WHITEHAVEN HIGH SCHOOL

RENOVATION PROJECT

2018-0594

SHELBY COUNTY SCHOOLS

O. T. MARSHALL ARCHITECTS PC
5859 RIDGE BEND ROAD
MEMPHIS, TENNESSEE 38120

MARCH 28, 2018

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OWNER:	Shelby County Schools Division of Design & Construction 1364 Farmville Road Memphis, Tennessee 38122 Phone: (901) 553-4527 Fax: (901) 416-6930 Attn.: Leonard Myers, Director Thomas Walker, Manager
ARCHITECT:	O.T. Marshall Architects, P.C. 5859 Ridge Bend Road Memphis Tennessee 38120 Phone: (901) 791-0115 Fax: (901) 791-0116 Attn: Tom Marshall, Project Architect
MECHANICAL/PLUMBING:	Haltom Engineering LLC 495 Mulberry Street Memphis, Tennessee 38013 Phone: (901) 575-2354 Attn: Steve Stephens
ELECTRICAL:	DePouw Engineering 9058 Germantown, Tennessee 38138 Phone: (901) 754-2535 Fax: (901) 754-2536 Attn: Jerry Moore

SECTION 00 01 15 – LIST OF DRAWING SHEETS

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A0.00 COVER SHEET
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ELECTRICAL

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E104 MECHANICAL ROOM FLOOR PLAN - ELECTRICAL
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E102 GYMNASIUM FLOOR PLAN - ELECTRICAL
E201 LIGHTING AND CONTROL DETAILS

END OF SECTION 00 01 15

SECTION 00 10 00
INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 PROJECT DESIGN DOCUMENTS

A. Project Design Documents are available electronically from the listed site in the Invitation for Bid for review.

B. Bidders (General Contractors) may obtain the Project Design Documents from the Architect/Designer by depositing a NON-REFUNDABLE company issued check in the amount of $350.00 made payable to the Shelby County Board of Education. Cash will not be accepted for Bid Packs.

C. Bidders securing Bid Packs from the Architect/Designer become Bidders of Record and are issued subsequent addenda. Therefore, it is strongly encouraged for Bidders to secure Project Design Documents from the Architect/Designer in order to ensure receipt of any subsequent addenda

D. Bidders of Record may obtain additional copies of Bidding Documents from Designer at cost (nonrefundable).

1.2 EXAMINATION

A. Bidders shall carefully examine site and documents to obtain first-hand knowledge of existing conditions and Work proposed.

B. Contractor will not be given extra payment for conditions which can be determined by examining site and documents.

1.3 QUESTIONS

A. Bidders shall submit questions about bidding documents to Procurement Services in writing, via emailed to: Andre Z. Woods, woodsaz@scsk12.org, and Wendy Stoltz Partee, parteews@scsk12.org.

B. Subject line of email shall read “Questions – < Name of Project >”. Questions must specifically reference the section of the Bid to which the question pertains.

C. Questions must be received by the time and date indicated in the Invitation for Bidders.

D. Answers will be posted to www.scsk12.org/procurement/bids by addenda and will become part of the Contract Documents.

E. In order to prevent an unfair advantage, Designer and Owner will not make oral clarifications.

1.4 SUBSTITUTIONS

A. Substitution requests before receipt of bids must be prepared in accordance with the process described in Section 01 60 00, Product Requirements, including submittal of a fully completed Section 01 62 32, Substitution Request Form. (Substitution requests after contract award shall be permitted in accordance with the Contract Conditions and Section 01 60 00.)

B. Substitution requests before receipt of bids must be received ten calendar days before date set to receive bids. However, regardless of the date received, consideration of substitution requests is not an obligation of the Designer or Owner and the Designer will determine if sufficient time is available for evaluation of the request.

C. Acceptable substitutions will be identified in addenda.

D. Bidders submitting bids in reliance upon a substitution when the substitution has not been approved prior to bidding do so at their own risk.

1.5 LICENSING AND QUALIFICATIONS

Bidders shall be familiar with the Contractors Licensing Act of 1976, as currently amended (codified in Tennessee Code Annotated Sections 62-6-101, et seq.). A contract will not be awarded to a bidder whose bid is in conflict with State licensing law.

1.6 BID PRICING FORM

A. Make bids on an unaltered Bid Pricing Form furnished by the Designer in Project Design Packet or in the Bid Documents. Submit one Bid Pricing Form. Failure to completely fill out Bid Form may cause bid to be rejected.

B. If a Bidder chooses not to bid an Alternate, Unit Price, or Base Bid in a multiple Base Bid project, write "No Bid" in the space. To indicate availability of an Add Alternate at no additional charge, write "No Charge" in the space. Additional stipulations or qualifications on Bid Form may cause bid to be rejected.

C. Bid Form shall be signed by person or persons legally authorized to bind Bidder to contract.

1.7 BID SECURITY

A. Bid Security is required in the amount of five percent (5%) of total amount of bid, including contingencies, allowances, and any alternates (if applicable) in the form of a Bid Bond or check (certified or cashier's) made payable to the SHELBY COUNTY BOARD OF EDUCATION.

B. Bid Bonds shall be issued by Surety company licensed to do business in Tennessee by Tennessee Department of Commerce and Insurance, and shall have certified and current Power-of-Attorney for Attorney-in-Fact attached.

C. Owner may retain Bid Security of bidders to whom award is being considered until either (a) Contract has been executed, or (b) specified time has elapsed so that bid is not binding, or (c) bid has been rejected. If Bidder refuses to enter into Contract or fails to furnish all required

attachments properly executed, the amount of Bid Security shall be forfeited to Owner as liquidated damages, not as penalty.

1.8 BID SUBMITTAL

A. Submit Bid Form, with required attachments, enclosed and sealed in Bid Envelope furnished by Designer in Project Design Pack, or envelope furnished by Bidder with Bid Submittal Envelope Form in the Bid Documents attached to the outside of the envelope. Bidder shall fill in blank spaces on face of Envelope or Envelope Form.

B. If any work, regardless of dollar value, is required for Plumbing, HVAC, Electrical, Masonry, or Geothermal list subcontractor that will perform that work. If Bidder will perform that work with Bidder's own forces, fill in Bidder's name as subcontractor. If no work is required in a category, write "N/R" (None Required) or "N/A" (Not Applicable) in space provided for subcontractor(s).

C. Provide State contractor license number, expiration date, and applicable classifications for Bidder and listed subcontractors, as applicable by State licensing law.

D. Bidders are solely responsible for ensuring that bids are received by the time and at the place identified for receipt of bids. The bid opening time shall be established by the timepiece of the Owner's representative. Bids received late will be returned unopened.

E. A bid sent by mail shall be enclosed in an envelope clearly marked "Bid Envelope Enclosed".

1.9 MODIFICATION AND WITHDRAWAL PRIOR TO CLOSE OF BIDDING

A. Modification: Bids, once submitted, may be modified before the scheduled opening time only upon receipt of a written modification signed by an authorized representative of the Bidder. Modification to a bid may be made as an "Add" or "Deduct" only. Modification to bid may be written on the Bid Envelope with the signature of an authorized representative of the Bidder also written on the Bid Envelope. Modification shall indicate only the amount of change, clearly identified as an "Add" or "Deduct", and not indicate either the prior or resulting bid amount.

B. Withdrawal: Bids, once submitted, may be withdrawn before the scheduled opening time only upon receipt of a written withdrawal request signed by an authorized representative of the Bidder.

1.10 POST-BID WITHDRAWAL OF BID FROM CONSIDERATION DUE TO MISTAKE

A. Request to withdraw bid due to mistake must be in writing to Owner, delivered in person or postmarked certified or registered mail not later than twenty-four hours after the time fixed for receipt and opening of bids. Request shall acknowledge that bidder refuses to enter into contract based on bid and intends to submit original work papers, documents, and materials used in preparation of the bid in like manner within five working days following date of bid opening.

B. Bidder making such request will be removed from consideration for award of contract; and, a determination shall be made by a duly appointed review panel or the State Architect as to whether forfeiture of Bid Security may be waived.

1.11 CONSIDERATION OF BIDS

A. To be considered, bids shall be made in accordance with these Instructions to Bidders and the Invitation for Bid. Failure to comply with these requirements may cause bid to be rejected.

B. The Owner reserves right to: reject Prices proposed in a bid without invalidating other portions of bid; reject a bid which does not provide all required Prices or Attachments; waive informalities; and, reject any or all bids.

C. It is Owner's intent to award contract, or multiple contracts in the case of multiple base bids, based upon lowest evaluated responsive bid submitted by responsible Bidder for Base Bid plus Alternates (if any) taken in order up to, but not to exceed the Bid Target. If the Base Bid of all bidders exceeds the established Bid Target, the low Bidder is determined by the lowest Base Bid submitted by a responsible Bidder irrespective of any Alternates (if any) bid. Alternates may be accepted or rejected at Owner's discretion, provided that final combination of Base Bid and accepted Alternates does not change low Bidder as established by above method.

