Provide 4" sheet metal escutcheon around duct on both sides of partition or floor to cover annular space.

P A R T 3 - E X E C U T I O N

DEMOLITION
Perform all demolition as indicated on the drawings to accomplish new work. Where demolition work is to be performed adjacent to existing work that remains in an occupied area, construct temporary dust partition to minimize the amount of contamination of the occupied space. Where pipe or duct is removed and not reconnected with new work, cap ends of existing services as if they were new work. Coordinate work with the user agency to minimize disruption to the existing building occupants.

All pipe, wiring and associated conduit, insulation, ductwork, and similar items demolished, abandoned, or deactivated are to be removed from the site by the Contractor. All piping and ductwork specialties are to be removed from the site by the Contractor unless they are dismantled and removed or stored by the user agency. All designated equipment is to be turned over to the user agency for their use at a place and time so designated. Maintain the condition of material and/or equipment that is indicated to be reused equal to that existing before work began.

CONCRETE WORK
All cast-in-place concrete will be performed by the Division 3 Contractor unless otherwise noted. Provide all layout drawings, anchor bolts, metal shapes, and/or templates required to be cast into concrete or used to form concrete for support of mechanical 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 and service. 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. Access doors in general construction are to be furnished by the Mechanical Contractor and installed by the General Contractor.

Provide color coded thumb tacks or screws, depending on the surface, for use in accessible ceilings which do not require access panels.

COORDINATION

Verify that all devices are compatible for the surfaces on which they will be used. This includes, but is not limited to, diffusers, register, grilles, and recessed or semi-recessed heating and/or cooling terminal units installed in/on architectural surfaces.

Coordinate all work with other contractors prior to installation. Any installed work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

Cooperate with the test and balance agency in ensuring Section 23 05 93 specification compliance. Verify system completion to the test and balance agency (flushing, pressure testing, chemical treatment, filling of liquid systems, proper pressurization and air venting of hydronic systems, clean filters, clean strainers, duct and pipe systems cleaned, controls adjusted and calibrated, controls cycled through their sequences, etc.), ready for testing, adjusting and balancing work. Install dampers, shutoff and balancing valves, flow measuring devices, gauges, temperature controls, etc., required for functional and balanced systems. Demonstrate the starting, interlocking and control features of each system so the test and balance agency can perform its work.

IDENTIFICATION

Identify equipment in mechanical equipment rooms by stenciling equipment number and service with one coat of black enamel against a light background or white enamel against a dark background. Use a primer where necessary for proper paint adhesion. Do not label equipment such as cabinet heaters and ceiling fans in occupied spaces.

Where stenciling is not appropriate for equipment identification, engraved name plates may be used.

Identify piping not less than once every 30 feet, not less than once in each room, adjacent to each access door or panel, and on both side of the partition where exposed piping passes through walls, floors or roofs. Place flow directional arrows at each pipe identification location. Use one coat of black enamel against a light background or white enamel against a dark background for stenciling, or provide snap-on pipe markers as specified in Part 2 – Products.

Identify valves with brass tags bearing a system identification and a valve sequence number. Valve tags are not required at a terminal device unless the valves are greater than ten feet from the device or located in another room not visible from the terminal unit. Provide a typewritten valve schedule indicating the valve number and the equipment or areas supplied by each valve; locate schedules in each mechanical room and in each Operating and Maintenance manual. Schedules in mechanical rooms to be framed under clear plastic.

Use engraved name plates to identify control equipment.

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 DSF. 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

PIPE SLEEVES:

Provide galvanized sheet metal sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall.

Pipe sleeves are not required in interior non-rated drywall, plaster or wood partitions and sleeves are not required in existing poured concrete walls where penetrations are core drilled.

Pipe sleeves in new poured concrete construction shall be schedule 40 steel pipe (sized to allow insulated pipe to run through sleeve), cast in place.

Extend the top of sleeve 1 inch above the adjacent floor in piping floor penetrations located in the mechanical rooms and wet locations listed below. In finished areas sleeves shall be flush with rough floor.

DUCT SLEEVES:
Duct sleeves are not required in non-rated partitions or floors.

Provide sleeve required for fire dampers in fire-rated partitions and floors. Reference fire damper details on drawings.

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 and exterior walls, pipe penetrations are required to be sealed. Apply sealant to both sides of the penetration in such a manner that the annular space between the pipe sleeve or cored opening and the pipe or insulation is completely blocked.

Duct penetrations through non-rated partitions shall require sheet metal escutcheons with fiberglass or mineral wool insulation fill for spaces that include laboratories, clean rooms, animal rooms, kitchens, cart wash rooms, janitor closets, cart wash rooms, toilet rooms, mechanical rooms, conference rooms, private consultation rooms, and where noted on drawings elsewhere.

AGENCY TRAINING
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01.

END OF SECTION

SECTION 23 05 23
GENERAL-DUTY VALVES FOR HVAC PIPING
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

PART 1 - GENERAL

SCOPE
This section includes valve specifications for all HVAC systems except where indicated under Related Work. Included are the following topics:

RELATED WORK
Section 01 91 01 – Commissioning Process
Section 23 05 15 - Piping Specialties
Section 23 09 14 - Pneumatic and Electric Instrumentation and Control Devices for HVAC

REFERENCE
Applicable provisions of Division 1 govern work under this section.

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS
Refer to division 1, General Conditions, Submittals.

Contractors shall submit a schedule of all valves indicating type of service, dimensions, materials of construction, and pressure/temperature ratings for all valves to be used on the project. Temperature ratings specified are for continuous operation.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
Where valves are specified for individual mechanical services (i.e. hot water heating, steam, etc.) all valves shall be of the same manufacturer unless prior written approval is obtained from DSF.

P A R T 2 - P R O D U C T S

MANUFACTURERS
Anvil, Armstrong, Bell & Gossett, Cash-Acme, Consolidated, Conval, Crane, Crosby, DeZurik, Durco, Fisher, Grinnell, Griswald, Hammond, Hancock, Hoffman, Illinois, Jamesbury, Keystone, Kunkle, Leslie, Lunkenheimer, Metraflex, Milwaukee, Mission, Mueller, Newco, Nexus, Nibco, Powell, RP&C, Sarco, Spence, Stockham, Taco, Tasco, Thrush-Amtrol, Vogt, Watts, or approved equal.

BYPASS VALVES
A bypass gate valve is required on main steam shutoff valves 4 inch and larger on steam pressures greater than 15 psig for supervised warmup.

NATURAL GAS SYSTEMS
SHUT OFF VALVES:
2" and smaller: Ball valve, bronze body, threaded ends, 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.

DeZurik, Homestead, Rockwell, Walworth.

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.

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 temperature control valves.

Install all valves with the stem in the upright position. Valves may be installed with the stem in the horizontal position only where space limitations do not allow installation in an upright position or where large valves are provided with chain wheel operators. Where valves 2-1/2" and larger are located more than 12'-0" above mechanical room floors, install valve with stem in the horizontal position and provide a chain wheel operator. Valves installed with the stems down, will not be accepted.

Install stem extensions when shipped loose from valve.

Prior to flushing of piping systems, place all valves in the full-open position.

SHUT-OFF VALVES
Install shut-off valves at all equipment, at each branch take-off from mains, and at each automatic valve for isolation or repair.

GAS PRESSURE REGULATORS
When the gas pressure regulator is equipped with a vent connection, run a connection size vent to outside air in accordance with codes. Use a larger size vent when required by the manufacturer's installation instructions.

END OF SECTION

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE

This sections includes specifications for supports of all HVAC equipment and materials as well as piping system anchors. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Description
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- Pipe Hanger and Support Manufacturers
- Structural Supports
- Pipe Hangers and Supports
- Pipe Penetration through Roof

PART 3 - EXECUTION
- Installation
- Hanger and Support Spacing
- Vertical Riser Clamps
- Concrete Inserts and Continuous Insert Channels
- Anchors
- Equipment Stands
- Pipe Penetration through Roof

RELATED WORK

Section 01 91 01 – Commissioning Process
Section 23 07 00 - HVAC Insulation

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 equipment and materials. All supports and installation procedures are to conform to the latest requirements of the ANSI Code for pressure piping.

Do not hang any mechanical item directly from a metal deck or run piping so it rests on the bottom chord of any truss or joist.

Support apparatus and material under all conditions of operation, variations in installed and operating weight of equipment and piping, to prevent excess stress, and allow for proper expansion and contraction.

Protect insulation at all hanger points; see Related Work above.

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Schedule of all hanger and support devices indicating shields, attachment methods, and type of device for each pipe size and type of service. Reference section 23 05 00.

DESIGN CRITERIA

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

Piping connected to base mounted pumps, compressors, or other rotating or reciprocating equipment is to have vibration isolation supports for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Standard pipe hangers/supports as specified in this section are required beyond the 100 pipe diameter/3 support distance.

Piping flexible connections and vibration isolation supports are required for piping connected to coils that are in a fan assembly where the entire assembly is mounted on vibration supports; the vibration isolation supports are required for a distance of one hundred pipe diameters or three supports away from the equipment, whichever is greater. Piping flexible connection and vibration isolation supports are not required when the fan section is separately and independently isolated by means of vibration supports and duct flexible connections. Standard pipe hangers/supports as specified in this section are required when there are no vibration isolation devices in the piping and beyond the 100 pipe diameter/3 support distance.

Piping supported by laying on the bottom chord of joists or trusses will not be accepted.

Fasteners depending on soft lead for holding power or requiring powder actuation will not be accepted.

Allow sufficient space between adjacent pipes and ducts for insulation, valve operation, routine maintenance, etc.

P A R T 2 - P R O D U C T S

PIPE HANGER AND SUPPORT MANUFACTURERS

B-Line, Fee and Mason, Grinnell, Kindorf, Michigan Hanger, Unistrut, or approved equal. Grinnell 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

Until this section gets revised, the consultant will have to insert roller hangers for use on hot piping (LPS, HPS and any other service with a fluid temperature over 220°F) and insulation protection shields for use between a hanger and insulation.

HANGERS FOR STEEL PIPE SIZES 1/2" THROUGH 2":
Carbon steel, adjustable, clevis, black finish. Grinnell figure 65 or 260.

STEEL HANGER RODS:
Threaded both ends, threaded one end, or continuous threaded, black finish.

Size rods for individual hangers and trapeze support as indicated in the following schedule.

Total weight of equipment, including valves, fittings, pipe, pipe content, and insulation, are not to exceed the limits indicated.

Maximum Load (Lbs.) (650°F Maximum Temp.)	Rod Diameter (inches)
610	3/8
1130	1/2
1810	5/8
2710	3/4
3770	7/8
4960	1
8000	1-1/4

Provide rods complete with adjusting and lock nuts.

PIPE PENETRATION THROUGH ROOF

Manufacturers: Custom Curb, Pate, Roof Products and Systems, ThyCurb, Vent Products.

Curb assembly constructed of not less than 18 gauge galvanized steel reinforced so it is structurally capable of supporting the intended load, inside and outside corner sections that are mitered and continuously welded, filled with 3 pound density insulation, integral deck mounting flange, nominal two inch wood nailer, laminated acrylic clad thermoplastic cover with graduated step boots to accommodate various size pipes, fastening screws for cover, and stainless steel clamps for securing boots around the pipe. Do not use built-in metal base flashings or cants. Height of assembly to be as follows:

Length of Support Rail (inches)	Min. Curb Height Above Deck
to 24	14 inches
25 - 36	18
37 - 48	24
49 - 60	30
61 and over	48

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 concrete inserts, beam clamps, ceiling plates, wall brackets, or floor stands. Fasten ceiling plates and wall brackets securely to the structure and test to demonstrate the adequacy of the fastening.

Coordinate hanger and support installation to properly group piping of all trades.

Where piping can be conveniently grouped to allow the use of trapeze type supports, use standard structural shapes or continuous insert channels for the supporting steel. Where continuous insert channels are used, pipe supporting devices made specifically for use with the channels may be substituted for the specified supporting devices provided that similar types are used and all data is submitted for prior approval.

Perform all welding in accordance with standards of the American Welding Society. Clean surfaces of loose scale, rust, paint or other foreign matter and properly align before welding. Use wire brush on welds after welding. Welds shall show uniform section, smoothness of weld metal and freedom from porosity and clinkers. Where necessary to achieve smooth connections, joints shall be dressed smooth.

HANGER AND SUPPORT SPACING

Place a hanger within 12 inches of each horizontal elbow, valve, strainer, or similar piping specialty item.

Where several pipes can be installed in parallel and at the same elevation, provide multiple or trapeze hangers.

Support riser piping independently of connected horizontal piping.

Adjust hangers to obtain the slope specified in the piping section of this specification.

Space hangers for pipe as follows:

Pipe Material	Pipe Size	Max. Spacing
Steel	1/2" through 1-1/4"	6'-6"
Steel	1-1/2" through 6"	10'-0"
Steel	8" through 12"	14'-0"
Steel	14" and over	20'-0"
Thermoplastic	All sizes	6'-0"
Copper	1/2" through 1-1/4"	5'-0"
Copper	1-1/2" and larger	8'-0"

EQUIPMENT STANDS

Height of pipe support to be selected from the following table, based on the maximum width of the equipment being supported:

Length of Support Rail (inches)	Min. Curb Height Above Deck
to 24	14 inches
25 - 36	18
37 - 48	24
49 - 60	30
61 and over	48

Weld vertical pipe supports to horizontal support members. Apply two coats of zinc rich paint to cut edges and welded areas of galvanized steel elements.

PIPE PENETRATION THROUGH ROOF

Install at points where pipes penetrate roof. Install as shown on the drawings, as detailed and according to the manufacturer's installation instructions. Flashing and counterflashing by the General Contractor.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC
BASED ON DSF MASTER SPECIFICATION DATED 4/4/08

P A R T 1 - G E N E R A L

SCOPE

This section includes air and water testing, adjusting and balancing for the entire project. Included are the following topics:

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process
Section 23 05 00 Common Work Results for HVAC
Section 23 07 00 HVAC Insulation

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.

DESCRIPTION

The Contractor will separately contract with an independent test and balance agency to perform all testing, adjusting, and balancing of air and hydronic systems required for this project. Work related to the testing, adjusting, and balancing that must be performed by the installing mechanical contractor is specified in other section of these specifications.

Provide total mechanical systems testing, adjusting and balancing. Requirements include the balance of air and water distribution, adjustment of new and existing systems and equipment to provide design requirements indicated on the drawings, electrical measurement and verification of performance of all mechanical equipment, all in accordance with standards published by AABC or NEBB.

Test, adjust and balance all air and hydronic systems so that each room, piece of equipment or terminal device meets the design requirements indicated on the drawings and in the specifications.

Accomplish testing, adjusting and balancing work in a timely manner that allows partial occupancy of major buildings, occupancy of one building when the project involves many buildings, and completion of the entire project in the time stated in the Instruction to Bidders and in accordance with the completion schedule established for this project.

Verify that provisions are being made to accomplish the specified testing, adjusting and balancing work. If problems are found, handle as specified in Part 3 under Deficiencies.

QUALITY ASSURANCE

Qualifications

An independent Firm specializing in the Testing and Balancing of HVAC systems for a minimum of 3 years. A Firm not engaged in the commerce of furnishing or providing equipment or material generally related to HVAC work other 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. If certification of firm or any staff performing work is terminated or expires during the duration of the project, contact DSF immediately.

Technicians on this project must have satisfactorily completed work on a minimum of (3) three projects of at least 50% in size, and of similar complexity.

Submit Qualifications of firm and project staff to DSF upon requested.

PRE-INSTALLATION MEETING AND SCHEDULING

The test and balance agency is required to attend a pre-installation meeting with all other project contractors before the construction process is started. The test and balance agency shall give the Lead Contractor a detailed schedule of testing and balancing tasks for incorporation into the project schedule. Reference General Conditions Article 12 for Lead Contractor responsibilities for scheduling.

PRE-BALANCE CONFERENCE

90 days prior to beginning testing, adjusting and balancing, schedule and conduct a conference with the Architect/Engineer, DSF's Project Representative and the mechanical system and temperature control system installing Contractors. Provide AE and Commissioning Provider (CxP) with a complete copy of the TAB plan for the project. The objective is final coordination and verification of system operation and readiness for testing, adjusting and balancing procedures and scheduling procedures with the above mentioned parties. Indicate work required to be completed prior to testing, adjusting, and balancing and identify the party responsible for completion of that work.

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.

Submission:

Distribute electronic copies of the Report to the Contractor, the Lead Contractor, the DSF Project Representative, the Agency Contact, the Prime A/E, the DSF Project Manager, Jim Polfuss (James.Polfuss@wisconsin.gov), John Chapman (John.Chapman@wisconsin.gov), Jim Kropp (James.Kropp@wisconsin.gov) and Penny Olson (Penny.Olson@wisconsin.gov)

Enter a RFI, with a copy of the Testing and Balancing Report Summary as an upload, indicating that the Testing and Balancing Report is posted on the WisBuild Project Overview page and requesting review of the report.

Format: Cover page identifying project name, project number and descriptive title of contents. Divide the contents of the report into the below listed divisions:

- General Information
- Summary
- Air Systems
- Hydronic Systems
- Special 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 DSF upon request. Calibration and maintenance of all instruments to be in accordance with the requirements of NEBB or AABC Standards

P A R T 3 - E X E C U T I O N

DAILY REPORTS

Submit to DSF's Project Representative daily work activity reports for each day on which testing and balancing work is performed. Reports shall include description of day's activities and description of any system deficiencies.

PRELIMINARY PROCEDURES

Review preconstruction meeting report, applicable construction bulletins, applicable change orders and approved shop drawings of equipment, outlets/inlets and temperature controls.

Check filters for cleanliness, dampers and valves for correct positioning, equipment for proper rotation and belt tension, temperature controls for completion of installation and hydronic systems for proper charge and purging of air.

Notify DSF's Project Representative on a daily basis during balancing. Identify deficiencies preventing completion of testing, adjusting and balancing procedures. Do not proceed until systems are fully operational with all components necessary for complete testing, adjusting and balancing. Installing Contractors are required to provide personnel to check and verify system completion, readiness for balancing and assist Balancing Agency in providing specified system performance.

PERFORMING TESTING, ADJUSTING AND BALANCING

Perform testing, adjusting and balancing procedures on each system identified, in accordance with the detailed procedures outlined in the referenced standards except as may be modified below.