D. In the event of tie bids, preference will be given to local bidder over non-local bidder.

E. In the case of a multiple Base Bid, Owner may award a combined contract for the Work of more than one Base Bid if the same Bidder is the successful low Bidder on each (project).

1.12 POST-BID INFORMATION

Each Bidder shall be prepared, if requested by Owner or Designer, to present, evidence of experience, qualifications, and financial ability to carry out the terms of the contract.

1.13 PERFORMANCE AND LABOR BOND

The successful respondent will be required to submit a performance and labor bond, Cashier’s or Certified Check in the amount of one hundred percent (100%) of the total amount of bid, of all phases of the contract, including contingencies, allowances, and any alternates (if applicable) to ensure the satisfactory completion of the work for which a contract or purchase order is awarded

The bond, cashier or certified check must be made in favor of the SHELBY COUNTY BOARD OF EDUCATION, MEMPHIS, TENNESSEE 38112.

1.14 EXECUTION OF THE CONTRACT

A. If a Bidder is presented the written Agreement form for signing, then that Bidder shall deliver to the Owner, within a stipulated time frame, the signed Agreement Form, Performance Bond, Payment Bond, and certificates of insurance.

B. Failure of the Bidder to return the Agreement as within the stipulated time frame, shall entitle the Owner to require forfeiture of Bid Security and to proceed with award to the next lowest responsive Bidder.

1.15 AWARD OF THE CONTRACT

Presentation of Agreement form by Owner to Bidder for signature does not constitute award of Contract. Contract shall not be considered awarded until Bidder has received a fully executed Agreement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 00 11 00
SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

MODIFICATIONS TO VARIOUS ARTICLES IN THE INSTRUCTIONS TO BIDDERS, AIA DOCUMENT A701: The following supplements modify, change, and delete from or add to the "Instructions to Bidders," **AIA Document A701, 2007.** Where any Article, Paragraph, Subparagraph, or Clause of the Instructions to Bidders is modified or deleted by these Supplementary Instructions to Bidders, and the unaltered provisions of that portion remain in effect.

ARTICLE I – DEFINITIONS

3.1 COPIES

3.2 DELETE IN ITS ENTIRETY AND REPLACE WITH THE FOLLOWING:

3.2.1 One set of bidding documents may be obtained only by qualified General Contractors from the office of the Architect upon receipt of a **non-refundable plan deposit** in the amount of $350.00. The plan deposit shall be a Company Check made payable to "Shelby City Schools." On the 11th day after the Bid Opening, ALL deposits checks shall be forwarded to the Shelby County Schools Manager of Design and Construction**.**
Only the General Contractors will be allowed to purchase Drawings and Specifications from the Architect ONLY. Subcontractors will obtain Drawings and Specifications from the General Contractor ONLY. The General Contractor MUST USE and COMPLETE the Bid Identification Submittal Form in the Invitation for Bid documents. The General Contractor Must Use this Approved Bid Identification Submittal Form in the Invitation for Bid documents to be considered Responsive for the bid of this project.

3.2.3 **SCS Approved Temporary VENDOR I.D. Badges will be issued to the awarded General Contractor for the General Contractor's personnel and subcontractors for this project following award of the Owner / Contractor Agreement. The General Contractor MUST contact the SCS Project Manager of Design and Construction for information to obtain SCS Approved Temporary I.D. Badges. General Contractor and General Contractor's personnel MUST NOT be on the project site without the SCS Approved Temporary Vendor I.D. Badges.**

GENERAL CONTRACTOR'S MUST PAY ALL REQUIRED COSTS TO OBTAIN SCS APPROVED I.D. BADGES FROM APPROPRIATE SCS DEPARTMENT ISSUING SCS TEMPORARY VENDOR I.D. BADGES. GENERAL CONTRACTOR'S PERSONNEL, SUBCONTRACTORS, VENDORS, REPRESENTATIVES, ETC. AND ALL OTHER PERSONS VISITING THIS PROJECT SITE ON-BEHALF OF THE GENERAL CONTRACTOR MUST HAVE COMPLETED ALL BACKGROUND CHECKS PER THE APPROVAL OF ALL APPROPRIATE SCS PERSONNEL AND HAVE OBTAINED IN- PERSON THE APPROVED SCS VENDOR I.D. BADGE PRIOR TO SUBSTANTIAL COMPLETION OF THIS PROJECT FOR THOSE PERSONS THAT WILL BE IN CONTACT WITH STUDENTS. ALL PERSONS ON-BEHALF OF THE GENERAL CONTRACTOR MUST NOT ENTER THIS PROJECT SITE OR OTHER PORTIONS OF THIS SCS PROPERTY WITHOUT THE SCS APPROVED TEMPORARY VENDOR I.D. BADGES BEING LEDGIBLE, CLEARLY

VISIBLE AND APPROPRIATELY DISPLAYED FOR ANY/AND ALL OTHER PERSON(S) TO RECOGNIZE.

3.4 ADDENDA

3.4.3 CHANGE “four days” to “two calendar days.”

ARTICLE 4 - BIDDING PROCEDURES

4.1 FORM AND STYLE OF BIDS
ADD THE FOLOWING SUBPARAGRAPH

4.2 BID SECURITY ADD NEW PARAGRAPH:

4.2.4 Bid security in the amount of (5%) if the “Base Bid” shall accompany each bid. (See the Bid Form for the “Base Bid.”) The bid security may be a bid bond or a certified check made payable to the Shelby County Schools. The bid security shall be executed by the bidder as principal and having as surety a company authorized to execute such in the State of Tennessee.

4.2.5 The Owner reserves the right to retain the security of all bidders until the successful bidder enters into Contract or until one hundred twenty days (120) days after bid opening, whichever is sooner.

4.3 SUBMISSION OF BID

4.3.1 DELETE IN ITS ENTIRETY AND REPLACE AS FOLLOWS:

4.3.1.2 All forms and attachments relating to the bid shall be enclosed and sealed in envelope furnished by Bidder with Bid Submittal Envelope Form in the Bid Documents attached to the outside of the envelope. Bidder shall fill in blank spaces on face of Envelope or Envelope Form.

If any work, regardless of dollar value, is required for Plumbing, HVAC, Electrical, Masonry, or Geothermal list subcontractor that will perform that work. If Bidder will perform that work with Bidder's own forces, fill in Bidder’s name as subcontractor. If no work is required in a category, write “N/R” (None Required) or “N/A” (Not Applicable) in space provided for subcontractor(s).

Provide State contractor license number, expiration date, and applicable classifications for Bidder and listed subcontractors, as applicable by State licensing law.

Bidders are solely responsible for ensuring that bids are received by the time and at the place identified for receipt of bids. The bid opening time shall be established by the timepiece of the Owner’s representative. Bids received late will be returned unopened.

A bid sent by mail shall be enclosed in an envelope clearly marked "Bid Envelope Enclosed".Submit Bids to:
Shelby County Schools
Procurement Services
160 S. Hollywood St., Room 126
Memphis, Tennessee 38112

4.4 MODIFICATION OR WITHDRAWAL OF BID
ADD NEW SUBPARAGRAPH

4.4.5 No bidder shall return his or her bid for a period of one hundred twenty days (120) calendar after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this period.

ARTICLE 5 - CONSIDERATION OF BIDS

5.3 ACCEPTANCE OF BID (AWARD)
ADD NEW SUBPARAGRAPH

5.3.3 In addition to the one hundred twenty days (120) calendar days after the issuance of the Notice to Proceed to exercise the right to accept or reject any or all alternates (if any alternates exist) on the Bid Form. This one hundred twenty days (120) day period shall not be waived if the Owner selects some the alternates (if any alternates exist) on the Bid Form for inclusion in the original contact.

END OF SECTION

SECTION 00 20 00
ADVERTISEMENT

The Shelby County Board of Education ("Owner") is inviting General Contractor bids for the Work of this project. Project Design documents may be examined at the Designer's office or Plan Rooms listed below. General Contractors may obtain the Project Design documents from the Designer's office only, by depositing a NON-REFUNDABLE company issued check made payable to the Shelby County Board of Education in the amount of $350.00. Cash will not be accepted for Bid Packs. General Contractors securing Bid Packs become Bidders of Record and are issued subsequent addenda.

Bidders must be licensed and qualified per state law. Please refer to the Invitation to Bid, released by the Department of Procurement Services, for information regarding the: Bid Deadline, Bid Opening, Pre-Bid Conference, Bid Security and other Contact Bonds, Bid Envelope Form, and Bid Pricing Form.

Once a Bid is published, all communication regarding the Project must be directed to Procurement Services. All questions or requests for clarification of technical issues and terms pertaining to the Project must be emailed to: Andre Z. Woods, woodsaz@scsk12.org, and Wendy Stoltz Partee, parteews@scsk12.org, by the time and date indicated in the Invitation for Bidders. Subject line of email shall read "Questions – < Name of Project >". Questions must specifically reference the section of the Bid to which the question pertains. In order to prevent an unfair advantage to any respondent, verbal questions will not be answered. The Owner reserves the right to accept or reject any and all bids submitted and to waive any informality in bidding.

Name of Project: **WHITEHAVEN HIGH SCHOOL RENOVATION PROJECT 2018**

Location of Project: **4851 ELVIS PRESLEY BOULEVARD, MEMPHIS, TENNESSEE 38116**

Designer: **O. T. MARSHALL ARCHITECTS PC**
5859 RIDGE BEND ROAD
MEMPHIS, TENNESSEE 38120
Phone: 901-791-0115 Contact: TOM MARSHALL AIA

Plan Rooms:

Memphis Reprographics
6178 Macon Road
Memphis, TN 38134
Phone: 901-590-4862

E-ARC Printing
5701 Quince Road
Memphis, TN 38119
Phone: 901-683-8292

McGraw Hill Construction Dodge Plan Room
5909 Shelby Oaks Drive
Building 1, Suite 238
Memphis, TN 38134
Phone: 901-386-3044

Memphis Builders Exchange,
642 South Cooper
Memphis, TN 38104
Phone: 901-272-7495

Memphis Area Minority Contractors Association (MAMCA),
555 Beale Street,
Memphis, TN 38103
Phone: 901-526-9300

Renaissance Business Center, City of Memphis Bid/Plan Room,
555 Beale Street,
Memphis, TN 38103
Phone: 901-526-9300

Mid-South Minority Business Council (MMBC)
158 Madison Avenue, Suite 300
Memphis, TN 38103
Phone: 901-525-6512

National Association of Minority Contractors Memphis
Tri-State Area Chapter 336
3360 Fontaine Road
Memphis, TN 38116
Phone: 901-332-5670

END OF SECTION

SECTION 00 30 00
BID PROPOSAL FORM

TO: Shelby County Board of Education
Department of Procurement Services
160 S. Hollywood Street, Room 126
Memphis, TN 38112

FROM:

Bidder Name: _____

Bidder's Address: _____

FOR: Name of Project Location
Description of Project Location

The Bidder hereby acknowledges, attests, certifies, warrants, and assures that:

1. Bidder has received, read and understands the Bidding Documents and this bid is made in accordance therewith.
2. Bidder has visited the site and become familiar with the local conditions under which the work is to be performed, and has correlated all observations with the requirements of the Bidding Documents.
3. Documents identified as "Information Available to Bidders" are prepared solely for the Designer's use in design of this Work and have not been relied upon in the preparation of this bid. The use and interpretation of such information for any purpose is entirely the responsibility of the using party.
4. Contractors and Subcontractors that have been disqualified from participating in State Building Commission projects have not been included in this bid and will not be allowed to perform work under the contract that may result.
5. Bidder shall not knowingly utilize the services of an illegal immigrant in the performance of this Contract and shall not knowingly utilize the services of any subcontractor or consultant who will utilize the services of an illegal immigrant in the performance of this Contract.
6. Failure to complete this Bid Form, provide required attachments, or comply otherwise with instructions to Bidders, may be cause for rejection of bid.
7. The person who signs this bid on behalf of the Bidder is legally empowered to bind the Bidder to a Contract.
8. Iran Divestment Act. The Contractor certifies, under penalty of perjury, that to the best of its knowledge and belief the Contractor is not on the list created pursuant to Tenn. Code Ann. § 12-12-106. The Contractor further certifies that it shall not utilize any subcontractor that is on the list created pursuant to Tenn. Code Ann. § 12-12-106.
9. This Bidder's status, as required by the State Building Commission Policy and Procedures, is:
   (True or False) _____The Bidder and/or any of the Bidder's employees, agents, independent contractors and/or proposed Subcontractors have been convicted of, pled guilty to, or pled nolo contendere to any contract crime involving a public contract.
   (Yes or No) _____The Bidder is a Women Owned or Minority Owned, Business Enterprise.
10. Bidder acknowledges receipt of the following addenda and the Supplemental Instructions to

Bidders:
Addendum No. _____ dated _____ Addendum No. _____ dated _____
Addendum No. _____ dated _____Addendum No. _____ dated _____

11. Bidder understands and agrees that the lump sum bid price includes all taxes such as sales, use, excise, licenses, etc., now or hereafter imposed by Federal, State or other government agencies upon the equipment, labor and materials specified, and that all said taxes shall be paid by the Contractor.
12. This Bidder agrees to:
    A. Honor this bid for a period of sixty (60) days following the date of the scheduled opening of bids.
    B. Enter into and execute a contract, if presented on the basis of this bid, and to furnish certificates(s) of insurance, bond(s), and other documents related to the contract as required by the Bidding Documents.
    C. Accomplish the Work in accordance with the Contract Documents.
    D. Achieve Substantial Completion of the Work in accordance with the number of calendar days Contract Time set forth, allotted from and including the date stipulated in the Notice to Proceed; and, accept the conditions for Liquidated Damages in the amount set forth per calendar day.
    E. Obtain SCS approved temporary vendor i.d. badges, if awarded a contract, for the Bidder's (General Contractor's) personnel and subcontractors, and pay all applicable cost associated with obtaining temporary vendor i.d. badges.
    F. The required Owner's Contingency, in the amount of ten percent (10%) of the BASE BID, is identified herein below.
    G. The required Allowances, in the amounts for the items identified herein below, for a total Combined Allowance of $_____:
    H. The required Bid Security (Bond), in the amount of five percent (5%) of the total amount of bid, including alternates and allowances is attached hereto.
    I. Bidder acknowledges receipt of the Invitation for Bid Documents, any and all addenda, the Supplemental Instructions, and all other Project Design and/or Bid Documents.
    J. Bidder assures in addition to this Bid Proposal Form, all required forms and documents listed in the Invitation for Bid and the Project Design Manual and Drawings are included and attached hereto with their Bid Response completed.
    K. Bidder acknowledges that Substantial Completion shall be achieved 90 days upon Notice to Proceed

Base Bid: (Words) _____

Base Bid: (Figures) _____

10% Owner's Contingency in addition to the Base Bid Amount (Figures) _____

Combined Allowances, Total (Figures) _____

Performance and Payment Bond Cost (Figures) _____

Total Combined Base Bid (Figures) _____

(Base Bid + 10% Owner's Contingency + Allowances + Performance and Payment Bond Cost)

The Authorized Representative, submits this Bid Proposal Form:

Print Name & Title	
Signature & Date	

On behalf of the following Prime Contractor:

Name of Company	
State of Incorporation:	
Address, City, State, Zip	
Phone #, Fax #, Email	

NOTE: TENESSEE CONTRACTOR'S LICENSE NUMBER, EXPIRATION DATE, AND LICENSE CLASSFICATION IS REQUIRED ON THE OUTSIDE OF THE BID ENVELOPE. ALL CONTARCTOR'S MUST USE THE BID ENVELOPES OR BID IDENTIFICATION SUBMITAL FORM PROVIDED IN THE PROJECT DESIGN PACKET OR INIVITATION TO BID DOCUMENTS.

END OF SECTION

SECTION 00 83 50
TOBACCO USE OR POSSESSION AND DRUG FREE WORKPLACE POLICIES

PART 1 - GENERAL

1.1 TOBACCO USE OR POSSESSION POLICY

A. PURPOSE: To provide a safe and healthy environment for all employees, students, and visitors and to serve as a positive example to all students concerning the use of tobacco.

B. SCOPE: This policy applies to all employees, students, and visitors.

C. POLICY STATEMENT: The Shelby County Schools system prohibits student smoking or possession of tobacco products, lighters or matches, on school campuses, at school sponsored activities or on school buses. Additionally, smoking and/or the use of all tobacco products, including smokeless tobacco, are prohibited in all Board of Education buildings (schools and other facilities); in any public seating areas, including but not limited to, bleachers used for sporting events, or public restrooms; and in all vehicles, owned, leased or operated by the district at all times. Signs will be posted throughout the District's facilities to notify students, employees and all other persons visiting the school that the use of tobacco and tobacco products is forbidden. A “Smoking is Prohibited by Law in Seating Areas and in Restrooms” sign shall be prominently posted for elementary or secondary school sporting events (including at each ticket booth). Any student who possesses tobacco products shall be issued a citation by the school principal. Parents and students shall be notified of this citation requirement at the beginning of each school year.