Unless specifically instructed in writing, all work in this specification section is to be performed during the normal workday.

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.

In air systems employing filters, blank off sufficient filter area to simulate a pressure drop that is midway between that of a clean filter and that of a dirty filter.

Measure and record system measurements at the fan and/or pump to determine total flow. Adjust equipment as required to yield specified total flow at terminals. Proceed taking measurements in mains and branches as required for final terminal balancing. Perform terminal balancing to specified flows balancing branch dampers, deflectors, extractors and valves prior to adjustment of terminals.

Measure and record static air pressure conditions across fans, coils and filters. Indicate in report if cooling coil measurements were made on a wet or dry coil and if filter measurements were made on a clean or dirty filter. Spot check static air pressure conditions directly ahead of terminal units.

Adjust outside air, return air and relief air dampers for design conditions at both the minimum and maximum settings and record both sets of data. Balance modulating dampers at extreme conditions and record both sets of data. Balance variable air volume systems at maximum air flow rate, full cooling, and minimum flow rate, full heating; record all data.

Adjust register, grille and diffuser vanes and accessories to achieve proper air distribution patterns and uniform space temperatures free from objectionable noise and drafts within the capabilities of the installed system.

Provide fan and motor drive sheave adjustments necessary to obtain design performance. Provide drive changes specifically noted on drawings, if any. If work of this section indicates that any drive or motor is inadequate for the application, advise the owner's project representative by giving the representative properly sized motor/drive information (in accordance with manufacturers original service factor and installed motor horsepower requirements); Confirm any change will keep the duct/piping system within its design limitations with respect to speed of the device and pressure classification of the distribution system. Required motor/drive changes not specifically noted on drawings or in specifications will be considered an extra cost and will require an itemized cost breakdown submitted to owner's project representative. Prior authorization is needed before this work is started.

Areas or rooms designed to maintain positive, negative or balanced air pressures with respect to adjacent spaces, as indicated by the design air quantities, require special attention. Adjust fan drives, distribution dampers, terminals and controls to maintain indicated pressure relationship.

Final air system measurements to be within the following range of specified cfm:

Fans	0% to +10%
Supply grilles, registers, diffusers	0% to +10%
Return/exhaust grilles, registers	0% to -10%
Room pressurization air	-5% to +5%

Final water system measurements must be within the following range of specified gpm:

Heating flow rates	0% to -10%
Cooling flow rates	-5% to +5%

Contact the temperature control Contractor for assistance in operation and adjustment of controls during testing, adjusting and balancing procedures. Cycle controls and verify proper operation and setpoints. Include in report description of temperature control operation and any deficiencies found.

Permanently mark equipment settings, including damper and valve positions, control settings, and similar devices allowing settings to be restored. Set and lock memory stops.

Leave systems in proper working order, replacing belt guards, closing access doors and electrical boxes, and restoring temperature controls to normal operating settings.

Coordinate and assist CxP with all verification activities defined within section (01 91 01, 02) including providing all required sampling date necessary for the commissioning process.

Verify and record, in the T&B Report, “K” factors for all VAV air terminal devices and air flow stations.

Coordinate air handling unit minimum outside air set points with the Temperature Control Contractor.

Coordinate Fume Hood Monitor calibration with the Fume Hood Manufacturer.

For HVAC pumps 10 horsepower or less, valve throttling alone may be used for hydronic system balancing.

Throttling of triple-duty valves shall not exceed 50% closed. Where additional throttling would be necessary to achieve the system design flow the impellor shall be trimmed.

Verify Triple duty valve utilized on systems with Variable Frequency Drives are 100% open when balancing work is complete.

The pressure drop across triple duty valves shall not exceed 25 ft. w.g. Where additional throttling would be necessary to achieve the system design flow the impellor shall be trimmed.

For HVAC pumps greater than 10 horsepower through 60 horsepower, trim the impellor where valve throttling will result in a draw that exceeds 3 horsepower.

For HVAC pumps larger than 60 horsepower, trim the impellor where valve throttling results in a horsepower draw that exceeds 5% of the pump motor horsepower rating.

Future fouling of an open piping system may be considered when determining impellor trim requirements.

Verify butterfly valves utilized for hydronic system balancing are provided with position-lock operators (memory stops) in accordance with Section 23 05 23. The adjustment and marking of lever-lock operators that use throttling notches will not be accepted. Lock all memory stops so the valves can be reopened to their balanced positions if they are used for isolation purposes.

DEFICIENCIES

Division 23 00 00 contractor to correct any installation deficiencies found by the test and balance agency that were specified and/or shown on the Contract Documents to be performed as part of that division of work. Test and balance agency will notify the DSF's Project Representative of these items and instructions will be issued to the Division 23 00 00 contractor for correction of the deficient work. All corrective work to be done at no cost to the State of Wisconsin. Retest mechanical systems, equipment, and devices once corrective work is complete as specified.

FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for performing the functional performance test procedures and completing the functional performance test form required under specification Section 01 91 01 or 01 91 02 Commissioning Process.. Notify the A/E and commissioning provider 5 business days prior to performing functional performance testing so that they may witness. Reference 01 91 01 or 01 91 02 and functional performance test form FPT-23 05 93 for specific requirements.

END OF SECTION

SECTION 23 07 00
HVAC INSULATION
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE

This sections includes insulation specifications for heating, ventilating and air conditioning piping, ductwork and equipment. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference Standards
- Quality Assurance
- Description
- Definitions
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Materials
- Insulation & Jackets
- Accessories

PART 3 - EXECUTION
- Installation
- Duct Insulation
- Construction Verification Items

RELATED WORK

Section 01 91 01 – Commissioning Process
Section 23 05 00 - Common Work Results for HVAC
Section 23 11 00 - Facility Fuel Piping
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment
Section 23 31 00 - HVAC Ducts and Casings

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ASTM C165	Test Method for Compressive Properties of Thermal Insulations
ASTM C177	Heat Flux and Thermal Transmission Properties
ASTM C195	Mineral Fiber Thermal Insulation Cement
ASTM C240	Cellular Glass Insulation Block
ASTM C302	Density of Preformed Pipe Insulation
ASTM C303	Density of Preformed Block Insulation
ASTM C449	Mineral Fiber Hydraulic Setting Thermal Insulation Cement
ASTM C518	Heat Flux and Thermal Transmission Properties
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Thermal Insulation
ASTM C547	Mineral Fiber Preformed Pipe Insulation
ASTM C552	Cellular Glass Block and Pipe Thermal Insulation
ASTM C553	Mineral Fiber Blanket and Felt Insulation
ASTM C578	Preformed, Block Type Cellular Polystyrene Thermal Insulation
ASTM C591	Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C610	Expanded Perlite Block and Thermal 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 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

Refer to division 1, General Conditions, Equals and Substitutions

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 DSF Project Representative.

DEFINITIONS
Concealed: shafts, furred spaces, space above finished ceilings, utility tunnels and crawl spaces. All other areas, including walk-through tunnels, shall be considered as exposed.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Submit a schedule of all insulating materials to be used on the project, including adhesives, fastening methods, fitting materials along with material safety data sheets and intended use of each material. Include manufacturer's technical data sheets indicating density, thermal characteristics, jacket type, and manufacturer's installation instructions.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

MATERIALS
Materials or accessories containing asbestos will not be accepted.

Use composite insulation systems (insulation, jackets, sealants, mastics, and adhesives) that have a flame spread rating of 25 or less and smoke developed rating of 50 or less, with the following exceptions:

Pipe insulation which is not located in an air plenum may have a flame spread rating not over 25 and a smoke developed rating no higher than 150.

INSULATION AND JACKETS
Manufacturers: Armacell, Certainteed, Manson, Childers, Dow, Extol, Fibrex, Halstead, H.B. Fuller, Imcoa, Johns Manville, Knauf, Owens-Corning, Partek, Pittsburgh Corning, Rubatex or approved equal.

Insulating materials shall be fire retardant, moisture and mildew resistant, and vermin proof. Insulation shall be suitable to receive jackets, adhesives and coatings as indicated.

FLEXIBLE FIBERGLASS INSULATION:
Minimum nominal density of 0.75 lbs. per cu. ft., and thermal conductivity of not more than 0.3 at 75 degrees F, rated for service to 250 degrees F.

Foil-scrim-kraft vapor barrier jacket, factory applied to insulation, maximum permeance of .02 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.

Insulation bands to be 3/4 inch wide, constructed of aluminum or stainless steel. Minimum thickness to be .015 inch for aluminum and .010 inch for stainless steel.

Tack fasteners to be stainless steel ring grooved shank tacks.

Staples to be clinch style.

Insulating cement to be ANSI/ASTM C195, hydraulic setting mineral wool.

Finishing cement to be ASTM C449.

Fibrous glass or canvas fabric reinforcing shall have a minimum untreated weight of 6 oz./sq. yd.

Bedding compounds to be non-shrinking and permanently flexible.

Vapor barrier coatings and tapes to have maximum applied water vapor permeance of .05 perms.

Fungicidal water base coating (Foster 40-20 or equal) to be compatible with vapor barrier coating.

P A R T 3 - E X E C U T I O N

INSTALLATION

Install insulation, jackets and accessories in accordance with manufacturer's instructions and under ambient temperatures and conditions recommended by manufacturer. Surfaces to be insulated must be clean and dry.

Do not insulate systems or equipment which are specified to be pressure tested or inspected, until testing, inspection and any necessary repairs have been successfully completed.

Install insulation with smooth and even surfaces. Poorly fitted joints or use of filler in voids will not be accepted. 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.

Insulation shall be continuous through sleeves and openings except where fire rated penetration materials require interruption of insulation. Vapor barriers shall be maintained continuous through all penetrations.

Provide a complete vapor barrier for insulation on the following systems:

- Cold Water Make-Up
- Chilled Water
- Refrigerant
- Glycol/Brine
- Insulated Duct
- Equipment or piping with a surface temperature below 65 degrees F

DUCT INSULATION

GENERAL:

Secure flexible duct insulation on sides and bottom of ductwork over 24" wide and all rigid duct insulation with weld pins or speed clips. Space fasteners 18" on center or less as required to prevent sagging for flexible duct insulation. Space fasteners not less than 3" from edge or corner and 12" on center or less for rigid duct insulation. 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.

DUCT INSULATION SCHEDULE:
Provide duct insulation on new and existing remodeled ductwork in the following schedule:

Service	**Insulation Type**	**Insulation Thickness**
Outside air ducts	Flexible Fiberglass	1-1/2"
Exposed supply ducts*	Flexible Fiberglass	1-1/2"
Concealed supply ducts	Flexible Fiberglass	1-1/2"
Exhaust ducts downstream of heat recovery units and desiccant dryers	Flexible Fiberglass	1-1/2"

* Exposed supply branch ducts located in the space they are serving do not require insulation. Exposed supply main ducts running through spaces they serve shall be insulated as exposed supply ducts scheduled above.

CONSTRUCTION VERIFICATION ITEMS
Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

END OF SECTION

SECTION 23 09 93
SEQUENCE OF OPERATION FOR HVAC CONTROLS
BASED ON DFD MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE
This section includes control sequences for HVAC equipment as well as equipment furnished by others that may need monitoring or control. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Description of Work
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Not Applicable

PART 3 - EXECUTION
- General Control
- Constant Volume Furnace Control
- Energy Recovery Ventilator Control

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Section 01 91 01 or 01 91 02 – Commissioning Process
Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC – Coordination

Division 23 - HVAC - Equipment provided to be controlled or monitored
Division 26 - Electrical - Equipment provided to be controlled or monitored
Division 28 - Electronic Safety and Security

REFERENCE
Section 23 09 14 work includes furnishing and installing all field devices, including electronic sensors for the DDC of this section, equipment, and all related field wiring, interlocking control wiring between equipment, pneumatic tubing, sensor mounting, etc., that is covered in that section.

Motorized control dampers and actuators, thermowells (temperature sensing wells), automatic control valves and their actuators are also covered in Section 23 09 14.

DESCRIPTION OF WORK
Control sequences are hereby defined as the manner and method by which automatic controls function. Requirements for each type of operation are specified in this section.

Operation equipment, devices and system components required for automatic control systems are specified in other Division 23 control sections of these specifications.

All temperature, humidity, and pressure sensing, and all other control signal transportation for the control sequences shall be furnished under Section 23 09 14. All pneumatic, electronic, and electric input/output signals shall be extended under Section 23 09 14, with adequate lead length for termination within the appropriate control panel being provided under Section [23 09 24 or 23 09 23].

Sequences for equipment controlled by Direct Digital Controls (DDC) as specified are accomplished by hardware and software provided under Section [23 09 24 or 23 09 23]. Sequences for equipment controlled by pneumatic or electric self-contained controls are accomplished by hardware provided under Section 23 09 14.

SUBMITTALS
Refer to Division 1, General Conditions, Submittals, Section 23 05 00 and Sections [23 09 24 or 23 09 23], and 23 09 14 for descriptions of what should be included in the submittals.

Shop drawings shall be provided by contractor(s) providing equipment under Sections [23 09 24 or 23 09 23] and 23 09 14. The contractor providing the DDC equipment shall provide a complete narrative of the sequence of operations for equipment that is controlled through the DDC system. The contractor providing the 23 09 14 equipment shall provide a complete narrative of the sequence of operation for equipment that is controlled directly from that equipment (without control logic through the DDC system). The narrative of the sequence of operation shall not be a verbatim copy of the sequences contained herein, but shall reflect the actual operation as applied by the contractor.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

P A R T 2 - P R O D U C T S

Not applicable to this Section – reference Sections [23 54 00 for product descriptions.

P A R T 3 - E X E C U T I O N

CONTROL SEQUENCES

GENERAL:

SETPOINTS:

All setpoints indicated in the control specification are to be adjustable. The setpoints shall be readily available to be modified in the mechanical system software system summary (either textual or graphic based) and under the same software level as hardware points. Some less used setpoints may be provided on a lower software level, if requested by the user Agency for clarity. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on requirements of the building. The control contractor shall work with the balancing contractor and the user Agency to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use. Document all final setpoints on the as-built control drawings. Any questions regarding the intended operation of the HVAC equipment and control systems shall be referred to the HVAC design engineer through the appropriate construction communication process. The following setpoints should be used as initial setpoints unless otherwise specified in the individual control sequences:

Occupied Space Terminal Unit Heating: 68º F
Occupied Space Terminal Unit Cooling: 76º F
Entry Way Heating: 60° F
Mechanical or Unoccupied Space Ventilation: 82º F
Mechanical or Unoccupied Space Heating: 60º F

DEADBANDS:

Provide deadbands for all DDC control loops to prevent constant hunting of output signals to controlled devices. Deadbands shall be set to provide adequate control around setpoint as follows unless otherwise specified in the individual control sequences:

Temperature Control: ±0.5º F
Humidity Control: ±1% RH
Airflow Control: ±2% of total flow
AHU Static Pressure Control: ±0.01 in. w.c.

ALARMS:

Provide all alarmed points with adjustable time delays to prevent nuisance tripping under normal operation and on equipment start-up. Provide alarms on all points as indicated on point charts. For existing campus automations systems, add/delete what is called on the point charts for after consultation with user Agency to provide consistent alarming throughout the automation system.

DAMPER INTERLOCKS FOR FANS WITH STARTERS:

For fan systems with magnetic starters and shutoff dampers specified with end switches, the damper interlock shall be hardwired in such a way that the damper shall open if the fan starter hand / off / auto switch is in the hand or in the auto position and being called to start. After the damper end switch has proven the damper open, a hardwire interlock from the end switch to the starter holding coil for the fan

shall cause the fan to start. For fan systems that are ducted in parallel, see specific sequence for fan system on interlock requirements.

THERMOSTATS AND SENSORS:
All devices and equipment including terminal units, specified to be controlled in a control sequence by a thermostat or sensor, shall be provided with a thermostat or sensor, whether or not the device is indicated on the plans. Consult the HVAC design engineer for the thermostat or sensor location.

CONSTANT VOLUME FURNACE CONTROL (F-1):
GENERAL:
The Furnace is constant air volume, indoor air unit.
The Furnace unit is equipped with the following:

- Supply fan with starter.
- Gas fired heat exchanger for heating.
- 30% filter bank(inside unit).

FAN CONTROL:
Start/Stop: Fan shall operate during occupied mode as scheduled on electric thermostat mounted in space.

VENTILATION AIR CONTROL:
Interlock fan operation with energy recovery operation.

UNOCCUPIED CONTROL:
General: Occupied/unoccupied schedule shall be set at the thermostat. When indexed to unoccupied the unit shall shutdown. Air handling unit to maintain setback and setup temperature setpoints unless overridden by occupancy sensor or manual pushbutton.

ENERGY RECOVERY VENTILATOR (ERV-1):

GENERAL:
Interlock operation with fans and exhaust/outside air dampers operation of F-1.

FUNCTIONAL PERFORMANCE TESTING
Contractor is responsible for utilizing the functional performance test procedures supplied under specification Section 01 91 01 or 01 91 02 in accordance with the procedures defined for functional performance test procedures.

END OF SECTION

SECTION 23 11 00
FACILITY FUEL PIPING
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE

This section contains specifications for fuel pipe and fuel pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Natural Gas Service

PART 2 - PRODUCTS
- Natural Gas
- Vents and Relief Valves
- Unions and Flanges

PART 3 - EXECUTION
- Preparation
- Erection
- Threaded Pipe Joints
- Natural Gas
- Vents and Relief Valves
- Unions and Flanges
- Piping System Leak Tests
- Piping System Test Report
- Construction Verification Items

RELATED WORK

Section 01 91 01– Commissioning Process
Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 05 15 - Piping Specialties
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

ANSI B16.3	Malleable Iron Threaded Fittings
ASTM A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
ASTM A234	Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures

SHOP DRAWINGS

Refer to division 1, General Conditions, Submittals.

Contractor shall submit schedule indicating the ASTM specification number of the pipe being proposed along with its type and grade and sufficient information to indicate the type and rating of fittings for each service.

TYPE E OR S STEEL PIPE:
Mill certification papers, also known as material test reports, for the pipe furnished for this project, in English. Heat numbers on these papers to match the heat numbers stenciled on the pipe. Chemical analysis indicated on the mill certification papers to meet or exceed the requirements of the referenced ASTM specification.