D. RESPONSIBILITY: The Superintendent (or designee) is responsible for administering this policy.

1.2 DRUG FREE WORKPLACE POLICY

A. PURPOSE: It is the policy of the Shelby County Schools to maintain a drug-free and safe work environment.

B. SCOPE: The unlawful manufacture, distribution, dispensing, possession, purchase, sale, transfer, or use of drugs or alcohol when on the job or in the workplace are strictly prohibited.

C. POLICY STATEMENT: Employees (and contractors) should not be under the influence of drugs (as defined below) or alcohol during their working hours for Shelby County Schools regardless of whether those drugs or alcohol were consumed during working hours or prior thereto.

Drugs are defined for the purpose of this policy as: (a) drugs which are not legally obtainable, and (b) drugs which are legally obtainable, but have not been prescribed by a licensed physician for the person that is in possession of the drug.

When management has reasonable suspicion to believe that an employee (or contactor) is using or is under the influence of drugs or alcohol while at work, management may request that the employee (or contactor) participate in a drug and/or alcohol screening procedure to determine if

the employee (or contractor) has evidence of alcohol or drugs in his or her blood or urine. The supervisor or managerial person shall relate to the employee the reason the test is being requested. A refusal to submit to the above procedure will be considered insubordination which is a major infraction and subject to major discipline, up to and including possible termination. If the employee (or contractor) does submit to the said screening procedure and it is determined that there is evidence of drugs or alcohol present, disciplinary action up to and including termination may result.

All persons in jobs within the system requiring commercial driver's licenses will be subject to drug and alcohol testing as mandated by federal law and the Tennessee Code Annotated.

The violation of any provision of this policy is considered a major disciplinary infraction and may result in disciplinary action up to and including termination.

Under appropriate circumstances, management may require that the employee participate fully and satisfactorily in an approved drug or alcohol rehabilitation program coordinated by Employee Assistance Program (EAP) and such participation may be considered as part of the disciplinary process. The employee will be allowed to return to work only with a signed Return to Work Agreement.

D. RESPONSIBILITY: As a condition of continued employment with Shelby County Schools, all employees (and contractors) must abide by Shelby County Schools System's policy on an alcohol and drug-free workplace.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 00 84 00
LOCAL PREFERENCES PURCHASING

PART 1- GENERAL

1.1 PURPOSE

To give a local preference to businesses located in Shelby County, Tennessee for the purchase of supplies, materials, equipment, and services.

1.2 SCOPE

This policy applies to District level contracts with a total dollar purchase amount of $10,000 or more.

1.3 DEFINITION

A. Local Preference Purchasing means giving preference to businesses located within Shelby County, Tennessee in the purchase of personal property, materials, and contractual services and in constructing improvements to real property or to existing structures.

B. Local Business means a vendor or contractor who holds a valid license to do business in Shelby County, Tennessee; has a street address within the limits of said locality for a continuous period of at least six (6) months prior to bid or proposal opening date; and has proof that Shelby County Personal Taxes are current (applies to local businesses who have been doing business in Shelby County, Tennessee for a year or more).

1.4 POLICY STATEMENT

A. The Shelby County Board of Education recognizes that a significant amount of funds are spent on purchasing personal property, materials, and contractual services and in constructing improvements to real property or to existing structures. The Board also recognizes that dollars used in making purchases are derived largely from revenues generated from businesses located within Shelby County, Tennessee. The Board believes that funds generated in the community should be placed back into the local economy. Therefore, it is the policy of Shelby County Board of Education to provide a preference to local businesses in procurement transactions whenever the application of such a preference is reasonable in light of the dollar-value of proposals received in relation to such expenditures.

B. In the bidding of, or letting for procurement of supplies, materials, equipment and services, with a total price of ten thousand ($10,000.00) dollars or more, if the lowest responsive bidder is a regional or nonlocal business, then all bids received from Local Businesses are decreased by five (5) percent. The original bid is not changed; the five (5) percent is calculated only for the purpose of determining the Local Preference. The Local Preference cost differential is not to exceed one hundred thousand dollars ($100,000.00).

C. In the case of request for proposals, letters of interest, best evaluated bids, qualifications or other solicitations and competitive negotiation and selection in which objective factors are used to evaluate the responses, Local Businesses will be assigned five (5) percent of the total evaluation points up to a maximum of five (5) points.

D. In the event of a tie between a local and non-local business, favor shall be given to the Local Business and a coin toss method will be used to break ties between two (2) or more local businesses meeting said specifications.

E. Exceptions: This preference shall not apply to purchases or contracts that are funded in whole or in part by a governmental entity if the laws, regulations or policies governing such funding prohibit application of the Local Preference; when exigent emergency conditions or noncompetitive situations exist; and when a particular purchase, contract, or category of contracts for which SCS is the awarding authority is waived upon written justification and recommendation of the Board.

F. Restrictions: The Local Preference shall apply to District level purchases only. The preference shall apply to new contracts for supplies, materials, equipment, and services first solicited after January 29, 2013.

1.5 RESPONSIBILITY

A. The "users" of services are responsible for furnishing an objective evaluation of their needs and for identifying the specifications of the services to be delivered.

B. The Chief Financial Officer is responsible for developing final specifications and obtaining all bids, requests for proposals, and contracted service agreements.

C. The Chief Financial Officer is responsible for ensuring that all services have been properly approved and all procedures followed before signing contractual agreements.

D. The Superintendent is responsible for ensuring compliance with this policy.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 00 93 50
REQUESTS FOR INFORMATION

PART 1 - GENERAL

1.1 PRIOR TO THE BID DATE

A. All Requests for Information prior to the Bid Deadline Date must be submitted to Procurement Services in writing, via emailed to: Andre Z. Woods, woodsaz@scsk12.org, and Wendy Stoltz Partee, parteews@scsk12.org.

B. Subject line of email shall read "Questions/RFI – < Name of Project >". Questions must specifically reference the section of the Bid to which the question pertains.

C. Questions/RFI must be received by the time and date indicated in the Invitation for Bidders.

D. Answers will be posted to www.scsk12.org/procurement/bids by addenda and will become part of the Contract Documents.

E. In order to prevent an unfair advantage, Designer and Owner will not make oral clarifications.

1.2 AFTER AWARD OF CONTRACT

A. All Requests for Information after award of the Construction Contract shall be submitted to the Designer by the General Contractor. Each Request for Information Form shall be complete with data indicating the specific drawing(s) or specification(s) in need of clarification including the following:
   a. RFI number (RFI's shall be numbered consecutively by the Contractor as submitted).
   b. Date submitted
   c. Subject requiring clarification
   d. Discipline (Architectural, etc.)
   e. Co-author, if applicable
   f. Detailed statement of the information requested
   g. Date information required

B. Requests for Information shall be made in a timely manner allowing the Architect/Designer a reasonable amount of time to review the request. If the date a response is required is not indicated, the assumed date the response is required shall be 15 working days from the date the Architect received the request.

C. Submittal of an RFI constitutes representation that the Contractor requires additional information about the Contract Documents after he or she has made careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior project correspondence or documentation.

D. If, upon evaluation of the RFI, the Architect/Designer finds that the requested information is contained in the Contract Documents or by other documents and/or methods as outlined in Paragraph "D", the Owner has the option to obtain reimbursement from the Contractor for costs incurred by the Owner for Architect/Designer 's services and expenses made necessary in answering such requests.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 01 00
SUMMARY OF WORK

PART 1- GENERAL

1.1 WORK UNDER THIS CONTRACT

A. Under this contract, the Bidder (Contractor) shall complete all work as identified in the drawings, specifications, addendums, and all issued contract documents inclusive of all but not limited to:

1. Alterations include, but not limited to, the following:
   Interior Gymnasium, Locker Room, Auditorium and Cafeteria improvements
   Restroom Locker Room reconfigurations
   Interior signage
   Door/hardware replacement
   Casework modifications
   Mechanical modifications
   Lighting modifications
   Auditorium Seating Replacement

2. Contractor shall install the following items provided by Shelby County Schools:
   Fire Extinguishers.

3. Awarded Contractor must provide Mr. Thomas Walker, Shelby County Schools, Project Manager of Major Construction, 1364 Farmville Road, Memphis, TN 38122, electronic photographs of all existing conditions throughout the project where contract work to be performed.

B. Bidders must provide the Work at the Total Combined Bid Price, to include Base Bid Price, 10% Owner's Contingency Cost, and Cost of Allowances. Reference Bid Proposal Form for required responsive bid items for this project.

C. Bidders must confirm with Shelby County Schools, Department of Procurement Services, any and all additional information related to the Project Scope of Work.

1.3 SPECIAL WORK RESTRICTIONS

A. Access to site, limit use of site and premises to allow:

1. Work by Contractor(s) for this Project Work is authorized.
2. Work by Contractor(s) for work not related to this Project is not authorized.

B. Coordination with occupants for disruptions in services and adjacent activities:

C. Use of the site by the Contractor for the Work including parking and staging and any required Owner and occupant continuing egress:

D. Restrictions on work hours: By mutual agreement

1..4 PROJECT UTILITIES

A. Water and electric power required for construction activities that will be provided to the Contractor from the Owner's utility system at no cost for consumption is described below:

B. Temporary line connections to any line services of the Owner shall not be made without prior approval of the Owner.

C. The Contractor shall furnish and install all temporary piping and wiring and meters that may be required for the use of water and electric power, for construction purposes, and, upon completion of work, remove all temporary piping and wiring. Temporary utility lines are not specifically shown on the drawings but shall be routed as required by conditions at the site.

D. Known existing utility lines that are to remain permanently or temporarily in service shall be carefully protected from damage or dislocation and any damage to these lines shall be repaired at no additional cost to the Owner.

E. The term "utility lines" shall be understood to include but not be limited to: water lines, gas lines, sanitary sewers, storm sewers, electric power lines, communication lines and appurtenances such as manholes, catch basins, fire hydrants, valves, junction boxes and switches.

F. Unknown underground utility lines:

1. In performing the Work, it is possible that unknown underground utility lines may be encountered. Such lines may be lines that have been or will be abandoned, inactive lines that may be preserved for future use, or active lines that must be preserved and either relocated or replaced.

2. Should such unknown lines be encountered, immediately notify the Owner, who will examine the lines to determine whether they have been or will be abandoned, or shall be preserved. The Contractor shall assist the Owner by making tests or otherwise as the Owner deems necessary to determine how best to dispose of them.

3. If the unknown lines have been or may be abandoned, remove them to the extent necessary, as determined by the Owner, without additional cost to the Owner. If it is found desirable or necessary to preserve the lines, they shall be capped off, relocated or replaced, as directed by the Owner. In general, this shall be done by the trades having jurisdiction, but all trades shall fully cooperate in such work.

4. Should relocation or replacement of unknown underground utility lines be required the Contract Conditions regarding Changes in the Work shall apply.

G. Equipment requiring a service connection from a utility supply such as electricity, steam, water, gas, etc. shall have the characteristics of the utility service required by the equipment confirmed prior to installation and purchase of the equipment.

1.5 COORDINATION OF WORK

A. The Contractor and subcontractors, particularly mechanical and electrical, shall review other sections of work applicable to their work and ascertain requirements in other sections applicable to their own work. Each shall be held responsible for coordination and inclusion of the work indicated as if it were in the particular subcontractor's section.

B. The Owner shall be advised of any discrepancies or conflicts at the earliest moment.

C. Each subcontractor, supplier, etc. shall be responsible for knowing what information is given on all sheets of the plans and specifications concerning its particular work. If an item or piece of work is shown on the architectural and not on the mechanical, electrical or structural drawings, it shall be interpreted that said item or piece of work is shown and included in the contract. The reverse condition also shall apply.

1.6 MANMADE CONCEALED STRUCTURES

A. In performing the work, Contractor may encounter concealed manmade structures or conditions not revealed in the Contract Documents and not otherwise detectable by a reasonable inspection of the site or existing structures. Such structures or conditions may have been abandoned or will be abandoned or, at the Owner's option, designated for preservation and future use.

B. Should such conditions or structures be encountered, the Contractor shall immediately notify the Owner, who will examine such conditions or structures and provide direction.

C. Should work be required to comply with the Project Design Manual, per the direction of the Owner, the Contract Conditions regarding Changes in the Work shall apply.

1.7 CONNECTION TO EXISTING WORK

A. Existing work shall be cut, altered, removed or temporarily removed and replaced as necessary for the performance of the Work. New work in extension of existing work shall match that to which it connects. Work to remain in place, which is damaged or defaced by reason of work performed under the Work, shall be restored equal to its condition at time of commencement of the Work.

B. All Work required in an existing building shall be performed carefully so as not to damage the Owner's finishes, furnishings, equipment and similar items. Such items that cannot be temporarily removed from the areas of construction shall be adequately protected from damage. The Contractor shall be responsible for any damage to the Owner's furniture, equipment or similar items resulting from the performance of this contract and shall repair or replace such damaged items to the satisfaction of the Owner at no additional cost.

PART 2 - PRODUCTS (NOT USED)

PART 3- EXECUTION (NOT USED)

END OF SECTION

SECTION 01 02 00
ALLOWANCES

PART 1 - GENERAL

1.1 Costs of Allowances are materials to contractor or sub-contractors, less applicable trade discounts, and taxes.

1.2 The Cost of the Allowances, include product handling, storage, protection, etc., should the Owner accept and approve each:

A. Sound System / Audio Visual Upgrades $125,000

B. Hardwar $ 12,000

C. Stage Curtains and Fittings $120,000

D.

1.3 Owner's Representatives Responsibilities includes, but not limited to, the following:

A. Make Allowance Selections.

B. Review Change Directives.

C. Review Submittals.

D. Review Other Contractor's Documents.

1.4 Contractor(s) Responsibilities:

A. Provide Architect and Shelby County Schools Manager of Design and Construction with sequences(s) of Contractor's Construction Schedules, items and materials to avoid dust and noise pollution prior to, during, and following the construction and removal and haul-off and installation of materials for this project.

B. Obtain proposals from subcontractors and installers and offer recommendations.

C. On notification of selection by Architect/Engineer execute purchase.

D. Process shop drawings, product data and samples.

E. Arrange for delivery of all equipment, products, materials, etc. and inspect for damage of same.

1.5 Funds will be drawn from Dollar Amount Allowance(s) only by Change Directives.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the **Owner's Contract for Construction** and other Division-1 Specification Sections apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:
   1. Contractor's construction schedule.
   2. Submission of Progress Schedule.
   3. Submittal schedule.
   4. Shop Drawings.
   5. Product Data.
   6. Samples.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
   1. Permits.
   2. Applications for Payment.
   3. Performance and payment bonds.
   4. Insurance certificates.
   5. List of subcontractors.

C. Progress Reports:
   1. Daily Reports: Progress reports shall be kept on a daily basis to cover each facet of the work. These reports shall be kept on file at the field office and shall be made available for review upon request of the Engineer/Architect or his representative.

D. Proposed products list:
   1. Within 20 days after date of Owner-Contractor Agreement submit complete list of major products proposed for use, with name of manufacturer, trade name, and model number or each product.
   2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.03 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

B. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

C. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
   1. The Engineer/Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
   2. Allow 2 weeks for processing each submittal. Allow additional time if the Engineer/Architect must delay processing to permit coordination with subsequent submittals.
   3. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer/Architect sufficiently in advance of the Work to permit processing.

D. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

E. Submittal Transmittal: Transmit each submittal from the Contractor to the Engineer/Architect using a transmittal form.
   1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations.
   2. Submittals may be submitted via email. If submitted via email, Contractor to use Project School Name, (i.e. "Sherwood") in the subject line along with product/ submittal name or division number. No exceptions.

1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule for the Owner's approval. Submit within 30 days after the date established for "Commencement of the Work."
   1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the "Schedule of Values."
   2. Coordinate the Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.
   3. Indicate completion in advance of the date established for Substantial Completion.
   4. Indicate Substantial Completion on the schedule.

B. Distribution: Following acceptance of the formatting of the initial submittal, print and distribute copies to the Engineer/Architect, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.
   1. When revisions are made, distribute to the same parties as required.

C. Schedule Updating: Revise the schedule monthly. Revised Schedules should reflect each event or

activity where approved revisions have been recognized or made. Issue the updated schedule in reduced form for attachment to the Minutes of each Progress Meeting.

1.05 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 7 calendar days of the date required for submittal of the Contractor's Construction Schedule.
   1. Prepare the schedule in chronological order, include submittals required during the first 90 days of construction. Provide the following information:
      a. Scheduled date for the first submittal.
      b. Name of the subcontractor.
      c. Scheduled date for the Engineer/Architect's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer/Architect, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1.06 SHOP DRAWINGS

A. Submit shop drawings, product data, samples, and other submittals where required in other sections of this document.

B. Definitions:
   1. Action Submittals: Written and graphic information and physical samples that require Company representative's responsive action.
   2. Informational Submittals. Written and graphic information and physical samples that do not require responsive action. Submittals may be rejected for not complying with requirements.

C. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
   1. Dimensions.
   2. Identification of products and materials included by sheet and detail number.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. One of the prints returned shall be marked up and maintained as a "Record Document."
   7. One (1) print of each Drawing and one sample bearing the final approval stamp of the Engineer/Architect shall be kept at the project office and shall be maintained in good condition. No Shop Drawing or sample other than those stamped "Approved," shall be on the job for any purpose whatsoever, and work installed directly from shop Drawings or samples shall be removed and corrected at no charge in contract price.

D. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

E. In checking Shop Drawings and samples, the Engineer/Architect shall not be required to check dimensions, quantities, electrical characteristics, specific capacities or coordination with other

trades, these being the responsibility of the Contractor. The Contractor shall attest, either in writing or by stamp or signature, that all Shop Drawings and samples submitted for approval have been checked for compliance with the Drawings and Specifications prior to submission to the Engineer/Architect. Otherwise, they will be returned unchecked. Any deviations in Shop Drawings shall be identified by letter accompanying Drawings. No Shop Drawings nor samples shall be submitted directly to the Engineer/Architect from a manufacturer, jobber or subcontractor.

1.07 GENERAL CONTRACTOR'S RESPONSIBILITY FOR DIMENSIONS

A. Dimensions shown in shop drawings will be reviewed (and revised if necessary) by the Engineer/Architect, solely as a convenience to the General Contractor. This in no way releases the General Contractor from his responsibility for providing correct dimensions on the shop drawings, in accordance with the Construction Documents, or from his responsibility to coordinate such dimensions with the work of other trades, and any field conditions which may affect the dimensions indicated in the shop drawings.

1.08 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
   1. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

B. Submittals: Submit five (5) hard copies of each required submittal; submit 5 copies where required for maintenance manuals. The Engineer/Architect will retain one and will return the other marked with action taken and corrections or modifications required.
   1. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
      a. Contractor may submit electronic copy of submittal if acceptable by Architect or Engineer.

C. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
   1. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
   2. Do not permit use of unmarked copies of Product Data in connection with construction.

1.09 SAMPLES

A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
   1. Include the following:
      a. Sample source.
      b. Product name or name of the manufacturer.

c. Compliance with recognized standards.
d. Availability and delivery time.

2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual components as delivered and installed.
3. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit multiple units (not less than 3) that show approximate limits of the variations.

B. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
1. The Architect or Engineer will review and return preliminary submittals with the Architect or Engineer mark, indicating selection and other action.

C. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Architect or Engineer will return one set marked with the action taken.
1. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
2. Sample sets may be used to obtain final acceptance of the construction associated with each set.

D. Distribution of Samples: Prepare and distribute additional sets to as required for performance of the Work.

E. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations.

F. Coordinate preparation and processing of submittals with performance of construction activities. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity. Allow time for submittal review, including time for resubmittals.

1.010 ARCHITECT/ ENGINEER'S ACTION

A. Except for submittals for the record or information, where action and return is required, the Engineer/Architect will review each submittal, mark to indicate action taken, and return promptly.
1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp of the Engineer/Architect on returned Shop Drawings and samples shall be interpreted as follows:
1. Approved: Conforms to design concept of the project.
2. No Exceptions Noted: Conforms to design concept of the project.
3. Approved as Noted: Items noted for correction must not be fabricated or furnished with correction as noted.
4. No Exceptions Taken Revised As Noted: Items noted for correction must not be fabricated or

furnished without correction as noted.
5. If the above comments are offered Fabrication/ Installation may be undertaken.
6. Revise and Resubmit or Rejected: The item is rejected as not in accordance with the contract requirement, or for other justified cause. The submission shall be corrected and resubmitted. No item is to be fabricated or furnished under this stamp.
7. If the above comments are offered Fabrication and/ or Installation may not be undertaken.
8. List of Subcontractors: Submit list of subcontractors as required by Instruction to Bidders.

C. Occupancy Permit: Submit Occupancy Permit as required by Section 01 70 00 - Project Closeout.

D. Other Submittals: (Where Applicable)
1. Shop Drawings and drawings, diagrams, illustrations, schedules, performance charts, nomenclature charts, brochures and other data which are prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the project.

1.011 REQUIRED SUBMITTALS

A. Submittals required by the Contract Documents include, but are not necessarily limited to:
Proposed Progress Schedule
Schedule of Values
List of Subs and Suppliers
Construction Waste management Plan
Contract Closeout Items
Project Record Documents
Manuals
Product Data, Mix Designs
Product Data, Shop Drawings
Steel Shop Drawings
Concrete Mixes
Masonry
Storefront Systems
Curtain Wall Systems
Door, Frame & Hardware
All Material & Finishes
Plumbing Systems
Fire protection Systems
HVAC Systems
Electrical Lighting
Electrical Power Systems
Electrical Life Safety Systems

B. Refer to individual product specification sections for additional required submittals.

C. After review, reproduce and. distribute in accordance with Article on Procedures above and for Record Documents described in Section 01 70 00 - Contract Closeout.

D. Provide Owner and Manager of Design and Construction with one (1) Electronic CD in AutoCAD

DWG FILE Format of ALL As-Built Documents CD MUST NOT BE READ ONLY. CD MUST BE AN AUTO CAD DWG FILE FOR OWNER PURPOSES AND RECORDS.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 SUBMITTALS REUIQRED BEFORE OR WITH FIRST INVOICE:

A. Construction Schedule.

B. List of Subcontractors and Suppliers.

C. Staging Area(s) for Contractor's Equipment, Materials, Appurtenance(s), Products, Contractor's Circulation Pattern(s) to and from Staging Areas to avoid interface and impact with Owner's Site Based Personnel and all persons related to Site Based Personnel.

D. Contractor's Documents showing ALL Safe travel zones for ALL Site Based Persons prior to, during, and following ingress to the Project Site and Project Building and ALL egress from the Project Site and Project Building.

E. Contractor's to show ALL safety fencing necessary to separate ALL Site Based Persons and ALL Persons related to Site Based Persons from Contractor's Work Areas/Zones.

3.02 SHOP DRAWINGS

A. Shop drawings shall be submitted for review and comments as noted under all sections listed in Divisions 2 through 32.

B. Miscellaneous Submittals Required:
   1. Inspection and Test Reports
   2. Warranties
   3. Survey Data

3.03 CLOSE-OUT DOCUMENTS BEFORE FINAL INVOICE

A. Refer to section "Project Closeout" and to individual sections of these specifications for specific submittal requirements of project closeout information, materials, tools and similar items.

END OF SECTION

SECTION 01 33 10

CONSTRUCTION SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. SCHEDULE(S)
   1. A schedule shall be provided as a basis for a detailed construction schedule. The detailed construction schedule shall conform to the construction sequence as outlined in other sections of these specifications.

B. DESCRIPTION
   1. Utilize a computer generated schedule for the planning and scheduling of all work required under the Contract Documents. In addition to construction activities, detailed network activities shall include the submittal of shop drawings, catalog cut sheets, and materials samples, review and approval of these submittals, and fabrication and delivery of materials and equipment. Work by separate contractors and project close - out activities shall also be included to account for their effect on the overall sequencing of the project.

1.02 SCHEDULE STANDARDS

A. The schedule shall demonstrate a logical succession of work from start to finish. Constrained start and. finish dates shall be kept to a minimum, such that the schedule logic (activity relationships and durations) will determine the schedule start and finish of each activity.

B. The durations indicate for each activity shall be in "work - days" and shall represent the required time for the activity considering the scope of work and resources planned for the activity including time for inclement weather and other predictable delays.

C. Multiple calendars shall be utilized as required to allow for specific times of the week, month, or year when specific activities can or cannot be accomplished. Specific examples include, but are not necessarily limited to, Site Based (School) activities which require no noise such as school testing timeframes, and other site based activities which require same considerations, confirm with the Architect and Mr. Leonard Myers, Major Construction Manager, regarding additional timeframes which require Site Based (School) activities to take priority over various parts of this Project.

1.03 QUALIFICATIONS

A. Submit evidence of in-house scheduling capability per Owner's Requirements for Project Scheduling.

B. Verify in-house capability by description of this project to which Contractor or Contractor's has successfully applied scheduling techniques for this Project. Include at least two projects of at least half the expected value of this project, and at least one project which was controlled throughout the duration of the project by means of computerized, periodic, systematic schedule.

C. Submit the requirements of the Section to the Architect and Mr. Leonard Myers, Major Construction Manager with the Contractor's Bid Documents.

PART 2 - PRODUCT

2.01 GENERAL

A. Provide Architect and Mr. Leonard Myers, Major Construction Manager with required number and product information as identified within other Sections of these Specifications.

PART 3 - PART 3 EXECUTION

3.01 GENERAL

A. Prepare a computer generated schedule of all construction related work required by this contract.

B. Include the following information in the database for each activity:
   1. Activity Description - should indicate type of work being performed and. general location or phase.
   2. Calendar - the standard calendar is a five day workweek. Other calendars have been determined including school year, vacation, student relocation, etc.
   3. Duration - should indicate "work - days" required to accomplish the task.
   4. Schedule Dates - Early Start, Early. Finish, Late Start, and Late Finish for each activity will result from the calculation of the schedule.