QUALITY ASSURANCE

Order all Type E and Type S steel pipe with heat numbers rolled, stamped, or stenciled to each length or each bundle, depending on the size of the pipe, and in accordance with the appropriate ASTM specification.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the Owner.

DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to eliminate rust and corrosion while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

DESIGN CRITERIA

Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM specifications as listed in this specification.

Construct all piping for the highest pressures and temperatures in the respective system in accordance with ANSI B31, but not less than 125 psig unless specifically indicated otherwise.

Non-metallic piping will be acceptable only for the services indicated. It will not be acceptable in occupied spaces and ventilation plenum spaces, including plenum ceilings.

Where weld fittings or mechanical grooved fittings are used, use only long radius elbows having a centerline radius of 1.5 pipe diameters.

Where ASTM A53 grade A pipe is specified, ASTM A53 grade B pipe may be substituted at Contractor's option. Where the grade or type is not specified, Contractor may choose from those commercially available.

P A R T 2 - P R O D U C T S

NATURAL GAS

2" and Smaller: ASTM A53, type E or S, standard weight (schedule 40) black steel pipe with ASTM A197/ANSI B16.3 class 150 black malleable iron threaded fittings or ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

2-1/2" and Larger: ASTM A53, type E or S, standard weight black steel pipe with ASTM A234 grade WPB/ANSI B16.9 standard weight, seamless, carbon steel weld fittings.

VENTS AND RELIEF VALVES

Use pipe and pipe fittings as specified for the system to which the relief valve or vent is connected.

UNIONS AND FLANGES

2" and Smaller: ASTM A197/ANSI B16.3 malleable iron unions with brass seats. Use black malleable iron on black steel piping and galvanized malleable iron on galvanized steel piping. Use unions of a pressure class equal to or higher than that specified for the fittings of the respective piping service but not less than 250 psi.

2-1/2" and Larger: ASTM A181 or A105, grade 1 hot forged steel flanges of threaded, welding and of a pressure class compatible with that specified for valves, piping specialties and fittings of the respective piping service. Flanges smaller than 2-1/2" may be used as needed for connecting to equipment and piping specialties. Use raised face flanges ANSI B16.5 for mating with other raised face flanges on equipment with flat ring or full face gaskets. Use ANSI B16.1 flat face flanges with full face gaskets for mating with other flat face flanges on equipment.

P A R T 3 - E X E C U T I O N

PREPARATION
Remove all foreign material from interior and exterior of pipe and fittings.

ERECTION
Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. In all cases, consult drawings for exact location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Mitered ells, notched tees, and orange peel reducers are not acceptable. On threaded piping, bushings are not acceptable.

"Weldolets" and "Threadolets" may be used for branch takeoffs up to one-half (1/2) the diameter of the main.

Do not route piping through transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment, unless the piping is serving this equipment

Install all valves, and piping specialties, including items furnished by others, as specified and/or detailed. Make connections to all equipment installed by others where that equipment requires the piping services indicated in this section.

THREADED PIPE JOINTS
Use a Teflon based thread lubricant or Teflon tape when making joints; no hard setting pipe thread cement or caulking will be allowed.

NATURAL GAS
Pitch horizontal piping down 1" in 60 feet in the direction of flow. Install a 4" minimum depth dirt leg at the bottom of each vertical run and at each appliance. When installing mains and branches, cap gas tight each tee or pipe end which will not be immediately extended. All branch connections to the main shall be from the top or side of the main.

Do not install gas pipe in a ventilation air plenum.

If an above ground vent terminates in an area subject to snow accumulation, terminate the line at least five feet above grade.

Install a shut off valve at each appliance. Provide a valved connection at the main for equipment and appliances furnished by others.

Piping through a roof shall be run through an approved roof penetration with flashing and counter flashing.

Each gas pressure reducing valve vent and relief valve vent shall be run separately to a point outside of the building, terminated with a screened vent cap, and located according to gas utility regulations.

Clean all welded piping before all regulators and control valves. Test by placing target cloth over piping and blow with compressed air. Clean piping until target cloth is clean and free of debris.

VENTS AND RELIEF VALVES
Install vent and relief valve discharge lines as indicated on the drawings, as detailed, and as specified for each specific valve or piping specialty item. In no event is a termination to occur less than six feet above a roof line.

UNIONS AND FLANGES
Install a union or flange, as required, at each automatic control valve and at each piping specialty or piece of equipment which may require removal for maintenance, repair, or replacement. Where a valve is located at a piece of equipment, locate the flange or union connection on the equipment side of the valve. Concealed unions or flanges are not acceptable.

PIPING SYSTEM LEAK TESTS

Verify that the piping system being tested is fully connected to all components and that all equipment is properly installed, wired, and ready for operation. If required for the additional pressure load under test, provide temporary restraints at expansion joints or isolate them during the test. Verify that hangers can withstand any additional weight load that may be imposed by the test.

Provide all piping, fittings, blind flanges, and equipment to perform the testing.

Conduct pressure test with test medium of air or water unless specifically indicated. Minimum test time is indicated in the table below; additional time may be necessary to conduct an examination for leakage. Each test must be witnessed by the Division's representative. If leaks are found, repair the area with new materials and repeat the test; caulking will not be acceptable.

Do not insulate pipe until it has been successfully tested.

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

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

Measure natural gas system test pressure with a water manometer or an equivalent device calibrated in increments not greater than 0.1 inch water column. System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Conduct fuel oil system test so as not to impose a pressure of more than 10 psig on the tank. Instead of a pressure test, suction lines may be tested under a vacuum of not less than 20 inches of mercury maintained for at least one hour.

System	Pressure	Medium	Duration
Natural gas	100 psig	Air	24 hr

All pressure tests are to be documented on a Division of State Facilities form included in this specification.

On piping that can not be tested because of connection to an active line, provide temporary blind flanges and hydrostatically test new section of piping. After completion of test, remove temporary flanges and make final connections to piping. Die penetrate test pass weld or x-ray the piping that was not hydrostatically tested up to the active system.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

END OF SECTION

PIPING SYSTEM TEST REPORT

State of Wisconsin
Department of Administration
Division of State Facilities

Date Submitted: _____

Project Name: _____

Location: _____ **DSF Project No:** _____

Contractor: _____

☐ **HVAC** ☐ **Refrigeration** ☐ **Controls**

☐ **Power Plant** ☐ **Plumbing** ☐ **Sprinkler**

Test Medium: ☐ **Air** ☐ **Water** ☐ **Other** _____

Test performed per specification section No. _____

Specified Test Duration _____ **Hours** **Specified Test Pressure** _____ **PSIG**

System Identification: _____

Describe Location: _____

_____

Test Date: _____

Start Test Time: _____ **Initial Pressure:** _____ **PSIG**

Stop Test Time: _____ **Final Pressure:** _____ **PSIG**

Tested By: _____ **Witnessed By:** _____

Title: _____ **Title:** _____

Signed: _____ **Signed:** _____

Date: _____ **Date:** _____

Comments: _____

_____

_____

SECTION 23 31 00
HVAC DUCTS and CASINGS
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

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. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Design Criteria

PART 2 - PRODUCTS
- General
- Materials
- Low Pressure Ductwork (Maximum 2 inch pressure class)
- Duct Sealant
- Gaskets

PART 3 - EXECUTION
- Installation
- Low Pressure Duct (Maximum 2 inch pressure class)
- Cleaning
- Leakage Test
- Construction Verification Items

APPENDIX
- Duct Leakage Test Report
- Duct Structural Test Report

RELATED WORK

Section 01 91 01 or 01 91 02 – Commissioning Process
23 33 00 – Air Duct Accessories
23 01 30.51 – HVAC Air Duct Cleaning
23 05 93 - Testing, Adjusting, and Balancing for HVAC

REFERENCE

Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS

ANSI SS-EN 485-2	Aluminum and Aluminum Alloys-Sheet, Strip and Plate-Part 2: Mechanical Properties
ASTM B209	Specification for Aluminum and Aluminum-Alloy Sheet and Plate
ASTM A90	Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron or Steel Articles
ASTM A167	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A623	Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
ASTM A527	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Lock-Forming Quality
ASTM 924	Standard Specification for General Requirements for Sheet Steel, Metallic-coated by the Hot-dip Method
ASTM C 1071	Specification for Fibrous Glass Duct Lining Insulation
ASTM C 411	Test Method for Hot Surface Performance of High Temperature Thermal Insulation
ASTM E 84	Test Method for Surface Burning Characteristics of Building Materials
ASTM C 1338	Test Method for Determining Fungal Resistance of Insulation Materials and Facings

ASTM G 21 to Fungi	Standard Practice for Determining Resistance of Synthetic Polymeric Materials
ASTM C 916	Standard Specification for Adhesives for Duct Thermal InsulationNFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
UL 181	Standard for Safety for Factory Made Air Ducts and Air Connectors.
NAIMA	Fibrous Glass Duct Liner Standard

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Include manufacturer's data and/or Contractor data for the following:

- Fabrication and installation drawings.
- Schedule of duct systems including material of construction, gauge, pressure class, system class, method of reinforcement, joint construction, fitting construction, and support methods, all with details as appropriate.
- Duct sealant and gasket material.
- Duct liner including data on thermal conductivity, air friction correction factor, and limitation on temperature and velocity.

DESIGN CRITERIA
Construct all ductwork to be free from vibration, chatter, objectionable pulsations and leakage under specified operating conditions.

Use material, weight, thickness, gauge, construction and installation methods as outlined in the following SMACNA publications, unless noted otherwise:

- HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition, 1995
- HVAC Air Duct Leakage Test Manual, 1st Edition, 1985
- HVAC Systems - Duct Design, 3rd Edition, 1990
- Rectangular Industrial Duct Construction Standard, 1st Edition, 1980
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Thermoplastic Duct (PVC) Construction Manual, 2nd Edition, 1995
- Round Industrial Duct Construction Standards, 2nd Edition, 1999
- Rectangular Industrial Duct Construction Standards, 1st Edition, 1980

Use products which conform to NFPA 90A, possessing a flame spread rating of not over 25 and a smoke developed rating no higher than 50.

DELIVERY, STORAGE AND HANDLING
Promptly inspect shipments to ensure that Ductwork is undamaged and complies with the specification.

Protect Ductwork against damage.

Protect Ductwork by storing inside or by durable, waterproof, above ground packaging. Do not store material on grade. Protect Ductwork from dirt, dust, construction debris and foreign material. Where end caps/packaging are provided, take precautions so caps/packaging remain in place and free from damage.

Offsite storage agreements do not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

PART 2 - PRODUCTS

GENERAL

All sheet metal used for construction of duct shall be 24 gauge or heavier except for round and spiral ductwork and spiral duct take-offs 12" and below may be 26 gauge where allowed in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 2nd Edition, 1995.

Duct sizes indicated on plans are net inside dimensions; where duct liner is specified, dimensions are net, inside of liner.

DUCTWORK PRESSURE CLASS

Minimum acceptable duct pressure class, for all ductwork except transfer ductwork, is 2 inch W.G. positive or negative, depending on the application. Transfer ductwork minimum acceptable duct pressure class is 1 inch W.G. positive or negative, depending on the application. Duct system pressure classes not indicated on the drawings to be as follows:

Supply ducts	_____0.8 in. calc. S.P.	_____ 2 in. pressure class
Return ducts	_____0.8 in. calc. S.P.	_____ 2 in. pressure class

MATERIALS

GALVANIZED STEEL SHEET:

Use ASTM A 653 galvanized steel sheet of lock forming quality. Galvanized coating to be 1.25 ounces per square foot, both sides of sheet, G90 in accordance with ASTM A90. Provide "Paint Grip" finish for ductwork that will be painted.

LOW PRESSURE DUCTWORK (Maximum 2 inch pressure class)

Fabricate and install ductwork in sizes indicated on the drawings and in accordance with SMACNA recommendations, except as modified below.

Construct so that all interior surfaces are smooth. Use slip and drive or flanged and bolted construction when fabricating rectangular ductwork. Use spiral lock seam construction when fabricating round spiral ductwork. Sheet metal screws may be used on duct hangers, transverse joints and other SMACNA approved locations if the screw does not extend more than 1/2 inch into the duct.

Use elbows and tees with a center line radius to width or diameter ratio of 1.5 wherever space permits. When a shorter radius must be used due to limited space, install single wall sheet metal splitter vanes in accordance with SMACNA publications, Type RE 3. Where space will not allow and the C value of the radius elbow, as given in SMACNA publications, exceeds 0.31, use rectangular elbows with turning vanes as specified in Section 23 33 00. Square throat-radius heel elbows will not be acceptable. Straight taps or bullhead tees are not acceptable.

Where rectangular elbows are used, provide turning vanes in accordance with Section 23 33 00.

Provide expanded take-offs or 45 degree entry fittings for branch duct connections with branch ductwork airflow velocities greater than 700 fpm. Square edge 90-degree take-off fittings or straight taps will not be accepted.

Button punch snaplock construction will not be accepted on aluminum ductwork.

Round ducts may be substituted for rectangular ducts if sized in accordance with ASHRAE table of equivalent rectangular and round ducts. No variation of duct configuration or sizes permitted except by written permission of the Architect/Engineer.

Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible. Divergence upstream of equipment shall not exceed 30 degrees; convergence downstream shall not exceed 45 degrees.

DUCT SEALANT

Manufacturer: 3M 800, 3M 900, H.B. Fuller/Foster, Hardcast, Hardcast Peal & Seal, Lockformer cold sealant, Mon-Eco Industries, United Sheet Metal, or approved equal. Silicone sealants are not allowed in any type of ductwork installation.

Install sealants in strict accordance with manufacturer's recommendations, paying special attention to temperature limitations. Allow sealant to fully cure before pressure testing of ductwork, or before startup of air handling systems.

GASKETS
2 INCH PRESSURE CLASS AND LOWER:
Soft neoprene or butyl gaskets in combination with duct sealant for flanged joints.

P A R T 3 - E X E C U T I O N

INSTALLATION
Verify dimensions at the site, making field measurements and drawings necessary for fabrication and erection. Check plans showing work of other trades and consult with Architect in the event of any interference.

Make allowances for beams, pipes or other obstructions in building construction and for work of other contractors. Transform, divide or offset ducts as required, in accordance with SMACNA HVAC Duct Construction Standards, Figure 2-7, except do not reduce duct to less than six inches in any dimension and do not exceed an 8:1 aspect ratio. Where it is necessary to take pipes or similar obstructions through ducts, construct easement as indicated in SMACNA HVAC Duct Construction Standards, Figure 2-8, Fig. E. In all cases, seal to prevent air leakage. Pipes or similar obstructions may not pass through high pressure or fume exhaust ductwork.

Test openings for test and balance work will be provided under Section 23 05 93.

Provide frames constructed of angles or channels for coils, filters, dampers or other devices installed in duct systems, and make all connections to such equipment including equipment furnished by others. Secure frames with gaskets and screws or nut, bolts and washers.

Install duct to pitch toward outside air intakes and drain to outside of building. Solder or seal seams to form watertight joints.

Where two different metal ducts meet, the joint shall be installed in such a manner that metal ducts do not contact each other by using proper seal or compound.

Install all motor operated dampers and connect to or install all equipment furnished by others. Blank off all unused portions of louvers, as indicated on the drawings, with 1-1/2 inch board insulation with galvanized sheet metal backing on both sides.

Do not install ductwork through dedicated electrical rooms or spaces unless the ductwork is serving this room or space.

Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

Provide adequate access to ductwork for cleaning purposes.

Provide temporary capping of ductwork openings to prevent entry of dirt, dust and foreign material.

Protect diffusers, registers and grilles with plastic wrap or some other approved form of protection to maintain dirt and dust free and to prevent entry of dirt, dust and foreign material into the Ductwork.

Install prefabricated grease ductwork assemblies in accordance with manufacturer requirements and NFPA 96.

During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

DUCTWORK SUPPORT

Support ductwork in accordance with SMACNA HVAC Duct Construction Standards, Figure 4-4, except supporting ductwork with secure wire method is not allowed.

Support with 3/32 inch, 7 x 7, stainless steel air-craft cable, with matching fastener rated for 50% of actual load, will be allowed on round ductwork under 12 inches if installed as detailed, with cable double looped on duct and at point of support.

LOW PRESSURE DUCT (Maximum 2 inch pressure class)

Seal all duct, with the exception of transfer ducts, in accordance with SMACNA seal class "A"; all seams, joints, and penetrations shall be sealed.

Install a manual balancing damper in each branch duct and for each diffuser or grille. The use of splitter dampers, extractors, or grille face dampers will not be accepted for balancing dampers.

Hangers must be wrapped around bottom edge of duct and securely fastened to duct with sheetmetal screws or pop rivets. Trapeze hangers may be used at contractor's option.

CLEANING

Remove all dirt and foreign matter from the entire duct system and clean diffusers, registers, grilles and the inside of air-handling units before operating fans.

Clean duct systems with high power vacuum machines where systems have been used for temporary heat, air-conditioning, or ventilation purposes during construction. Protect equipment that may be harmed by excessive dirt with filters, or bypass during cleaning.

LEAKAGE TEST

Test all ductwork in accordance with test methods described in Section 5 of SMACNA HVAC Air Duct Leakage Test Manual. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

If excessive air leakage is found locate leaks, repair the duct in the area of the leak, seal the duct, and retest.

Leakage rate shall not exceed more than 5% of the system air quantity for low pressure ductwork, determined in accordance with Appendix C of the SMACNA HVAC Air Duct Leakage Test Manual.

Submit a signed report to the Division's Construction Representative, indicating test apparatus used, results of the leakage test, and any remedial work required to bring duct systems into compliance with specified leakage rates.

STRUCTURAL TEST

Random test all ductwork per DSF direction. Do not insulate ductwork until it has been successfully tested. Test pressure shall be equal to the duct pressure class.

Deflection limits shall not exceed those listed in accordance with Chapter 7 of SMACNA HVAC Duct Construction Standards, 3.0 Performance Requirements.

Submit a signed report to the Division's Construction Representative, indicating test apparatus used, results of the structural test, and any remedial work required.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

DUCT LEAKAGE TEST REPORT

State of Wisconsin Department of Administration Division of State Facilities	**DSF Project Number:**_____ **Date Submitted:**_____

Project	**Name:**_____		
	Location:_____		
	Contractor:_____		
System Data	**Fan No:**_____	**Leakage Class (C_L):**_____	
	Fan Design CFM:_____	**Duct Pressure Class (P_C):**_____	
		Test Pressure (P_T):_____	
Test Equipment	**Manufacturer:**_____	**Model No:**_____	**Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data					Field Test Data							
			Allowable Leakage		Diameter		Pressure (in. wc.)					
Duct Section	Duct Shape	Duct Surface (Ft^2)	Leakage Factor ($P^{.65}C_L$)	CFM for Section	Tube (D_1)	Orifice (D_2)	In Duct (P)	Across Orifice (P_{drop})	Date	Performed By	Observed By	Actual CFM
TOTAL												

DUCT STRUCTURAL TEST REPORT

State of Wisconsin **DSF Project Number:**_____
Department of Administration
Division of State Facilities **Date Submitted:**_____

Project **Name:**_____
Location:_____
Contractor:_____

System Data **Fan No:**_____
Description of Test Method:_____
_____
_____

Test Equipment **Manufacturer:**_____ **Model No:**_____ **Serial No:**_____

For large systems, use the reverse side for a simple sketch of the entire duct system. Then use letter designations to indicate the various duct sections being tested at one time. Also use the reverse side for test comments.

Note that due to normal construction sequencing it is usually necessary to test risers separately prior to enclosing chases.

Design Data								Field Test Data						
Duct Test Location	Ductwork Shape		Duct Pressure Class	Allowable Ductwork Wall Deflection		Allowable Joint/ Reinforcement Deflection		Pressure (in. wc.) In Duct	Measured Ductwork Wall Deflection		Measured Joint/ Reinforcement Deflection		Per-formed By/ Date	Wit-nessed By/ Date
	H	W		H	W	H	W		H	W	H	W		

END OF SECTION

SECTION 23 33 00
AIR DUCT ACCESSORIES
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE
This sections includes accessories used in the installation of duct systems. Included are the following topics:

PART 1 - GENERAL
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Shop Drawings
- Operation and Maintenance Data

PART 2 - PRODUCTS
- Manual Volume Dampers
- Turning Vanes
- Control Dampers
- Access Doors
- Flexible Duct
- Flashings
- Duct Flexible Connections

PART 3 - EXECUTION
- Manual Volume Dampers
- Turning Vanes
- Control Dampers
- Access Doors
- Flashings
- Duct Flexible Connections

RELATED WORK
Section 01 91 01 – Commissioning Process
23 05 29 – Hanger and Supports for HVAC Piping and Equipment
23 31 00 – HVAC Ducts and Casings

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

REFERENCE STANDARDS
NFPA 90A Standard for Installation of Air Conditioning and Ventilating Systems
SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition, 1995
UL 214
UL 555 (6^{th} edition) Standard for Fire Dampers and Ceiling Dampers
UL 555S (4^{th} edition) Leakage Rated Dampers for Use in Smoke Control Systems

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions

SHOP DRAWINGS
Refer to division 1, General Conditions, Submittals.

Submit for all accessories and include dimensions, capacities, ratings, installation instructions, and appropriate identification.

Include certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance of sound attenuators.

Submit manufacturer's color charts where finish color is specified to be selected by the Architect/Engineer.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

MANUAL VOLUME DAMPERS
Manufacturers: Ruskin, Vent Products, Air Balance, or approved equal.

Dampers must be constructed in accordance with SMACNA Fig. 2-12, Fig. 2-13, and notes relating to these figures, except as modified below.

Reinforce all blades to prevent vibration, flutter, or other noise. Construct dampers in multiple sections with mullions where width is over 48 inches. Use rivets or tack welds to secure individual components; sheet metal screws will not be accepted. Provide operators with locking devices and damper position indicators for each damper; use an elevated platform on insulated ducts. Provide end bearings or bushings for all volume damper rods penetrating ductwork constructed to a 3" w.c. pressure class or above.

TURNING VANES
Manufacturers: Aero Dyne, Anemostat, Barber-Colman, Hart & Cooley, or approved equal.

Construct turning vanes and runners for square elbows in accordance with SMACNA Fig. 2-3 and Fig. 2-4 except use only airfoil type vanes. Construct turning vanes for short radius elbows and elbows where one dimension changes in the turn in accordance with SMACNA Fig. 2-5 and Fig. 2-6.

CONTROL DAMPERS
Control dampers are specified in section 23 09 14.

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 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.

Use insulated, 1-1/2 hour UL 1978 listed and labeled access doors in kitchen exhaust ducts.

FLEXIBLE DUCT
Manufacturers: Anco Products, Clevaflex, Thermaflex, Flexmaster or approved equal.

Factory fabricated , UL 181 listed as a class 1 duct, and having a flame spread of 25 or less and a smoke developed rating of 50 or under in accordance with NFPA 90A.

Suitable for pressures and temperatures involved but not less than a 180°F service temperature and ±2 inch pressure class, depending on the application.

Duct to be composed of polyester film, aluminum laminate or woven and coated fiberglass fabric bonded permanently to corrosion resistant coated steel wire helix. Two-ply, laminated, and corrugated aluminum construction may also be used.

Where duct is specified to be insulated, provide a minimum 1 inch fiberglass insulation blanket with maximum thermal conductance of 0.23 K (75 degrees F.) and vapor barrier jacket of polyethylene or metalized reinforced film laminate. Maximum perm rating of vapor barrier jacket to be 0.1 perm.

FLASHINGS
Provide flashing to completely weatherproof connection of ductwork to louvers. Flashing to be constructed of material similar to louver material.

Flashing and counterflashing for roof curbs will be provided by others.

Flashing and curbs for duct and pipe penetrations of roof assemblies to be in accordance with details.

DUCT FLEXIBLE CONNECTIONS
Material to be fire retardant, be UL 214 listed, and meet the requirements of NFPA 90A.

Connections to be a minimum of 3 inches wide, crimped into metal edging strip, and air tight. Connections to have adequate flexibility and width to allow for thermal expansion/contraction, vibration of connected equipment, and other movement.

Use coated glass fiber fabric for all applications. Material for inside applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with neoprene, air and water tight, suitable for temperatures between -10°F and 200°F, and have a nominal weight of 30 ounces per square yard. Material used for outdoor applications other than corrosive environments, fume exhaust, or kitchen exhaust to be double coated with Hypalon¿,air and water tight, suitable for temperatures between -10°F and 250°F, and have a nominal weight of 26 ounces per square yard.

P A R T 3 - E X E C U T I O N

MANUAL VOLUME DAMPERS
Install manual volume dampers in each branch duct and for each grille, register, or diffuser as far away from the outlet as possible while still maintaining accessibility to the damper. Install so there is no flutter or vibration of the damper blade(s).

TURNING VANES
Install turning vanes in all rectangular, mitered elbows in accordance with SMACNA standards and/or manufacturer's recommendations.

Install double wall, airfoil, 2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity less than 2000 fpm. Install double wall, airfoil, 4-1/2 inch radius vanes in ducts with vane runner length 18" or greater and air velocity 2000 fpm or greater.

If duct size changes in a mitered elbow, use single wall type vanes with a trailing edge extension. If duct size changes in a radius elbow or if short radius elbows must be used, install sheetmetal turning vanes in accordance with SMACNA Figure 2-5 and Figure 2-6.

FIRE DAMPERS
Install dampers in strict accordance with manufacturer's installation instructions. Install damper sleeves with retaining angles on both sides of rated partition. Connections of ductwork to fire damper assemblies to be as specified on the installation instructions. Where it is necessary to set dampers out from the rated wall, install a sleeve extension encased in two hour rated fire proofing insulation. Install an access door at each fire damper, located to permit resetting the damper replacing the fusible link.

Manually test each fire damper for proper operation by removing the fusible link. Repair or replace any fire damper that does not close completely. Re-install fusible link after test.

SMOKE DAMPERS AND COMBINATION FIRE/SMOKE DAMPERS
Install smoke dampers in locations indicated on the drawings in accordance with the manufacturer's instructions. Install an access door adjacent to each damper for inspection and cleaning. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

Install combination fire/smoke dampers as specified above for fire dampers. Coordinate damper linkage with operators so the dampers are closed when the air system is not operating.

CONTROL DAMPERS
Install dampers in locations indicated on the drawings, as detailed, and according to the manufacturer's instructions. Install blank-off plates or transitions where required for proper mixing of airstreams in mixing plenums. Provide adequate operating clearance and access to the operator. Install an access door adjacent to each control damper for inspection and maintenance.

ACCESS DOORS

Install access doors where specified, indicated on the drawings, and in locations where maintenance, service, cleaning or inspection is required. Examples include, but are not limited to motorized dampers, fire and smoke dampers, smoke detectors, fan bearings, heating and cooling coils, filters, valves, and control devices needing periodic maintenance.

Size and numbers of duct access doors to be sufficient to perform the intended service. Minimum access door size shall be 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, or other size as indicated. Install access doors on both inlet and outlet sides of reheat coils as well as other duct mounted coils.

FLEXIBLE DUCT

Flexible duct may only be used for final connections of air inlets and outlets at diffuser, register, and grille locations. Where flexible duct is used, it shall be the minimum length required to make the final connections, but no greater than 5 feet in length, and have no more than one (1) 90 degree bend.

Secure inner jacket of flexible duct in place with stainless steel metal band clamp. Secure insulation vapor barrier jacket in place with steel or nylon draw band. Sheetmetal screws and/or duct tape will not be accepted.

Flexible duct used to compensate for misalignment of main duct or branch duct will not be accepted.

Individual sections of flexible ductwork shall be of one piece construction. Splicing of short sections will not be accepted.

Flexible ductwork used as transfer duct shall be sized for a maximum velocity of 300 fpm.

Penetration of any partition, wall, or floor with flexible duct will not be accepted.

HIGH TEMPERATURE FLEXIBLE DUCT

Manufacturers: Clevaflex, Thermaflex, Wiremold, Flexmaster or approved equal.

Duct to be all aluminum construction made from soft aluminum sheet, spiral wound into a tube and spiral corrugated. The construction to be a triple mechanical lock to form a continuous and secure air tight joint.

Duct to be suitable for 600°F.

FLASHINGS

Flashing for roof curbs, equipment supports or rails located on roof, will be installed by others.

DUCT FLEXIBLE CONNECTIONS

Install at all duct connections to rotating or vibrating equipment, including air handling units (unless unit is internally isolated), fans, or other motorized equipment in accordance with SMACNA Figure 2-19. Install thrust restraints to prevent excess strain on duct flexible connections at fan inlets and outlets; see Related Work.

For applications in corrosive environments or fume exhaust systems, use a double layer of the Teflon¿ coated fabric when making the connector.

END OF SECTION

SECTION 23 37 13
DIFFUSERS, REGISTERS & GRILLES
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

PART 1 - GENERAL

SCOPE

This section includes specifications for air terminal equipment. Included are the following topics:

RELATED WORK

Section 01 91 01 – Commissioning Process
Section 23 31 00 - HVAC Ducts and Casings
Section 23 33 00 - Air Duct Accessories
Section 23 05 93 - Testing, Adjusting and Balancing for HVAC

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
UL 181 - Factory-Made Air Ducts and Connectors.
ARI-ADC Standard 880

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Furnish submittal information including, but not limited to, the following:

- Manufacturer's name and model number
- Identification as referenced in the documents
- Capacities/ratings
- Materials of construction
- Sound ratings
- Dimensions
- Finish
- Color selection charts where applicable

Manufacturer's installation instructions
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, and United Sheet Metal.

Acceptable manufacturers for specific products are listed under each item.

SQUARE CEILING DIFFUSERS - High Performance

High performance type diffuser incorporating short throws and low NC levels. Titus model TMS, Carne series SF, EH Price model SCD, Metal Aire series 5800, and Krueger series 1400.

Diffusers to be aluminum (Steel) unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

Diffuser shall have throw characteristics of a round diffuser having a 360º horizontal blow pattern.

Louver cones shall be one-piece construction with no corner joints.

Unless otherwise indicated, diffuser shall have baked enamel finish with color selected by Architect.

SQUARE CEILING DIFFUSERS

Titus model TDC, Carnes series SK or SE, EH Price model AMD, Metal Aire series 5000 or 5500, and Krueger series S.

Aluminum (Steel) unless otherwise indicated, louvered face furnished with frame type appropriate to installation.

Directional blow pattern as shown on the drawings and/or as scheduled.

One-piece construction louver cones with no corner joints.

Unless otherwise indicated, baked enamel finish with color selected by Architect.

PART 3 - EXECUTION

INSTALLATION

Install grilles, registers and diffusers as shown on drawings and according to manufacturer's instructions.

Furnish diffusers with equalizing grids where it is not possible to maintain minimum 2 duct diameter straight duct into diffuser. Equalizing grids shall consist of individually adjustable vanes designed for equalizing airflow into diffuser neck and providing directional control of airflow.

Unless otherwise indicated, size ductwork drops to diffusers or grilles to match unit collar size.

Seal connections between ductwork drops and diffusers/grilles airtight.

Blank off unused portion of linear slot diffusers and linear bar diffusers and grilles.

Where diffusers, registers and grilles cannot be installed to avoid seeing inside duct, paint inside of duct with flat black paint to reduce visibility.

In clean rooms and animal holding rooms, caulk space between diffuser or grille and ceiling or wall to be air and watertight. User clear, non-hardening silicone sealant compatible with ceiling or wall surfaces. Sealant shall be resistant to microbiological growth.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

END OF SECTION

SECTION 23 54 00
GAS FIRED FURNACES
BASED ON DSF MASTER SPECIFICATION DATED 5/1/08

PART 1 - GENERAL

SCOPE

This section includes specifications for gas fired furnaces. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Quality Assurance
- Energy Efficiency
- Submittals
- Operation and Maintenance Data
- Warranty

PART 2 - PRODUCTS
- Furnaces

PART 3 - EXECUTION
- Installation
- Furnaces
- Construction Verification Items
- Functional Performance Testing
- Agency Training

RELATED WORK

Section 01 91 01 – Commissioning Process
Section 23 11 00 - Facility Fuel Piping
Section 23 05 23 - General-Duty Valves for HVAC Piping
Section 23 05 13 - Common Motor Requirements for HVAC Equipment

REFERENCE

Applicable provisions of Division 1 govern work under this section.

REFERENCE STANDARDS

AGA	American Gas Association
ANSI Z21.64	Direct Vent Central Furnaces
GAMA	Gas Appliance Manufacturers Association
NEC	National Electrical Code

QUALITY ASSURANCE

Refer to division 1, General Conditions, Equals and Substitutions.

ENERGY EFFICIENCY

Provide gas furnaces that bear the ENERGY STAR label and meet the ENERGY STAR specifications for energy efficiency.

SUBMITTALS

Refer to division 1, General Conditions, Submittals.

Include specific manufacturer and model numbers, equipment identification corresponding to project drawings and schedules, dimensions, capacities, materials of construction, ratings, weights, power requirements and wiring diagrams, filter information and information for all accessories.

OPERATION AND MAINTENANCE DATA

All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

WARRANTY

Furnace primary and secondary heat exchangers warranted for 20 years under normal use and maintenance. Remainder of furnace components warranted for 1 year from date of start up.

PART 2 - PRODUCTS

FURNACES

Manufacturers: Bryant, Carrier, Lennox, Trane or York.

Direct vent, sealed combustion, condensing type AGA certified for use with [natural][propane] gas. Minimum annual fuel utilization efficiency (A.F.U.E.) of 91. All ratings are to be certified by GAMA. All wiring shall comply with the National Electrical Code.

22 gauge steel casing with baked enamel finish or prepainted galvanized steel. Insulate casing back and side panels with foil faced fiberglass insulation.

Construct primary heat exchanger of aluminized steel. Construct secondary heat exchanger of stainless steel with aluminum fins or of polypropylene laminated steel. Aluminized steel multi-port in-shot burner with hot surface or electronic spark ignition, approved for vertical or sidewall venting.

AGA listed gas controls including manual main shut-off valve, double automatic gas valves for redundancy and gas pressure regulator.

Centrifugal type blower fan statically and dynamically balanced with multiple speed, direct drive or belt drive fan motor. Provide low energy induced draft blower for heat exchanger prepurge and combustion gas venting.

Provide unit with 2" thick 30% efficient disposable type panel air filter and filter holding rack with a maximum filter face velocity of 500 fpm.

Provide solid state integral control unit with all necessary controls and relays including but not limited to:
-Pressure switch for airflow of flue products through furnace and out vent system
-Rollout switch with manual reset to prevent overtemperature in burner area
-Electronic flame sensor
-Blower access safety interlock
-Timed blower start after main burners ignite
-Factory installed 24 v transformer for controls and thermostat
-LED's to indicate status and to aid in troubleshooting

[This Contractor shall provide all temperature control and interlocking necessary to perform the specified control sequence. All wiring is to be in conduit in accordance with Division 26 00 00 - Electrical. All relays, transformers and controls are to be in enclosures.

Provide a 7 day programmable thermostat with 2 occupied periods per day, automatic changeover, separate heating and cooling set points for both occupied and unoccupied modes. Provide auxiliary controls on sub-base to open minimum outside air damper during occupied mode. Equal to Honeywell model T7300 with Q7300 sub-base.

Provide lockable thermostat guards in public spaces.

During occupied mode run the supply fan continuously, open the outside air damper and cycle the cooling or heating as required to maintain occupied space temperature cooling or heating set point. During unoccupied mode close the outside air damper and cycle the supply fan and cooling or heating as required to maintain unoccupied cooling or heating space temperature set point.]

PART 3 - EXECUTION

INSTALLATION

Install units as shown on plans, as detailed and according to the manufacturer's installation instructions.

[Install remote panels and thermostats where indicated on the drawings. Provide all wiring between remote panels/thermostats and the gas fired item.]

FURNACES

Install on concrete housekeeping pad, steel stand or suspend unit from structure as indicated on the drawings. Pipe condensate to floor drain.

Provide schedule 40 PVC, ASTM D1785 combustion air and vent piping and fittings with solvent welded joints as indicated on the drawings. Terminate as recommended by the furnace manufacturer.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

FUNCTIONAL PERFORMANCE TESTING

Contractor is responsible for utilizing the functional performance test procedures supplied under specification Section 01 91 01 in accordance with the procedures defined for functional performance test procedures.