3.02 SCHEUDULE PROCEDURE

A. Time of Submittals:
   1. Within Five (5) working days after Notice to Proceed, the. Contractor shall submit its project schedule for review. The schedule produced and submitted shall indicate interim milestone and completion dates identical to the milestones required by the contract. The Architect and Manager of Design and Construction will review the schedule within ten working days and state acceptance or rejection of the schedule.
   2. Within ten working days after the conclusion of the Architect's and Manager of Design and Construction's review, the Contractor shall revise the schedule as required and resubmit. This schedule shall constitute the project Work schedule unless a revised schedule is required due to substantial changes in work or contract time, delinquency by the Contractor requiring a recovery schedule, or as otherwise provided.
      Acceptance of the project schedule will be required prior to the processing of any application for payment.
   3. Submit a copy of the schedule, clearly showing progress made during the previous month along with the Application for Payment.

B. Acceptance of Schedule:
   1. The schedule will be acceptable when it provides an orderly progression of the work to completion in accordance with the contract requirements, adequately defines the Contractor's work plan,

and. provides a workable arrangement for the processing of submittals in accordance with the requirements.

2. Review and acceptance of the Contractor's project schedule is for conformance to the requirements of the contract documents only. It does not relieve the Contractor of any responsibility for the accuracy or feasibility of the project schedule, or of the Contractor's ability to meet the interim milestone dates and contract completion date, nor does such review and acceptance expressly or implicitly warrant, acknowledge, or otherwise admit the reasonableness of the logic or durations of the Contractor's project schedule.

C. Submittal Items:
1. Initial submittals shall include the following:
   a. Bar Chart Graphic Report - include all activities for the entire project. Sort by early start, early finish, and total float; organize by submittal activities, construction activities, etc. Include activity ID, description, original duration, early start, early finish, and total float. Individual pages shall not exceed 11 inches by 17 inches.
   b. Back-up DWG - Electronic (CD) (NOT "PDF" READ ONLY) containing schedule back-up.
   c. Reports shall be submitted in triplicate plus any copies to be returned to the Contractor.
2. Monthly submittals to be included with Application for Payment shall include the following:
   a. Project Narrative. Report - shall include a brief description of work that was accomplished during the previous month as well as work to be pursued during the upcoming month.
   b. Bar Chart Graphic Report - shall be a three-month look ahead schedule to include previous month's progress plus work to accomplish during the two months following the data date. Schedule bars shall be compared to the initial schedule as a baseline. Include the same activity information as in initial bar chart graphic report.
   c. Back-up DWG - Electronic (CD) (NOT "PDF" READ ONLY) containing schedule back-up.
   d. Reports shall be submitted in triplicate plus any copies to be returned to the Contractor.

D. Schedule Revisions:
1. No changes may be made in the sequence, duration, or relationship of any activity without the acceptance of the Architect and Manager of Design and Construction. Requests for minor changes to the schedule may be submitted in the form similar to the schedule form identified herein. More substantial revisions will require re-submittal of the entire schedule.
2. If at any time the Architect and Manager of Design and Construction considers the milestone or completion dates to be in jeopardy because of work activities behind schedule, the Contractor shall provide a revised Critical Path Work Schedule, including resource requirements, to show how the Contractor intends to bring the project back on schedule. "Activities behind schedule" are any activities whose current schedule early dates are later than indicated in the initial schedule.
3. If a change directive has a schedule impact, that impact shall be submitted with the change directive request in the form of a fragment that adequately indicated the effect of the change on the original schedule. If a fragment can not adequately delineate the schedule impact, re-submittal of the entire schedule may be required.

3.03 SCHEDULE MAINTENANCE

A. Updating the Schedule At not less than one month intervals, or when specifically requested by the Architect or Manager of Design and Construction, the Contractor shall perform a schedule update. Progress of the project shall be evaluated as of the last Sunday of the month (the data date). The updating process shall evaluate the status of each activity, noting actual start dates, actual finish dates, and remaining durations. After this data is input the schedule shall be calculated as of the data date. It is suggested that due to the nature of these projects, the Contractor perform a mid-month update as well, to assure that the project does not fall behind schedule.

B. Schedule Monitoring - The updated schedule shall be utilized for the monthly reports as required under "submittals." Monthly updates will be compared to the original (baseline) schedule and the previous month's update to evaluate progress.

C. Progress Meetings - For the progress meetings held every other week, the Contractor shall prepare a three week look-ahead schedule based on the latest updates of the schedule. This three-week schedule shall show all activities in progress, uncompleted, or scheduled to be worked on during the three-week period. The three weeks shall include the current week plus the next two. The purpose of the meetings is to review the progress of work and resolve potential problems to avoid delays.

END OF SECTION

SECTION 01 33 20

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Still Photography

B. Prints

C. Submittals

1.02 RELATED SECTIONS

A. Section 01010 - Summary of Work

B. Section 01700 – Contract

1.03 PHOTOGRAPHY

A. Still Photography
   1. Existing Conditions:Provide Photographs of site and existing buildings (interior and exterior) before any construction is started. This includes the surrounding streets and sidewalks and other areas that could be damaged by construction traffic for this project.
   2. Progress Photographs: Take photographs of work associated with each monthly Application for Payment.

B. Prints:
   1. Digital Color two prints of each view
   2. Paper: single weight, neutral, white base
   3. Finish: smooth surface, glossy
   4. Size: 3-1/2" x 5" inch
   5. Identify each print on back, Identify Name of Project, Contract Number, Phase, Orientation of View, Date and Time of View, and a numbered identification of print corresponding to the strip of negatives.

1.04 TECHNIQUE

A. Provide Factual Presentation.

B. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

C. Provide monthly progress photographs from views until Substantial Completion. Consult with Architect for instructions on views required.

1.05 SUBMITTALS

A. 3-Ring Binders: Submit (4) four 3-ring binders with metal hinges and elliptical rings.
   1. Place label in spine pocket: "Photographs, (project)." Binder is similar to Avery 287787.No handwritten labels.
   2. Submit prints in non-glare heavyweight polypropylene sheet protectors that are punched for 3-ring binders.
   3. Tabs in Binders: Provide Tabs similar to Avery. 5-tab clear, L311221. These are taller and wider, to use with sheet protectors and extra wide binders. Provide two sets of tabs with a tab for each month of construction. Insert month and year in each set of tabs (Ex: "October 2017") will be in each set of tabs. Each set of tabs will have the last tab read "Photograph." No handwritten tabs.

B. Deliver prints of Existing Conditions within 10 days of NTP.

C. Deliver prints of progress photographs with each Application for Payment. Place progress photographs in the protectors specified in 1.05A.3.

PART 2 - PRODUCTS

2.01 MATERIALS

A. NOT USED

PART 3 - PART 3 EXECUTION

3.01 GENERAL

A. NOT USED

END OF SECTION

SECTION 01 41 00

LABORATORY TESTING AND FIELD INSPECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Employment and payment of an independent testing laboratory for specified services shall be by the Contractor. This laboratory will perform all testing and inspection required by the specifications.

B. Payment: The Contractor shall be reimbursed for any additional testing required by Shelby County Schools or other government agency having jurisdiction which are not required by the specifications.

1.02 TESTING REQUIRED

A. All Special Inspections required by the International Building Code, Memphis and Shelby County Office of Construction Code Enforcement and/ or the Tennessee State Fire Marshal's office.

B. Special Inspection Testing required per Sheet S0.1 and S0.2 in Drawings.

C. Concrete under Division 03 - Concrete.

D. Mortar and masonry under Division 04 - Masonry.

E. Steel welding under Division 05 - Metals.

F. Fireproofing under Division 07 - Thermal and Moisture Protection.

1.03 LABORATORY QUALIFICATIONS: Meet "Recommended Requirements for Independent Laboratory Qualifications" as published by the American Council of Independent Laboratories.

1.04 REPORTS: The testing laboratory will provide copies of all reports to the Contractor, the architect, and the Shelby County Schools Representative.

1.05 RETESTING: Retesting of areas not conforming to the specifications will be by the testing laboratory but will be at the expense of the Contractor.

1.06 RE-INSPECTION: Visits for re-inspection of an area will be by the testing laboratory but will be at the expense of the Contractor.