AGENCY TRAINING

All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of [X] hours.

END OF SECTION

SECTION 23 72 00
AIR-TO-AIR ENERGY RECOVERY EQUIPMENT
BASED ON DSFF MASTER SPECIFICATION DATED 5/1/08

P A R T 1 - G E N E R A L

SCOPE
This section includes specifications for energy recovery equipment that is used to recover heating and/or cooling energy. Included are the following topics:

PART 1 - GENERAL
- Scope
- Reference
- Related Work
- Quality Assurance
- Submittals
- Operation and Maintenance Data
- Design Criteria

PART 2 - PRODUCTS
- Air-to-Air Heat Exchangers (Fixed plate type)

PART 3 - EXECUTION
- Installation
- Air-to-Air Heat Exchangers (Fixed plate type)
- Construction Verification Items
- Functional Performance Testing
- Agency Training

REFERENCE
Applicable provisions of Division 1 govern work under this Section.

RELATED WORK
Section 01 91 01 – Commissioning Process
Section 23 07 00 - HVAC Insulation
Section 23 41 00 - Particulate Air Filtration
Section 23 33 00 - Air Duct Accessories

QUALITY ASSURANCE
Refer to division 1, General Conditions, Equals and Substitutions.

SUBMITTALS
Refer to division 1, General Conditions, Submittals.

Include unit dimensions, weights, materials of construction, thermal characteristics, ratings, fabrication methods, manufacturer's installation requirements, and appropriate identification.

OPERATION AND MAINTENANCE DATA
All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

DESIGN CRITERIA
Capacity, efficiency, and operating characteristics as indicated on the drawings and/or as scheduled.

P A R T 2 - P R O D U C T S

AIR-TO-AIR HEAT EXCHANGERS (Cross Flow Core type)
MANUFACTURERS:
Lossnay, Micrometl, Renewaire, , or approved equal.

DESIGN:
Units to be crossflow core type, capable of operating at temperatures from a minimum of -10 deg. F to a maximum of 100deg. F and withstanding entrained moisture from outside air or steam cleaning without damage or deterioration in performance.

CASING:

Construct casings from minimum 22 gauge galvanized or aluminized steel suitable for flanged installation. Casings shall be insulated with a minimum R-4 cabinet insulation. Provide units with hinged and gasketed access doors to allow manual cleaning of heat exchange surfaces.

HEAT EXCHANGER CORE:
Use hydroscopic resin coated cellulose fiber .crossflow fixed position heat exchanger. Exhaust and fresh airsteams shall at all times travel in separated passages, and airsteams shall not mix. The exhaust air transfer ration (EATR) shall be ARI-1060 certified as 0% at balance pressure. The energy recovery core shall meet NFPA 90A and 90B requirements for flame spread, not to exceed 25, and smoke generation, not to exceed 50, through an on going testing and verification program using UL standard 723.

FILTERS:
Furnish 2" pleated filters and filter track on both entering air sides of unit. Filter rack may be integral with unit or installed independently in duct upstream of unit.

FANS:
Centrifugal direct drive on units below 500CFM, belt drive fans on all units above 500CFM. Fans shall be balanced. Motors shall comply with EPACT minimum efficiency standards. Motors shall have internal thermal protection or be provided with appropriately sized motor starters with over current protection.

CONTROLS:
Unit to be furnished with single point power connection and low voltage control relay for start stop operation.

P A R T 3 - E X E C U T I O N

INSTALLATION
Install units in accordance with unit manufacturer's installation requirements in locations indicated on the drawings and as detailed.

Install "filter" gauges for both airstreams to measures air pressure drop through unit while in operation; see Related Work in Part 1.

Install thermometers in both supply and exhaust airstreams at inlet and outlet connections to units; see Related Work in Part 1.

AIR-TO-AIR HEAT EXCHANGERS (Cross Flow Core)
Coordinate insulation of unit casing with section 23 07 00 so that the casing is insulated in the manner specified.

Install filter rack with panel filters where supply and exhaust airstreams enter units. Pipe condensate drain pan to the nearest floor drain.

CONSTRUCTION VERIFICATION ITEMS
Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01 in accordance with the procedures defined for construction verification checklists.

FUNCTIONAL PERFORMANCE TESTING
Contractor is responsible for utilizing the functional performance test procedures supplied under specification Section 01 91 01 or in accordance with the procedures defined for functional performance test procedures.

AGENCY TRAINING
All training provided for agency shall comply with the format, general content requirements and submission guidelines specified under Section 01 91 01

END OF SECTION

SECTION 26 05 00
COMMON WORK RESULTS FOR ELECTRICAL
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

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.

PROJECT OVERVIEW

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
- Project Overview
- 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
- State and/or User Agency Furnished Equipment
- Work by State and/or User Agency
- Provisions for Future Work
- Intent
- Omissions
- Submittals
- Project/Site Conditions
- Asbestos Abatement
- Work Sequence and Scheduling
- Work by Other Trades
- Offsite Storage
- Request and Certificate for Payment
- Salvage Materials
- Certificates and Inspections
- Operating and Maintenance Data
- 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
- Agency Training

RELATED WORK

Applicable provisions of Division 1 govern work under this Section.

01 91 01, or 01 91 02, – Commissioning Process.

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 Wisconsin State Electrical Code Volumes 1 and 2, 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).

All Division 26 work shall be done under the direction of a currently certified State of Wisconsin Certified Master Electrician.

QUALITY ASSURANCE

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.

Manufacturer references used herein are intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

All materials, except medium voltage equipment and components, 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, if available, applicable, and approved by DSF, 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, except for medium voltage equipment and components, shall be so labeled.

CONTINUITY OF EXISTING SERVICES AND SYSTEMS

No outages shall be permitted on existing systems except at the time and during the interval specified by the user agency and by the DSF Project Representative. The institution may require written approval. Any outage must be scheduled when the interruption causes the least interference with normal institutional schedules and business routines. No extra costs will be paid to the Contractor for such outages which must occur outside of regular weekly working hours.

This Contractor shall restore any circuit interrupted as a result of this work to proper operation as soon as possible. Note that institutional operations are on a seven-day week schedule.

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.

SLEEVES AND OPENINGS

SEALING AND FIRESTOPPING

Sealing and firestopping of sleeves/openings between conduits, cable trays, wireways, troughs, cablebus, busduct, etc. and the 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 firestopping. These individuals hired shall normally and routinely be employed in the sealing and fireproofing occupation.

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 DSF's intent (as determined by the DSF Project Manager). Refer to the General Conditions of the Contract for further clarification.

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 DSF's and/or 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 intended to establish a level of quality and performance requirements unless more explicit restrictions are stated to apply.

OMISSIONS

No later than ten (10) days before bid opening, the Contractor shall call the attention of the DSF to any materials or apparatus the Contractor believes to be inadequate and to any necessary items of work omitted.

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. Failure to do this may result in the submittal(s) being returned to the Contractor for correction and resubmission. Failing to follow these instructions does not relieve the Contractor from the requirement of meeting the project schedule.

On request from the DSF, the successful bidder shall furnish additional drawings, illustrations, catalog data, performance characteristics, etc.

Submittals shall be grouped to include complete submittals of related systems, products, and accessories in a single submittal. Mark dimensions and values in units to match those specified. Include wiring diagrams of electrically powered equipment.

The submittals must be approved before fabrication is authorized.

Submit sufficient quantities of submittals to allow the following distribution:

Operating and Maintenance Manuals	2 copies
User agency	2 copies
A/E	1 copy
DSF Field Office	1 copy

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. Obtain permission of DSF before proceeding.

Tools, materials and equipment shall be confined to areas designated by the DSF and user agency.

ASBESTOS ABATEMENT

The State is responsible for identifying Asbestos Containing Materials (ACMs) in State buildings. The Contractor is responsible for marking the extent of the identified ACMs that will be disturbed by the Contractor's work and coordination with an asbestos abatement contractor under a direct contract with the State. The asbestos abatement contractor will require sole occupancy of the work space during asbestos abatement work. Contractor shall communicate with the asbestos abatement contractor and make adequate allowance for the asbestos abatement work in the work schedule. Contractor shall not supply or install any materials that contain any amount of asbestos.

WORK SEQUENCE AND SCHEDULING

Install work in phases to accommodate user agency's occupancy requirements. During the construction period coordinate electrical schedule and operations with DSF's Construction Representatives.

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.

OFFSITE STORAGE

If payment will be requested for approved offsite stored material, then the Contractor shall complete an "Off-site Storage Agreement" which is available from the DSF. Prior approval by DSF personnel for offsite storage will be needed. No material will be accepted for offsite storage unless submittals for the material have been approved.

REQUEST AND CERTIFICATE FOR PAYMENT

Within 10 days after Notice to Proceed, the successful bidder will submit to the DSF in a form prescribed below and by the General Conditions of the Contract, Scheduling and Coordination of Work, Reports, Records and Data, and Payments to Contractor, a cost breakdown of the proposed values for work performed which, if approved by the DSF, will become the basis for construction progress and monthly payments. The cost breakdown items shall reflect actual work progress stages as closely as feasible.

In addition, if payment will be requested for approved off-site stored material, then that material shall be listed as a line item and the Contractor shall complete an "Off-site Storage Agreement" which is available from the DSF.

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

Obtain and pay for all required State installation inspections except those provided by the DSF in accordance with Wis. Adm. Code Section Comm. 50.12. Deliver originals of these certificates to the DSF's Project Representative.

This contractor is responsible for coordination of DSF electrical inspection. Inspection requirements will be issued at a pre-installation meeting, arranged by this contractor and the DSF Electrical Inspector (See Article 15 of the General Conditions).

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. Manufacturer's wiring diagrams for electrically powered equipment.
2. *[A/E and commissioning provider to define detailed operation and maintenance data requirements for this section per agency direction.]*

RECORD DRAWINGS
The Contractor shall maintain at least one copy each of the specifications and drawings on the job site at all times.

The DSF will provide the Contractor with a suitable set of 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 DSF prior to final payment.

PART 2 - PRODUCTS

IDENTIFICATION
See Electrical section 26 05 53 – Identification for Electrical Systems.

NON-RATED PENETRATIONS:

Conduit Penetrations Through Below Grade Walls:
In exterior wall openings below grade, use a modular mechanical type seal consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the uninsulated conduit and the cored opening or a water-stop type wall sleeve.

Conduit and Cable Tray Penetrations:
At conduit and cable tray penetrations of non-rated interior partitions, floors and exterior walls above grade, use urethane caulk in annular space between conduit and sleeve, or the core drilled opening.

PART 3 - EXECUTION

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 and DSF's personnel 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 DSF, 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:

Install approved product in accordance with the manufacturer's instructions where a pipe (i.e. cable tray, bus, cable bus, conduit, wireway, trough, etc.) penetrates a fire rated surface.

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 Surfaces:

When the opening is through a non-fire rated wall, floor, ceiling or roof the opening must be sealed using an approved type of material.

Install escutcheons or floor/ceiling plates where conduit, penetrates non-fire rated surfaces in occupied spaces. Occupied spaces for this paragraph include only those rooms with finished ceilings and the penetration occurs below the ceiling.

In exterior wall openings below grade, assemble rubber links of mechanical seal to the proper size for the conduit and tighten in place, in accordance with the manufacturer's instructions. Install so that the bolts used to tighten the seal are accessible from the interior of the building or vault.

At interior partitions, conduit penetrations are required to be sealed for all clean rooms, laboratories, and most hospital spaces, computer rooms, dormitory rooms, tele/data/com rooms and similar spaces where the room pressure or odor transmission must be controlled. Apply sealant to both sides of the penetration in such a manner that the annular space between the conduit sleeve and the conduit is completely filled.

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.

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.

Contractor to provide factory authorized representative and/or field personnel knowledgeable with the operations, maintenance and troubleshooting of the system and/or components defined within this section for a minimum period of [XX] hours.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

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:

PART 1 - GENERAL
- Scope
- Related Work
- References
- Submittals
- Project Conditions

PART 2 - PRODUCTS
- General
- Building Wire
- Underground Wire for Exterior Work
- Modular Wiring Systems - Light Fixtures
- Modular Wiring Systems - Receptacles
- Wiring Connectors

PART 3 - EXECUTION
- General Wiring Methods
- Wiring Installation In Raceways
- Modular Wiring System Installation
- Wiring Connections and Terminations
- Field Quality Control
- Wire Color
- Branch Circuits
- Emergency Circuits

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 mechanical screw-type connector or mechanical compression-type connector. Connector shall be dual rated (AL7CU or AL9CU) and Listed by UL for use with aluminum and copper conductors, and sized to accept aluminum conductors of the required ampacity. When using compression-type connectors, the lugs shall be marked with wire size, die index, number and location of crimps and shall be suitably color-coded. Using a suitable stripping tool, remove insulation from the required length of the conductor. Wire brush the conductor and apply a Listed joint compound. Tighten or crimp the connection per the connector manufacturer’s recommendation. Wipe off any excess joint compound.

When terminating aluminum conductors to aluminum bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be anodized alloy and conform to current ANSI and ASTM chemical and mechanical property limits. Nuts shall be aluminum alloy and conform to current ANSI standards. Washers shall be flat aluminum alloy, Type A plain, standard wide series conforming to current ANSI standards. Lubricate and tighten the hardware per manufacturer’s recommendations.

When terminating aluminum conductors to copper bus, prepare a mechanical screw-type or compression-type connection. Bolts shall be plated or galvanized medium carbon steel; heat treated, quenched and tempered equal to current ASTM standard or SAE grade 5. Nuts shall conform to current ANSI standards. Washers shall be steel, Type A plain, standard wide series conforming to current ANSI standards. Belleville conical spring washers shall be of hardened steel, cadmium plated or silicone bronze. Lubricate and tighten the hardware per manufacturer’s recommendations.

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. The infrared survey results shall be provided in report form, in the completed O&M manuals.

No copper-to-aluminum transitions permitted when splicing onto existing copper feeders.

Insulation shall have a 600 volt rating.

All conductors shall 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.

This wiring shall be used in all underground applications, except when run in a concrete-encased ductbank.

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 – Use colored wire, or 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.

All switch legs shall be the same color as their associated circuit. Traveler conductors run between 3 and 4 way switches shall be colored pink or purple.

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 a different stripe.

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 colored wire, or 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 single-phase, multi-wire branch circuits with a common neutral is not permitted. All branch circuits shall be furnished and installed with an individual accompanying neutral, sized the same as the phase conductors.

EMERGENCY CIRCUITS

All emergency system wiring (level 1 and level 2) shall be installed in separate raceways after their associated transfer switches. The wiring shall be separate from each other and from all normal system wiring.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

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
- Construction Verification Items

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. Exception: the use of split bolts is acceptable for grounding of wire-basket type cable tray, and for cable shields/straps of medium voltage cable.

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.

Feeder and Branch Circuit Equipment Ground: Size as shown on drawings, specifications or as required by NFPA 70, whichever is larger. Differentiate between the normal ground and the isolated ground when both are used on the same facility.

PART 3 - EXECUTION

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, in exposed locations.

LESS THAN 600 VOLT SYSTEM GROUNDING

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

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

PART 1 - GENERAL

SCOPE
The work under this sections 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.

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.

Power-actuated fasteners and plastic wall anchors are not permitted.

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.

Do not drill structural steel members unless approved by DSF.

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 minimum of four anchors. Provide steel channel supports to stand cabinet one inch (25 mm) off wall (7/8" Uni-strut or ¾" painted, fire-retardant plywood is acceptable).

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
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

PART 1 - GENERAL

SCOPE

The work under this section includes conduits, surface raceways, multi-outlet assemblies, auxiliary gutters, wall duct, and boxes for electrical systems including wall and ceiling outlet boxes, floor boxes, and junction boxes. Included are the following topics:

RELATED WORK

Applicable provisions of Division 1 govern work under this section.

Section 26 27 26 – Wiring Devices.
Section 26 27 02 – Equipment Wiring Systems.

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.

PART 2 - PRODUCTS

RIGID METAL CONDUIT AND FITTINGS

Conduit: Heavy wall, galvanized steel, schedule 40, threaded.

Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

Conduit: Galvanized steel, threaded.

Fittings and Conduit Bodies: Use all steel threaded fittings and conduit bodies.

ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

Conduit: Steel, galvanized tubing.

Fittings: All steel, set screw, concrete tight. No push-on or indenter types permitted.
Conduit Bodies: All steel threaded conduit bodies.

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 NONMETALLIC CONDUIT AND FITTINGS
Conduit: Schedule 40 PVC minimum, Listed, sunlight resistant, rated for 90^0 C conductors.

Fittings and Conduit Bodies: NEMA TC 2, Listed.

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 type deep type, gasketed cover, threaded hubs.

FLOOR BOXES
Floor Boxes for Installation in Cast-In-Place Concrete Floors: Full adjustable.

PULL AND JUNCTION BOXES
Pull boxes and junction boxes shall be minimum 4 inch square (100 mm) by 2 1/8th 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 or larger, pull and junction boxes shall be sized per NEC but not less than 4 11/16 inch square (117 mm).

For telecommunication, fiber optic, security, and other low voltage cable installations the NEC box size requirements shall apply. All boxes, used on telecommunication, security, other low voltage and fiber optic systems with conduits of 1 1/4" and larger, shall be sized per the NEC conduit requirements. For determining box size, the conduit is the determining factor not the wire size.

Sheet Metal Boxes: code gauge galvanized steel, screw covers, flanged and spot welded joints and corners.

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.

Cast Metal Boxes for Outdoor and Wet Location Installations: Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron or aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

Fiberglass or Concrete Handholes with weatherproof cover of non-skid finish shall be used for underground installations.

Box extensions and adjacent boxes within 48" of each other are not allowed for the purpose of creating more wire capacity.

Junction boxes 6" x 6" or larger size shall be without stamped knock-outs.

Wireways shall not be used in lieu of junction boxes.

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.

Wireways, gutters and c-condulets shall not be used in lieu of pull boxes and condulets.

All boxes shall be of sufficient size to provide free space for all conductors enclosed in the box and shall comply with NEC requirements.

PART 3 - EXECUTION

CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

EMT is permitted to be used in sizes 4" (50 mm) and smaller for power and telecommunication 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 (13 mm) minimum except **all homerun conduits shall be ¾",** 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 conduit for all other wiring, including but not limited to data, control, security, fire alarm, telecommunications, signal, video, etc. shall be sized per number of conductors pulled and their cross-section. 40% fill shall be maximum for all new conduit fills.

Arrange conduit to maintain 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.

In general, all conduit shall be concealed 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.

All conduit terminations (except for terminations into conduit bodies) shall use conduit hubs, or connectors with one locknut, or shall use double locknuts (one each side of box wall) and insulated bushing. 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.

Install no more than the equivalent of three 90 degree bends between boxes.

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.

Conduit shall be bent according to manufacturers recommendations. Torches or open flame shall not be used to aid in bend 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 fitting in PVC conduit runs as recommended by the manufacturer.

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 Listed conduit seals to prevent the passage of moisture and water vapor through the conduit.

Route conduit through roof openings for piping and ductwork where possible.

Conduit is not permitted in any slab topping of two inches (50 mm) or less.

Ground and bond conduit under provisions of Section 26 05 26.

Maximum Size Conduit in Slabs Above Grade: 3/4 inch (19 mm). Do not route conduits to cross each other in slabs above grade.

PVC conduit shall transition to galvanized rigid metal conduit before it enters a concrete pole base, foundation, wall (where exposed) 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” below finished grade, whether or not the conduit is concrete encased.

PVC conduit shall be cleaned with solvent, and dried before application of glue. The temperature rating of glue/cement shall match weather condition. Apply full even coat of cement/glue to entire area that will be inserted into fitting. The entire installation shall meet manufacturers recommendations.

CONDUIT INSTALLATION SCHEDULE

Conduit other than that specified below for specific applications shall not be used.

Underground Installations Within Five Feet (1.5 m) of Foundation Wall: Rigid steel conduit.

Underground Installations More than Five Feet (1.5 m) From Foundation Wall: Rigid steel conduit. Plastic-coated rigid steel conduit. Schedule 40 PVC conduit.

Under Slab on Grade Installations: Schedule 40 PVC conduit.

Exposed Outdoor Locations: Rigid steel conduit.

Concealed in Concrete and Block Walls: Rigid steel conduit. Electrical metallic tubing. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Within Concrete Slab: Rigid steel conduit. Schedule 40 PVC conduit. Electrical Nonmetallic Tubing (ENT).

Wet Interior Locations: Rigid steel conduit. [Schedule 40 PVC conduit][PVC coated rigid steel conduit].

Concealed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Exposed Dry Interior Locations: Rigid steel conduit. Intermediate metal conduit. Electrical metallic tubing.

Motor and equipment connections: Flexible PVC coated metal conduit (all locations). Minimum length shall be one foot (300 mm), maximum length shall be three feet (900 mm). Conduit must be installed perpendicular to direction of equipment vibration to allow conduit to freely flex.

Light fixtures: Direct box or conduit connection for surface mounted and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Conduit size shall be 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Conduit length shall allow movement of fixture for maintenance purposes.

Medium Voltage Applications (Interior Locations): Rigid steel conduit.

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.

The 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 raceway and all systems devices shall adhere to the EIA/TIA Category 5e bend radius standard.

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.

Boxes shall not be fastened to the metal roof deck.

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.

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.

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” maximum) outlet boxes in masonry, concrete or tile construction 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.

Low Voltage:

Recessed (1/4” maximum) outlet boxes in masonry, concrete or tile construction shall be minimum 4 11/16 inch square, 2-1/8” deep. 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 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. 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.

FLOOR BOX INSTALLATION

Set boxes level and flush with finish flooring material.

PULL AND JUNCTION BOX INSTALLATION

Locate pull boxes and junction boxes above accessible ceilings, in unfinished areas or furnish and install DSF approved access panels in non-accessible ceilings where boxes are installed. All boxes are to be readily-accessible.

Support pull and junction boxes independent of conduit.

CONSTRUCTION VERIFICATION ITEMS

Contractor is responsible for utilizing the construction verification checklists supplied under specification Section 01 91 01, or 01 91 02 in accordance with the procedures defined for construction verification checklists.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

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 and labeling of inner duct (fiber optic). Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
- Materials

PART 3 - EXECUTION
- General
- Junction and Pullbox Identification
- Power and Control Wire Identification
- Panelboard Directories

RELATED WORK

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

Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
Section 26 27 26 – Wiring Devices

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. Exception: back side of device plates and junction boxes may use handwritten, legible labeling on box covers, unless specifically prohibited by other specification sections.

Cable 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. Labels for power conductors (600V and lower) shall be cloth-type. 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.

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. Machine generated adhesive labels shall be permitted for device plates, 4-11/16" and smaller junction boxes, Fire alarm and control devices.

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, rivets or manufacturer approved adhesive or cement.

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

Provide circuit numbers, and source panel designations for power wiring. Other system shall be identified as shown on details or approved shop drawings. Temperature control shall identify the source.

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.

WIRING DEVICE IDENTIFICATION

Wall switches, receptacles, occupancy sensors, wall dimmers, device plates and box covers, poke-through fittings, access floor boxes, photocells and time clocks shall be identified with circuit numbers and source. In exposed areas, identifications should be made inside of device covers, unless directed otherwise. Use machine-generated labels, or neatly hand-written permanent marker.

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 27 26
WIRING DEVICES
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

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:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals

PART 2 - PRODUCTS
- Wall Switches
- Receptacles
- Occupancy Sensors
- Wall Dimmers
- Device Plates and Box Covers

PART 3 - EXECUTION
- Installation
- Field Quality Control
- Occupancy Sensors
- Adjusting

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Section 01 91 01, or 01 91 02 – Commissioning Process.

SUBMITTALS
Provide product data showing model numbers, configurations, finishes, dimensions, and manufacturer's instructions.

For occupancy sensor shop drawings, the manufacturer’s actual layout of occupancy sensors and the wiring diagrams shall be provided.

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

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, or approved equal.

Handle: Ivory made of nylon or high impact resistant material.

RECEPTACLES
Convenience and Straight-blade Receptacles: NEMA Type 5-20R, ivory 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, Pass & Seymour model PT5362 with 90º connector, Cooper model 5362C, or approved equal.

Generally, all receptacles shall be duplex convenience type unless otherwise noted.

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 2095 or approved equal.

All receptacles on emergency circuits shall have a red face.

All receptacles designated as isolated ground shall have an isolated ground triangle imprint on the face of the receptacle.

Locking-Blade Receptacles: As indicated on drawings.

Specific-use Receptacle Configuration: As indicated on drawings.

MOTION 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, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard single gang switch box.

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 1 to 2 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, or passive infrared and ultrasonic, for detecting room occupancy. The unit shall fit in/on a standard octagon box. All ceiling mounted sensors shall be installed to a box with ring and box support.

Rated capacity shall be 20 amps at 120 or 277 volts, for fluorescent lamps. Provide power pack as required for low voltage sensors.

Sensitivity shall be user adjustable or self adjusting type.

The delay timer shall be adjusted within a range of 6 to 30 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.

See drawings for actual type of sensor.

DEVICE PLATES AND BOX COVERS

Decorative Cover Plate: Ivory 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.

PART 3 - EXECUTION

INSTALLATION

Install wall switches 48 inches 1.2m above floor, OFF position down.

Install wall dimmers 48inches 1.2 m above floor; de-rate ganged dimmers as instructed by manufacturer; do not use common neutral.

Install convenience receptacles 48 inches above floor, above grounding pole on bottom.

Install box for information outlet 48" above finished floor. Install box for telephone jack for wall telephone above finished floor.

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.

The user agency and DSF personnel reserve the right to be present at all tests.

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, and on the back of the device cover.

END OF SECTION

SECTION 26 29 00
LOW-VOLTAGE CONTROLLERS
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

PART 1 - GENERAL

SCOPE
The work under this section includes manual motor starters, magnetic motor starters. Included are the following topics:

RELATED WORK
Applicable provisions of Division 1 shall govern work under this Section.

Section 26 05 29 – Hangers and Supports for Electrical Systems.

COORDINATION WITH OTHER TRADES
Motors: In general, all electric motors required for this installation will be supplied with equipment, apparatus and/or appliances covered under other sections of the specifications.

For the sake of consistency and conformity of manufacturer, design and construction, all motors shall conform to the following description unless otherwise noted or required.

- Motors 1/3 HP and smaller shall be wound for operation on single phase, 60 Hz. service unless otherwise noted.
- Motors 1/2 HP and above shall be wound for operation on 3 phase, 60 Hz service unless otherwise noted.
- Refer to drawings in each case in order to verify voltage characteristics required.

Equipment:
All building utility motors such as fans, pumps, overhead doors, etc., together with certain "controlling equipment" for same, except motor starters and related apparatus, will be furnished under other sections of the specifications and delivered to the building site unless specifically noted otherwise. The above mentioned "controlling equipment" pertains to electrical thermostats, electro-pneumatic and pneumatic-electric and detection devices, or any other device not purely electrically operating in nature.

The Electrical Trade shall set and connect all specified starting equipment, install all power conduits and wiring and shall furnish and make all connections from starting equipment to motors as required to leave the apparatus in running condition.

Wiring Connections:
Furnish branch circuits for all motors to the starting equipment and then to the motors, complete with all control wiring for automatic and remote control where required or noted. Conduits to motors shall terminate in the conduit fittings on the motors, the final connection being made with flexible, PVC-coated metal conduit.

Provide all necessary labor and material to completely connect all electrical motors and controls (where required) in connection with the building utility equipment, including fans, pumps, overhead door operators, etc.

All conduits and wiring required for control work from the holding coil circuit of the starter, including the furnishing and installation of control devices such as auxiliary contacts, control relays, time delay relays, pilot lights, selector switches, alternators, etc., shall be provided and installed by other trades unless otherwise indicated.

Power Branch Circuits:
Wire sizes for branch circuits not specifically called for on drawings or in specifications shall be based on 125 percent of the full load current of the motor unless the voltage drop of motor branch circuits exceeds 1-1/2 percent from the distribution panel to the motor; in which case, voltage drop shall govern wire sizes. A power factor of 80 percent shall be used for motors in such calculations.

REFERENCES
ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
ANSI/UL 198E - Class R Fuses.
NEMA AB 1 - Molded Case Circuit Breakers.
NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies.
NEMA KS 1 - Enclosed Switches.
NEMA PB 1 - Panelboards.
NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

SUBMITTALS
Indicate on shop drawings, front and side views of motor control center enclosures with overall dimensions. Include conduit entrance locations and requirements; nameplate legends; size and number of bus bars per phase, neutral and ground; electrical characteristics including voltage, frame size and trip ratings, withstand ratings, and time-current curves of all equipment and components.

Provide product data on motor starters and combination motor starters, relays, pilot devices, and switching and 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.

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 manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to motor control center components, enclosure, and finish.

SPARE PARTS
Keys: Furnish two (2) each to Owner.

Provide three (3) spares of each size and type fuse used. Provide enclosure for spare fuses.

Fuse Pullers: Furnish one fuse puller to Owner.

PART 2 - PRODUCTS

CONTROLLER OVERCURRENT PROTECTION AND DISCONNECTING MEANS
[Molded Case Thermal-Magnetic Circuit Breakers: NEMA AB 1; circuit breakers with integral thermal and instantaneous magnetic trip in each pole.]

[Motor Circuit Protector: NEMA AB 1; circuit breakers with integral instantaneous magnetic trip in each pole.]

[Nonfusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position.]

[Fusible Switch Assemblies: NEMA KS 1; quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle. Provide interlock to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: [Designed to accommodate Class R fuses.]]

FUSES

Fuses 600 Amperes and Less: Dual element, time delay, [250] [600] volt, UL Class [RK 1.] [RK 5.] Interrupting Rating: 200,000 rms amperes.

PART 3 - EXECUTION

INSTALLATION

Install motor control equipment in accordance with manufacturer's instructions.

Motor Starter Panelboard Installation: In conformance with NEMA PB 1.1.

Select and install heater elements in motor starters to match installed motor characteristics.

Motor Data: Provide neatly typed label inside each motor starter enclosure door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating.

END OF SECTION

SECTION 26 51 13
INTERIOR LIGHTING FIXTURES, LAMPS, AND BALLASTS
BASED ON DSF MASTER ELECTRICAL SPEC DATED 5/1/08

PART 1 - GENERAL

SCOPE
The work under this section includes interior luminaires and accessories, exit signs, lamps, and ballasts. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Submittals
- Operation and Maintenance Data
- Extra Material

PART 2 - PRODUCTS
- Interior Luminaires and Accessories
- Lamps
- Fluorescent Ballasts

PART 3 - EXECUTION
- Installation
- Adjusting and Cleaning
- Interface with Other Products
- Field Quality Control
- All Fixture Connections Including Master-Slave
- Construction Verification Items
- Agency Training

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

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 in the following example table format, and submit catalog cuts with highlighted catalog numbers and required accessories.

LUMINAIRE		BALLAST	LAMP	ANSI INPUT WATTS
Type	Manufacturer and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	Manufacturer, Quantity per Fixture, and Catalog No.	

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 fixture type, but not less than one (1) fixture of each type.

Provide ten (10) percent of each lamp type, but not less than one (1) of each type.

Provide three (3) percent of each ballast type, but not less than one (1) ballast of each type.

PART 2 - PRODUCTS

INTERIOR LUMINAIRES AND ACCESSORIES
See the Lighting Fixture Schedule on the drawings, for type of fixtures and catalog numbers. Catalog numbers are shown on the drawings for quality and performance requirements only. Fixtures manufactured by others are equally acceptable provided they meet or exceed the performance of the indicated fixtures, and meet the intent of the design.

Provide fluorescent fixtures with quick-connect disconnecting means, similar to Thomas & Betts Sta-Kon.

LAMPS

General Use Incandescent Lamps and Incandescent Reflector Lamps:

- Rated 130 volts.

Four Foot Fluorescent Lamps: High Performance T8 Lamps:

- Minimum 3000 initial lumens and minimum of 2820 mean lumens.
- Minimum 24,000 hour rated life at three-hour starts.
- Color Rendering Index (CRI) of 81 or higher.
- 5000ºK color temperature.
- Lamps shall be suitable for use with instant start ballasts and occupancy sensors.
- Lamps shall meet "TLCP" requirements for low mercury.
- Mean system efficiency equal to 90MLPW minimum, with instant start ballasts.

Acceptable lamp manufacturers and catalog numbers are (or equal):

Philips F32T8/ADV85/ALTO
GE F32T8/XL/SPX50/HL/ECO
Sylvania F032/850/XP/ECO
SLI Lighting F32T8/HL/850
Standard Products F32T8/850/XL31
MaxLite F32T8/850XL
Technical Consumer Products, Inc. F32T8/850/H

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.

Compact Fluorescent Lamps:

Compact fluorescent lamp temperature shall be 5000ºK with a color rendering index (CRI) at or above 80. See lighting fixture schedule on drawings.

HID Lamps:

Metal halide HID lamps shall be pulse-start, clear coated, suitable for all burning positions, and shall have a maintenance factor of 0.75 or greater and CRI of 65 or higher. High pressure sodium lamps shall be clear coated and suitable for all burning positions. See lighting fixture schedule on drawings.

All lamps shall be new.

FLUORESCENT BALLASTS

All fluorescent ballasts shall be electronic type and shall meet the following specs:

- UL Listed (Class P) sound rating A and CSA certified.
- Comply with EMI and RFI limits set by the FCC (CFR 47 part 18) or NEMA and not interfere with normal electrical equipment.
- Meet any applicable standards set forth by ANSI.
- Be potted or conformal coated in a metallic case and not contain PCBs.
- Provide normal rated lamp life as stated by lamp manufacturers (i.e. rated life at 3 hour burn time per start).
- Provide independent test results from an approved testing laboratory for all of the specifications below. This is required for all submitted ballasts.
- Nominal power factor of .90 or higher.
- Total harmonic distortion of less than 10% at 120 or 277 volts (universal voltage).
- Ballast factor 0.70 through 1.2, as shown on the lighting fixture schedule.
- Frequency of operation shall be 40 kHz - 50 kHz and units shall operate without visible flicker.
- Ballast efficiency factor shall meet Consortium of Energy Efficiency (www.cee1.org) specifications (adopted by Focus on Energy program).
- Multi-lamp ballasts shall operate in parallel so that when one lamp burns out, the other lamps will continue to operate at full light output.
- Ballast Efficiency Factor (BEF) shall be as shown in the table below.

Number of Lamps	Low (BF ≤ 0.85)	Normal (0.85 < BF ≤ 1)	High (BF > 1.0)
INSTANT – START BALLASTS (T8 lamps)			
1	≥ 3.08	≥ 3.11	N.A.
2	≥ 1.60	≥ 1.58	≥ 1.55
3	≥ 1.04	≥ 1.05	≥ 1.04
4	≥ 0.79	≥ 0.80	≥ 0.77
PROGRAMMED – START BALLASTS (T5 lamps)			
1	≥ 2.85	≥ 2.84	N.A.
2	≥1.48	≥1.47	≥ 1.51
3	≥ 0.97	≥ 1.00	≥ 1.00
4	≥ 0.76	≥ 0.75	≥ 0.75

- Ballasts shall carry a minimum 5 year warranty with a $10 replacement labor allowance.
- Ballasts shall not be affected by lamp failure.
- Ballasts shall be a standard production item.
- Ballasts shall be marked with manufacturer's name, part number, supply voltage, power factor, open circuit voltage, current draw for each lamp type and UL Listing.
- Ballasts shall withstand line transients as defined in IEEE 587, Category A.
- SYSTEM PERFORMANCE: System performance for instant-start ballasts shall be as follows:

1. Instant-Start, Low Ballast Factor (BF = 0.77-0.78)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	25
2 – F32T8	32	48
3 – F32T8	32	73
4 – F32T8	32	97

2. Instant-Start, Normal Ballast Factor (BF = 0.87-0.88)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	28
2 – F32T8	32	56
3 – F32T8	32	83
4 – F32T8	32	109

- SYSTEM PERFORMANCE: System performance for programmed-start ballasts shall be as follows:

1. Programmed-Start, Low Ballast Factor (BF = 0.71)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	25
2 – F32T8	32	47
3 – F32T8	32	73
4 – F32T8	32	93

2. Programmed-Start, Normal Ballast Factor (BF = 0.88)

Lamps	Nominal Lamp Watts	System Input (Watts @ Univ Volt)
1 – F32T8	32	31
2 – F32T8	32	60

3 – F32T8	32	88
4 – F32T8	32	118

Acceptable ballast manufacturer's names and product lines are as follows:
Osram Sylvania – Quicktronic High Efficiency and Quicktronic PROstart.
GE Lighting – Ultramax and UltraStart.
Maxlite – High Efficiency Ballast.
Advance – Optanium.
Universal Lighting Technologies – F32T8.

Manufacturer names are used to develop quality and performance requirements only. All manufacturers and their products shall meet the system performance requirements and this entire specification.

PART 3 - EXECUTION

INSTALLATION

Install in accordance with manufacturer's instructions.

Install suspended luminaires and exit signs using pendants supported from swivel hangers. Heavy duty jack chain supports may be used where indicated on the fixture schedule. Provide pendant or chain length required to suspend luminaire at indicated height.

Support luminaires larger than 2 x 4 foot (600 x 1 200 mm) size independent of ceiling framing.

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 fixture supports as required. Fixture installations with fixtures supported only by insecure boxes will be rejected. It shall be the Contractor's responsibility to support all lighting fixtures adequately, providing extra steel work for the support of fixtures if required. Any components necessary for mounting fixtures 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] [Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires] [Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips]. Provide independent support for all fixtures over 50 lbs.

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.

Install accessories furnished with each luminaire.

Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

Bond fixtures and metal accessories to branch circuit equipment grounding conductor.

Install specified lamps in each luminaire and exit sign.

HID Luminaires: Use power hook hangers rated 500 pounds (225 kg) minimum or provide safety chain between ballast and structure. Provide safety chain between reflector and ballast.

All lamps shall be delivered to the job in sealed cartons and protected from dirt and dust during storage on the project. Lamps shall be taken directly from the cartons and installed in the fixture with special care so that they do not become dusty and are not soiled in the operation.

Lamps installed in fixtures using dimming ballasts shall be burned in at 100% rated output by the contractor for a minimum of 100 hours as recommended by the ballast manufacturer.

All new lamps shall be operational at the Substantial Completion of the project.

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.

FIELD QUALITY CONTROL

Operate each luminaire after installation and connection. Inspect for proper connection and operation.

ALL FIXTURE CONNECTIONS INCLUDING MASTER-SLAVE

Direct box or conduit connections for surface and recessed fixtures. Flexible metal conduit from a J-box for recessed lay-in light fixtures. Flexible metal conduit shall be minimum 3/8" (10 mm) minimum diameter and six foot (1.8 M) maximum length. Flexible whip between master and slave fixtures may be supported off of the ceiling grid wires. Conduit length shall allow movement of the fixture for maintenance purposes. Minimum wire size shall be #18 AWG for single fixture or master-slave fixture.

The flexible connectors shall be all steel, galvanized, clamp type with locknut or snap-in connector including those used on the master-slave unit.

END OF SECTION

Department of Military Affairs
Convert Indoor Weapons Range
1215 Wall Street
Oconomowoc, WI.
JULY 17, 2008

PROJECT LOCATION: DEPARTMENT OF MILITARY AFFAIRS
ARMORY BUILDING
1215 Wall Street
Oconomowoc, WI.

CONTACT: DIVISION OF STATE FACILITIES
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7th FLOOR
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MADISON, WI 53707

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(608) 267-2710 FAX

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ATTN.: TONY GARZA, AIA

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(262) 652-2435 FAX

MECHANICAL: SOUTHPORT ENGINEERED SYSTEMS, LLC
6919 51st STREET
KENOSHA, WI 53144
ATTN.: TIM PANN

(262) 654-6440
(262) 654-6404 FAX

ELECTRICAL: BECKER ELECTRICAL GROUP
4210-43rd AVENUE
KENOSHA, WI 53144
ATTN.: JAMES A. BECKER

(262) 654-5393
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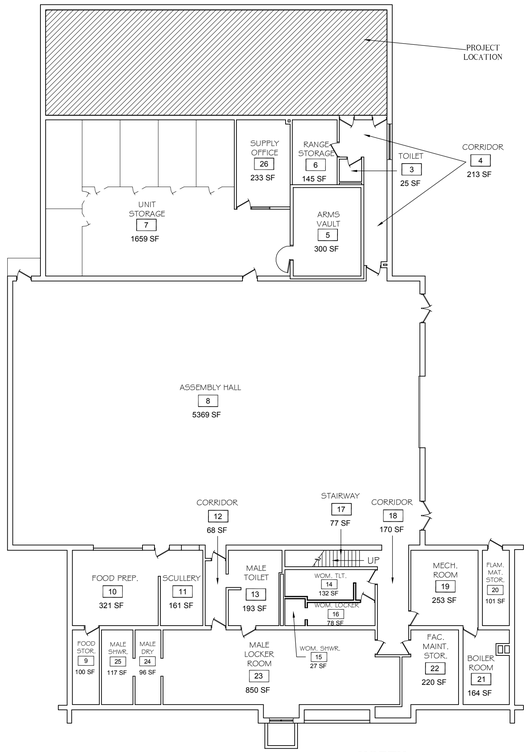
(262) 654-0686 FAX

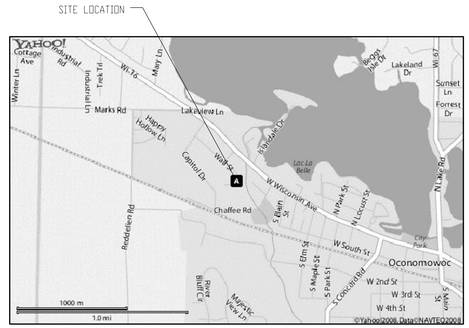


1 1ST FLOOR PLAN
1 SCALE: NTS

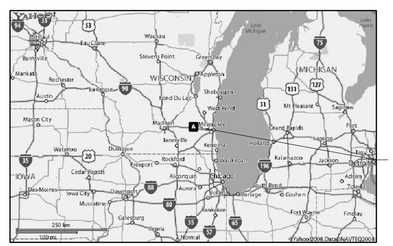
NORTH

TGAR GROUP, Inc.
ARCHITECTURE · ENGINEERING · CONSTRUCTION
DESIGN BUILD

SHEET INDEX



VICINITY MAP STREET



VICINITY MAP STATE

TGAR

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State of Wisconsin
Department of Administration
Division of State Facilities

Agency / Institution:
Department of Military Affairs
Oconomowoc

Project Title:
Department of Military Affairs
Convert Indoor Weapons Range

Project Location:
1215 Wall Street
Oconomowoc, WI.

Sheet Title:
Title Sheet

Revisions:

No.	Date:	By:	Description:

Scale	AS NOTED
Graphic Scale	
DSF Number	06K3E
Set Type	BD
Date Issued	07/17/2008
Sheet Number	T100

DOOR SCHEDULE

DR #	FIRST FLOOR AREA	SIZE	GENERAL: DOOR TYPE	GENERAL: FRAME TYPE	GENERAL: MATERIAL DOOR	GENERAL: MATERIAL FRAME	GENERAL: DETAIL	HARDWARE: BUTTS 1.5 PAIR STANDARD	BUTTS 1.5 PAIR BALL BEARING	LATCH SETS-LOCK SETS: CYLINDER	PASSAGE (MORTISE)	STOREROOM (MORTISE)	ENTRANCE (MORTISE)	PASSAGE (CYLINDRICAL)	STOREROOM (CYLINDRICAL)	PRIVACY (CYLINDRICAL)	OFFICE (CYLINDRICAL)	MISC.: PUSH/PULL	WALL STOP	FLOOR STOP	HEAVY DUTY CLOSER	STANDARD DUTY CLOSER	ACCESSORIES: THRESHOLD PER ADA REQ'S	PANIC HARDWARE	DRIP CAP	WEATHERSTRIPPING	NOTES
100	STORAGE	3'-0" x 7'-0" x1.75"	A	1	HM	HM	3/6		●				●										●		●	●	INSULATE DOOR, GROUT FRAME
101	MECHANICAL	3'-0" x 6'-8" x1.75"	A	2	HM	HM	4	●							●								●		●	●	INSULATE DOOR, GROUT FRAME

GENERAL NOTES:
1. FIELD VERIFY ALL DIMENSIONS PRIOR TO FABRICATION.
2. ALL HANDLES TO BE LEVERS, UNLESS NOTED OTHERWISE.

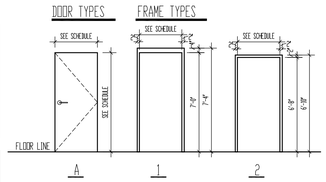
ROOM SCHEDULE

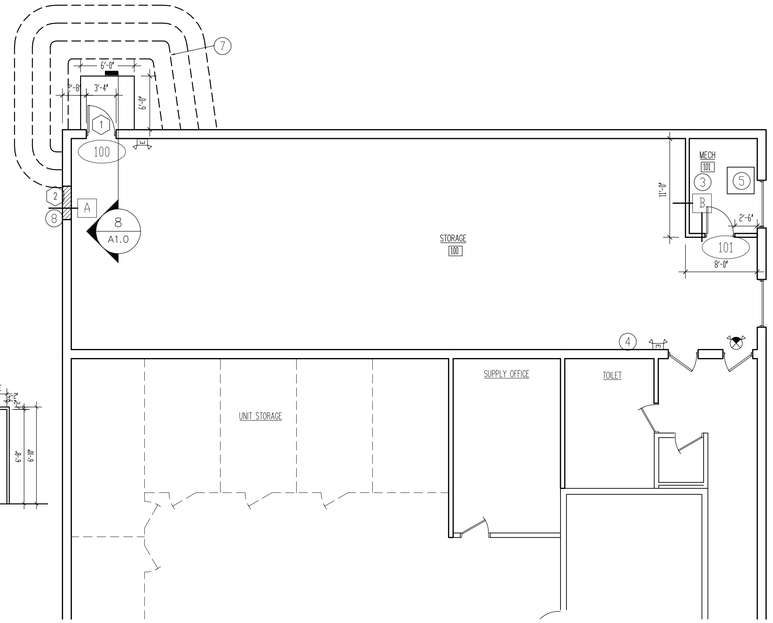
ROOM #	ROOM NAME	HEIGHT	WALLS: NORTH	SOUTH	EAST	WEST	WALL MATERIAL	FLOOR	BASE	CEILING	FINISH AT CEILING	REMARKS
100	STORAGE	8'-0"	P-1	P-1	P-1	P-1	CMU	SEALED CONCRETE	NONE	ACT	---	
101	MECHANICAL	8'-0"	P-1	P-1	P-1	P-1	CMU / DRYWALL	SEALED CONCRETE	NONE	ACT	---	

FINISH SELECTION KEY

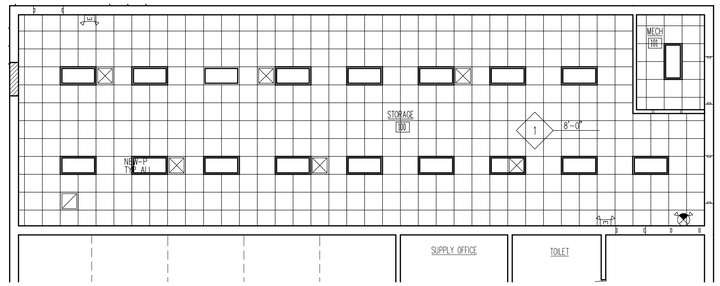
P-1	SATIN PAINT: SHERWIN WILLIAMS "PROMAR 200", INTERIOR LATEX - 1 PRIMER COAT, 2 FINISH COATS.
P-2	STEEL PAINT: SHERWIN WILLIAMS PROMAR SYSTEM: 1 COAT CLASSIC LATEX PRIMER, 2 COATS "PROMAR 400" SATIN LATEX.

DOOR TYPES / FRAME TYPES



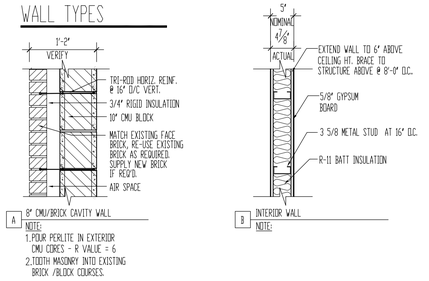


1 FLOOR PLAN
1/8" = 1'-0"



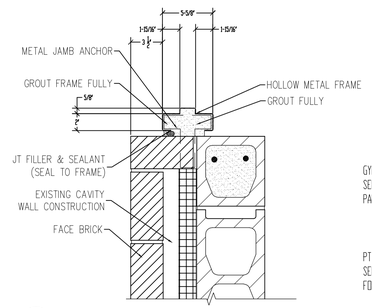
2 REFLECTED CEILING PLAN
1/8" = 1'-0"

WALL TYPES

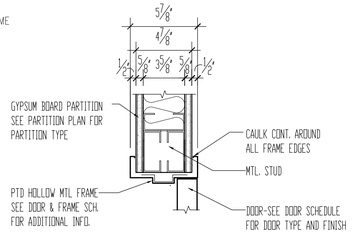


A 8" CMU/BRICK CAVITY WALL
NOTE:
1. POUR PERLITE IN EXTERIOR CMU CORES - R VALUE = 6
2. TOOTH MASONRY INTO EXISTING BRICK /BLOCK COURSES.

B INTERIOR WALL
NOTE:



3 TYP DOOR JAMB INSTALLATION
NO SCALE



4 TYP DOOR JAMB INSTALLATION
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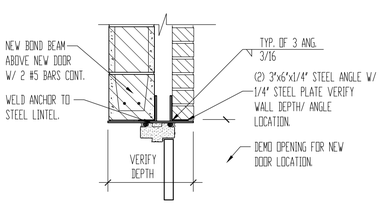
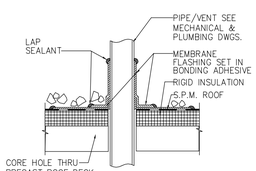
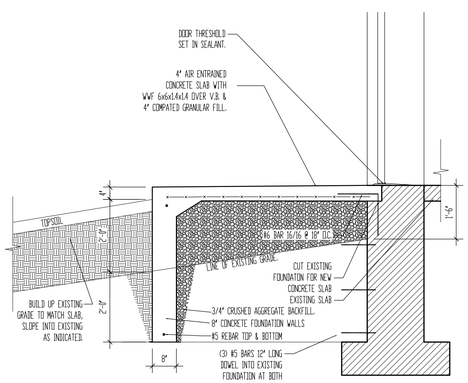


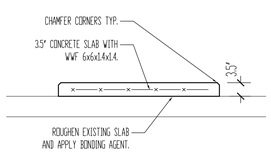
6 LOUVER DETAIL
NO SCALE



7 DETAIL - PIPE PENETRATION
N.T.S



8 DETAIL - EXTERIOR STAIR
1/2" = 1'-0"



9 DETAIL - HOUSEKEEPING PAD
3/4" = 1'-0"

SYMBOL DESIGNATIONS

- # — DOOR TAG – SEE DOOR SCHEDULE
- (#) — SEE CONSTRUCTION NOTES
- # — EQUIPMENT TAG
- # — PARTITION TYPES TAG

CONSTRUCTION NOTES (#)

1. CONTRACTOR TO VERIFY EXISTING CONDITIONS PRIOR TO SUBMISSION OF BIDS.
2. CONTRACTOR TO FIELD VERIFY ALL DIMENSIONS, ADJUST AS REQUIRED.
3. DRILL HOLE FOR 5" FURNACE VENT THRU ROOF. FLASHING KIT AS REQ'D TO MAINTAIN ROOF WARRANTY. SEE DET#. 7.
4. PATCH / MATCH CMU AT OLD SWITCH LOCATION.
5. 36"x 36" x 3.5" CONCRETE HOUSEKEEPING PAD FOR NEW FURNACE. SEE DETAIL #9. COORDINATE LOCATION WITH MECHANICAL CONTRACTOR.
6. INSTALL NEW LOUVERS WHERE INDICATED ON MECHANICAL DRAWINGS.
7. STRIP TOPSOIL, PROVIDE 8 CUBIC YARDS OF CLAY FILL. SLOPE GRADE FROM CONCRETE PAD TO EXISTING GRADE. RE-SPREAD TOPSOIL. SEE DETAIL 8 / A1.0. PROVIDE NEW TOPSOIL AT NEWLY GRADED AREA. INSTALL GRASS SEED OVER TOPSOIL.
8. CLOSE OFF OLD LOUVER LOCATION WITH CMU AND BRICK VENEER TO MATCH EXISTING WALL SYSTEM.

GENERAL DEMOLITION NOTES

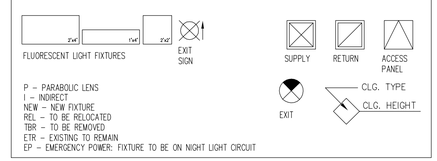
1. REVIEW WITH OWNER ALL SALVAGEABLE COMPONENTS BEING REMOVED PRIOR TO DISCARDING OR REMOVING MATERIALS.
2. COORDINATE ALL CAPPING OF MISCELLANEOUS SYSTEMS WHICH END AT FIXTURES, WALLS, OR CEILINGS TO BE REMOVED. CAPPING SHALL BE COMPLETED IN SUCH A MANNER THAT WILL NOT INTERFERE WITH NEW WORK OR BE VISIBLE IN FINISHED SPACES.
3. COORDINATE REMOVAL, RELOCATION, AND REROUTING (AS REQUIRED) OF ALL MECHANICAL OR ELECTRICAL PIPES, CONDUITS, VENTS, CONTROLS, ETC., WHICH ARE LOCATED IN WALLS, FLOORS, OR CEILINGS TO BE REMOVED.
4. REMOVE ALL EXISTING WALL MOUNTED ITEMS NOT REQUIRED PATCH HOLES TO MATCH EXISTING CONDITIONS PRIOR TO PAINTING.
5. GENERAL CONTRACTOR TO REMOVE ALL ITEMS WHICH MIGHT INTERFERE ANY NEW WORK ITEMS. CAREFULLY SET ASIDE AND PROTECT.

KEYED DEMOLITION NOTES

REFERENCED WITH HEXAGONS ON PLAN (X)

1. DEMO EXISTING MASONRY WALL TO EXTENTS SHOWN FOR INSTALLATION OF NEW DOOR AND FRAME. SAVE FACE BRICK FOR RE-USE AT FILL-IN LOCATIONS.
2. DEMO EXISTING LOUVER ENTIRELY.

CEILING PLAN LEGEND



CEILING PLAN GENERAL NOTES

ALL CEILINGS TO BE TYPE 1 UNLESS NOTE OTHERWISE ON REFLECTED CEILING PLAN.
ALL CEILING HEIGHTS TO BE 8'-0" UNLESS NOTED OTHERWISE ON REFLECTED CEILING PLAN.
PROVIDE DUAL LEVEL SWITCHING AND (3) LAMP FIXTURES IN ALL ROOMS OVER 100 SQ. FT. IN AREA.
ALL CEILING TILE TO BE 2' X 2' LAY-IN REGRESSED EDGE ACOUSTICAL TYPE.

CEILING TYPES

1 — 2'x2' LAY-IN ACOUSTICAL CEILING TILE (ACT-1)

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State of Wisconsin
Department of Administration
Division of State Facilities

Agency / Institution:
Department of Military Affairs
Oconomowoc

Project Title:
Department of Military Affairs
Convert Indoor Weapons Range

Project Location:
1215 Wall Street
Oconomowoc, WI.

Sheet Title:
Floor Plan, Wall Types, Details, Notes

Revisions:

No.	Date:	By:	Description:

Scale	AS NOTED
Graphic Scale	
DSF Number	05K3E
Set Type	BD
Date Issued	07/17/2008
Sheet Number	A100

PANEL SCHEDULE "LIGHTING"

I-T-E PANEL BOARD "C"
208 V 120 V
225 AMPS
DATE 10/05
S.O. 17-69310-3

PANEL C — FED FROM

1		LIGHTS/ RANGE STG. AND COR.	22	✳ LIGHTS FIRING RANGE
2		ALARM EQUIPMENT	23	REC. BATH
3		REC. SUPPLY OFFICE	24	✳ SPARE
4	✳	~~REC. WALL RANGE~~	25	
5		HEATERS/ RANGE	26	
6	✳	~~REC. WALL RANGE~~	27	
7		LIGHTS THIS ROOM	28	
8		LIGHTS SUPPLY OFF/ VAULT	29	
9		WATER HEATER REC/ TOILET	30	
10	✳	FURNACE	31	
11	✳	ERV - 1 (30 AMP 120v 1 P)	32	
12	✳	F - 1 (20 AMP 120v - 1P)	33	
13	✳	SPARE	34	
14		SPARE	35	
15		REC. CORRIDOR	36	
16		REC. UNIT STG. ROOM	37	
17	✳	LOCKER ROOM LIGHTS	38	
18	✳	LOCKER ROOM LIGHTS	39	
19	✳	LOCKER ROOM RECEPTACLES	40	
20	✳	LOCKER ROOM RECEPTACLES	41	
21	✳	EMERGENCY LIGHTS	42	

✳ CIRCUITS TO BE REWORKED

LEGEND

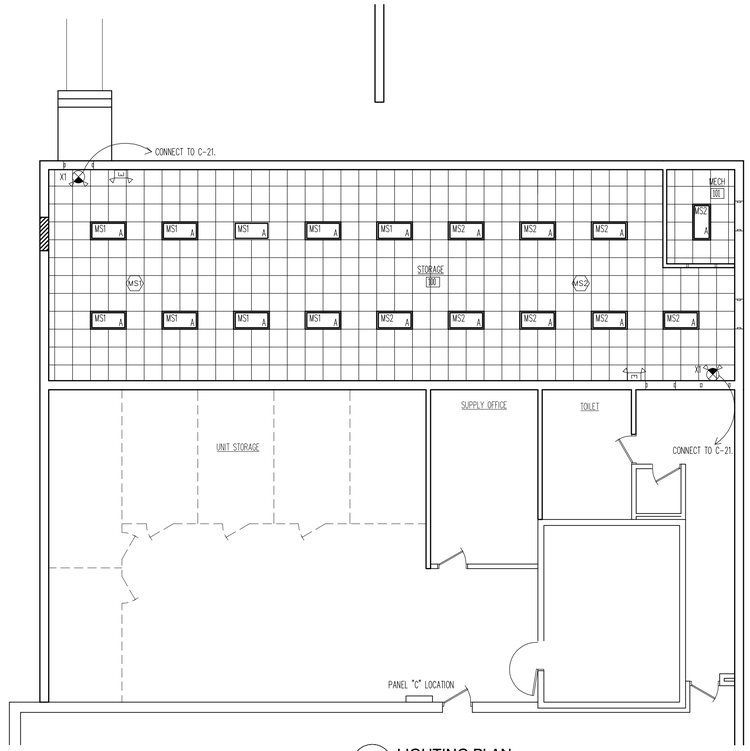
- 2x4 LAY-IN FIX. 3 LAMPS
- X1 — EXIT LIGHT W/ TWIN BEAM EM. LIGHTS
- EM — TWIN BEAM EMERGENCY BATTERY UNIT
- DUPLEX RECTACLE
- MS — MOTION SENSOR INDICATES CIR.
- DISCONNECT SWITCH

NOTE:

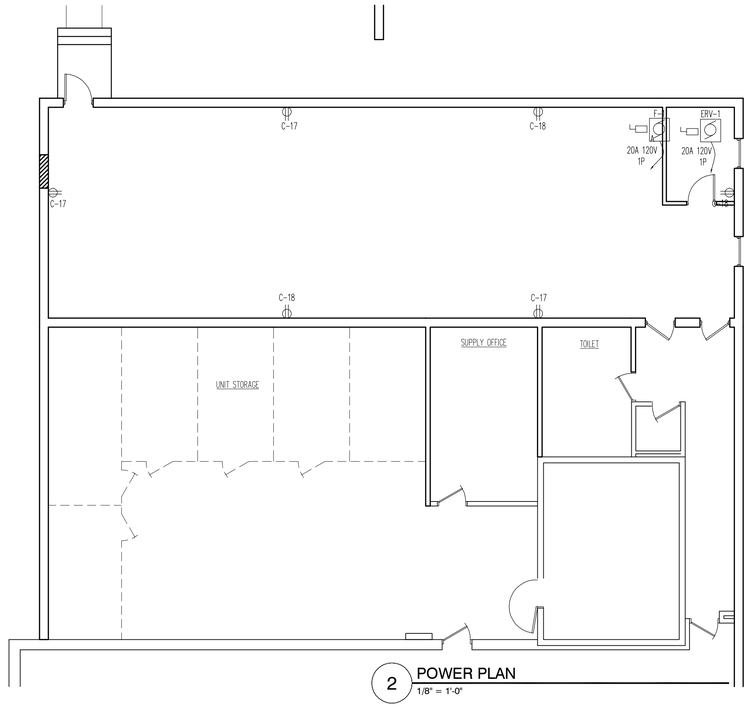
1. UTILIZE EXISTING CIRCUITS FROM PANEL C.
2. SURFACE MOUNT ALL OUTLET CONDUITS.
3. MOUNT CONDUITS AT 16" UNLESS NOTED OTHERWISE.
4. USE NEMA 3R DISCONNECT SWITCH FOR EXTERIOR LOCATIONS, AND NEMA 1 DISCONNECT FOR INTERIOR LOCATIONS.
5. PROVIDE 3#12 WIRING TO NEW LIGHT FIXTURES.

TYPE	STYLE	LAMPS	MANUFACTURER	PART NUMBER
A	2x4 LAY IN ACRYLIC LENS	(3) F32 T8	LITHONIA	2GT8 332 A12 120 GEB
EM	BATTERY BACK UP EXIT	INC.	LITHONIA	ELM2
X1	EXIT WITH EMERGENCY HEADS	INC	LITHONIA	LHQM S W 1 R 120/277 N

NOTE:
1. METALUX OR COLUMBIA FIXTURES OR APPROVED EQUALS ARE ACCEPTABLE.



1 LIGHTING PLAN
1/8" = 1'-0"



2 POWER PLAN
1/8" = 1'-0"

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State of Wisconsin
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Agency / Institution:
Department of Military Affairs
Oconomowoc

Project Title:
Department of Military Affairs
Convert Indoor Weapons Range

Project Location:
1215 Wall Street
Oconomowoc, WI.

Sheet Title:
Electric Plan, Lighting Plan

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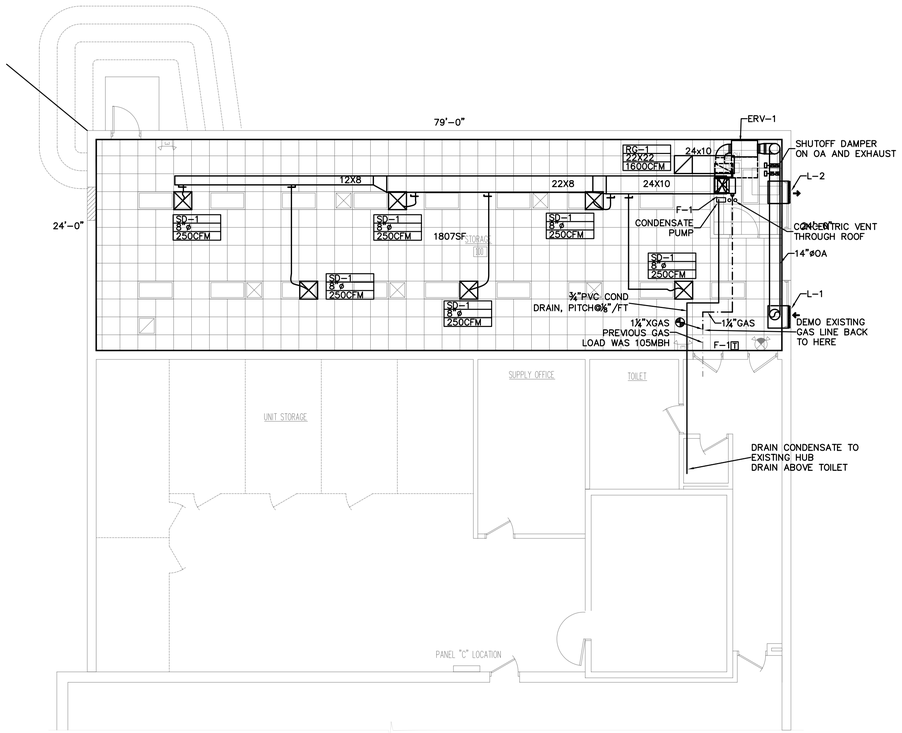
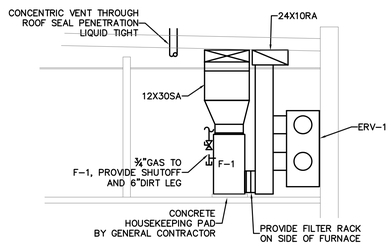
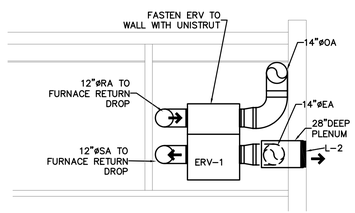


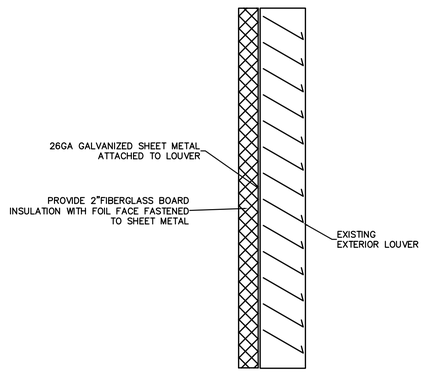
HVAC FLOOR PLAN
SCALE: 1/8"=1'-0"



1 H100 HVAC SECTION LOOKING WEST
SCALE: 1/4"=1'-0"



2 H100 HVAC SECTION LOOKING NORTH
SCALE: 1/4"=1'-0"



3 H100 BLANK OFF LOUVER DETAIL
SCALE: No Scale

GRILLES, REGISTERS, AND DIFFUSERS SCHEDULE

TAG	TYPE	MOUNTING	AIR FLOW CFM	NECK SIZE	FACE SIZE	# OF SLOTS	MATERIAL	MODEL	MANUFACTURER	NOTES
SD-1	SUPPLY	LAYIN	AS SHOWN	8"ø	24X24	NA	STEEL	SPD	PRICE	1,2
RG-1	RETURN	LAYIN	1600	22X22	24X24	NA	STEEL	530	PRICE	1,2

NOTES:
1. WHITE BAKED ENAMEL FINISH
2. MANUFACTURER LISTED IS FOR BASIS OF DESIGN, SEE SPECS FOR APPROVED ALTERNATE MANUFACTURERS

FURNACE SCHEDULE

TAG	SERVES	AIR FLOW CFM	OA CFM	HEATING SECTION				ESP	ELECTRICAL			MODEL	MANUFACTURER	NOTES
				TYPE	MBH IN	MBH OUT	LAT DB		V/ø/HZ	MCA	MOCP			
F-1	SPACE	1600	900	GAS	100	92	93	0.7	120/1/60	10.2	15	58MCB100-16	CARRIER	1,2,3,4

NOTES:
1. PROVIDE 2"PLEATED FILTER RETURN CONNECTIONS ON SIDE AND BOTTOM
2. MOUNT ON CONCRETE PAD
3. MANUFACTURER LISTED IS FOR BASIS OF DESIGN, SEE SPECS FOR APPROVED ALTERNATE MANUFACTURERS
4. PROVIDE LITTLE GIANT OR BECKETT CONDENSATE PUMP RATED AT 18GPH@12' HEAD, 120/1/60, 1/18HP, 2QT TANK CAPACITY

LOUVER SCHEDULE

TAG	SERVES	PD IN WC	NOMIMAL CFM	VELOCITY FPM	SIZE (IN)		MODEL	MANUFACTURER	NOTES
					WIDTH	HEIGHT			
L-1	ERV-1 OA	--	900	125	64	40	EXISTING	EXISTING	1
L-2	ERV-1 EA	--	900	125	64	40	EXISTING	EXISTING	1

NOTES:
1. USE 30" WIDE SECTION OF EXISTING LOUVER BLANK OFF THE REST OF THE LOUVER

ENERGY RECOVERY VENTILATOR

TAG	SERVES	NOMINAL CFM	SUMMER TEMPS			WINTER TEMPS			TOTAL EFFICIENCY		ELECTRICAL			MODEL	MANUFACTURER	WEIGHT LBS	NOTES
			OUTSIDE	ROOM	SUPPLY	OUTSIDE	ROOM	SUPPLY	WINTER	SUMMER	V/ø/HZ	MCA	MOCP				
ERV-1	F-1	900	90/73	--	--	-11/-11.9	65/47	40.6/30.5	65%	--	120/1/60	19.4	25	HE1XINV	RENEWAIRE	145	1,2

NOTES:
1. MOUNT ERV ON WALL
2. MANUFACTURER LISTED IS FOR BASIS OF DESIGN, SEE SPECS FOR APPROVED ALTERNATE MANUFACTURERS

HVAC SYMBOLS AND ABBRVIATIONS

12X10	12"WIDE X 10"DEEP DUCT
12"ø	12"ROUND DUCT
	LINED DUCT
	RECTANGULAR ELBOW
	RECTANGULAR ELBOW WITH TURNING VANES
	RECTANGULAR ELBOW DOWN OR UP
T	THERMOSTAT
S	SENSOR
CO	CO SENSOR
S	WALL SWITCH
SD	SMOKE DETECTOR
TC	TIME CLOCK
	VOLUME DAMPER
	MOTORIZED DAMPER
	SUPPLY
	RETURN
	ROUND ELBOW
	RECTANGULAR RADIUS ELBOW
	FLEX DUCT
	ROUND TAP
12X10AL	12X10 ALUMINUM DUCT
12X10SS	12X10 STAINLESS STEEL DUCT
12X10BI	12X10 BLACK IRON DUCT
	CONNECTION TO EXISTING
HWS	HEATING HOT WATER SUPPLY
HWR	HEATING HOT WATER RETURN
FSD	FIRE SMOKE DAMPER
FD	FIRE DAMPER
SD	SMOKE DAMPER
MOD	MOTOR OPERATED DAMPER

TGAR GROUP, Inc.
1213 Fifty-Fifth Street
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Ph.: (262) 652-2417
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SOUTHPORT Engineered Systems, LLC
6919 51st Street P:262.654.6440
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State of Wisconsin
Department of Administration
Division of State Facilities

Agency / Institution:
Department of Military Affairs
Oconomowoc

Project Title:
Department of Military Affairs
Convert Indoor Weapons Range

Project Location:
1215 Wall Street
Oconomowoc, WI.

Sheet Title:
HVAC PLAN AND SCHEDULES

Revisions:

No.	Date:	By:	Description:

Scale	AS NOTED
Graphic Scale	
DSF Number	06K3E
Set Type	BD
Date Issued	07/17/2008
Sheet Number	H100

TGAR Group, Inc.

Architecture ■ Engineering ■ Construction■

CONVERT INDOOR WEAPONS RANGE
DEPARTMENT OF MILITARY AFFAIRS-OCONOMOWOC
DSF Project Number 06K3E

ADDENDUM #1

08/05/08

Department of Military Affairs – Oconomowoc
1215 Wall Street
Oconomowoc, WI

A. Addendum No. One to the Drawings:

1. Revised Drawings and specifications: The attached following listed drawing revisions that were incorporated into the Issued for Construction Set dated 07/17/08 are hereby made a part of the Contract Documents.

2. Drawing E100, Mechanical Room 101, eliminate reference to MS2 at light fixture. Add note "Electrical contractor to furnish and install new single pole switch for light fixture"

3. List of Plan Holders as of 08/05/2008:
   Absolute Construction Enterprises, Inc. Ph# 262-639-2620
   Bid & Builders Exchange Ph# 608-221-3148
   McGuire Contractors Ph# 414-235-0941
   Rupel Construction Ph# 262-522-7600
   Sackerson Construction Ph# 414-765-0088
   Ford Construction Ph# 262-896-9370
   Total Team Construction Ph# 262-548-8888
   Lyons Electric Ph# 262-434-6740
   Steiner Electric Ph# 262-334-5517
   Magaw Electric Ph# 262-782-7400

END OF ADDENDUM NO. 1

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