1.07 COORDINATION: Contractor shall coordinate with the testing laboratory to schedule tests and inspections.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Contractors shall arrange for, provide, and remove Contractor's Temporary Facilities and Controls at the Contractor's own expense(s) through project completion and through removal of ALL Contractor's Temporary Construction Facilities off the Project Site without damage(s) to any existing City of Memphis Property, Existing Project Site materials (underground, in and on ground surface(s), above ground (i.e. trees and limbs of trees, utility lines, light fixture(s), etc.), existing building materials, facilities, structures, etc. Contractors MUST coordinate with Owner, Manager and Project Manager of Shelby County Schools Design & Construction, and Architect regarding all locations and movement of ALL Contractors' Temporary Construction Facilities within the Project Site Area(s). Contractors Must repair any and All Damage(s) to any and All materials within and on existing Project Site and within and on existing Project Site Building(s) as damage(s) deemed by Owner, Manager of Shelby County Schools Design & Construction, and Architect, the cause(s) by the Contractors. **Contractors MUST ADHERE TO AND COMPLETE ALL REPAIRS WITHIN THE TIMEFRAME(S) SET BY THE OWNER, SHELBY COUNTY SCHOOLS MANAGER OF DESIGN AND CONSTRUCTION, AND ARCHITECT AT THE CONTRACTOR'S EXPENSE(S).**

1. Temporary Field Office
2. Temporary Telephone and Fax Service / Printer
3. Temporary Toilets
4. Temporary Utilities
5. Temporary Heat
6. Temporary Protection and Protective Barricades
7. Vermin Control
8. Temporary Storage Sheds and Enclosures
9. Existing Sewers, Drainage, Etc.
10. Temporary Equipment
11. Removal
12. Parking for Construction Vehicles
13. Control of Dust and Mud
14. Laydown Area
15. Stormwater Bureau Letter of Intent
16. Construction Storm Water General Permit

1.02 SUBMITTALS:

A. Vermin Control Plan: Before, or with, the first invoice submit for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's plan(s) for controlling vermin during the course of construction.

B. Parking For Construction. Vehicles: Before, or with, the first invoice submit for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's and subcontractor's plan(s) showing where the workers will park (if allowed by the Owner and Shelby County Schools Manager of Design & Construction) their respective personal, company, and equipment vehicles while Contractors and subcontractors are working at and on the Project Site and at and around Project Site Building(s).

C. Control of Dust and Mud: Before, or with, the first invoice submit for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's plan(s) detailing how the Contractors will control dust and mud. Show where dust and mud catchments point(s) will be located and where the temporary water hose will be located and from where the temporary water and Cleaning Material Solution(s) will be piped. Detail ALL other aspects of Contractor's plan(s).

D. Roads On Site: Before, or with, the first invoice submit for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's plan(s) showing where the Contractor's and subcontractor's proposes to install any Temporary Vehicle Access (if applicable and allowed by Owner, Shelby County Schools Manager of Design & Construction) within and on the Project Site leading to, within and exiting from the Project Site and Building(s) to perform and complete ALL work for this project.

E. Set-up and Breakdown Area(s): Before, or with, the first invoice submit for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's plan(s) showing ALL locations where Contractors will set up Equipment, Materials, Products, Appurtenances, Etc. along with ALL drawing(s) showing ALL movement(s) of their respective Equipment, Materials, Products, Appurtenances, Etc. by the Contractor's and subcontractor's to the respective Contractor's and subcontractor's work area(s) for this Project. Contractor's must identify before, or with, the first invoice for the Owner, Shelby County Schools Manager of Design & Construction and Architect's approval of the Contractor's and subcontractor's plan(s) to provide and maintain ALL SAFETY MEASURES, MATERIALS AND PROCEDURES to keep ALL separation(s) between ALL Owner's Personnel and ALL Contractor's and subcontractor's On-Site Prior to, During, Upon Completion of, Throughout Completion of, and Following Completion until all Contractor's Equipment, Materials, Materials and Products Containers, Contractor's Vehicles, Completion of ALL Repairs of Damage(s) caused by Contractor's, Etc. are deemed complete by the Owner, Shelby County Schools Manager of Design & Construction and Architect regarding the Contractor's and subcontractor's Completion of the Contractor's and subcontractor's work for this Project.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 **TEMPORARY FIELD OFFICE:** Contractor's and subcontractor's Discretion, at ALL Contractor's and subcontractor's expense(s) at NO EXPENSE(S) TO THE OWNER, CONTACTORS AND SUBCONTRACTORS MUST SUBMIT REQUEST(S) FOR APPROVAL(S) FOR LOCATION(S), ETC. by the Owner, Shelby County Schools Manager of Design & Construction and Architect.

3.02 **TEMPORARY TELEPHONE AND FAX SERVICE:** Contractor's and subcontractor's Discretion, at ALL Contractor's and subcontractor's expense(s) at NO EXPENSE(S) TO THE OWNER, CONTACTOR'S AND SUBCONTRACTOR'S. MUST SUBMIT REQUEST(S) FOR APPROVAL(S) FOR LOCATION(S), ETC. by the Owner, Shelby County Schools Manager of Design & Construction and Architect.

3.03 **TEMPORARY TOILETS:** Contractor shall provide ample temporary water closets with enclosures with connections to city sewers or chemical toilets with enclosures for use of Contractor's and subcontractor's personnel during construction period to meet ALL location(s) of ALL Temporary Toilets MUST BE APPROVED BY THE OWNER, SHELBY COUNTY SCHOOLS MAJOR CONSTRUCTION MANAGER, AND THE ARCHITECT PRIOR TO PLACEMENT OF TEMPORARY TOILETS. ALL local health department and other governing health and City of Memphis requirements. Contractor's MUST IDENTIFY ALL TIMEFRAMES TEMPORARY WATER CLOSETS WILL BE CHANGED AND BY ALL RESPECTIVE COMPANIES WHICH WILL CHANGE ALL TEMPORARY WATER CLOSETS PRIOR TO, DURING, THROUGHOUT COMPLETION OF THIS PROJECT AND UNTIL ALL WATERCLOSET(S) ARE REMOVED FROM THIS PROJECT SITE. ALL WATER CLOSTES MUST NOT AT ANY TIME CREATE A PROBLEM FOR ANY OWNER'S PERSONNEL OR ANY PERSONS ON OR WITHIN THIS PROJECT SITE.

3.04 **TEMPORARY UTILITIES:** Contractor's and subcontractor's MUST Make arrangements with for and furnish, at Contractor's and subcontractor's expense(s), all electrical, potable water, sanitary sewer, storm sewer, and other utilities necessary for construction purposes. Coordinate with MLG&W. Include time in the Construction Schedule for making these connections. Contractors and subcontractors shall pay on-time ALL utility charges prior to, connection charges and ALL monthly utility charges at Contractor's and Subcontractor's Expense(s).

3.05 **TEMPORARY HEAT:** Contractors and subcontractors MUST PROVIDE All necessary provisions shall be made, and required equipment shall be supplied and maintained prior to, during, throughout construction, and until all Temporary Heat Equipment are removed from this Project Site and Project Site Temporary Site Buildings. Temporary Heat is for purpose(s) of drying up moisture within Project Site Area(s) and structure(s), and maintaining proper working conditions during cold and damp weather as deemed cold and damp weather. Contractor shall supply fuel and maintain heat at his expense for heating season. Lack of heat in temporary building(s) will not be acceptable as an excuse for delay in construction.

3.06 **TEMPORARY PROTECTION AND PROTECTIVE BARRICADES:**

1. Responsible For Protection of Project. It is the. Contractor's responsibility to provide protection of the project to protect the Owner's interest, to prevent theft of any materials which would delay the scheduled completion, to prevent vandalism and damage to installed materials, and to prevent harm to non-workers which possibly could result in a lawsuit listing the Owner as a

defendant and perhaps delay the scheduled completion.

2. Barricades: Furnish, erect, and remove protective fencing, barricades, guard rails and other safety devices around site and building openings and edges as required by local, state and federal building and safety codes. Remove protective devices at completion of the project construction.
3. Fence. Around. Contractor Work Area: The Contractor shall install a temporary fence around its work area(s), for their own protection. The work area(s) are to be shown on the site plan.
4. Completed Work Protection: Barriers, warnings, cordons, etc., as necessary to prevent damage to completed work. .
5. General: Protect work from injury due to weather, frost, accident or other causes and protect the Owner's property from damage(s) and personnel, visitors, etc. from injury arising in connection with this contract. All open trenches of hazardous nature shall be covered at night and non-working days.

3.07 EXISTING SEWERS, DRAINAGE, ETC.: Protect existing sewers from clogging. Remove any water that accumulates within or around the building during construction.

3.08 TEMPORARY SOIL EROSION: Control soil erosion during cleaning as required by the Tennessee Department of Environment and Conservation, Division of Water Pollution Control.

3.09 REMOVAL: All temporary facilities shall be removed promptly as each is no longer required. When the temporary facilities are removed, finish grade and sod any areas where they had been located.

3.010 PARKING FOR CONSTRUCTION VEHICLES: Parking arrangements for personal vehicles of all construction workers and construction vehicles of the Contractor and all subcontractors shall be controlled. Limit locations allowed for parking to reduce impact on community: this may include spreading out the parking of the workers. Do not assume that you can park in. any particular location that is public or owned by the Owner. The Contractor shall request approval to park on any public street or any area owned by the Owner, and the Owner shall consider granting such approval. There is no guarantee that the Owner will approve parking on any of their land.

3.011 CONTROL OF DUST AND MUD:

A. Establish One Entry Point: Control construction vehicle traffic by establishing only one entry/exit point on and off Owner's Property.

B. Watering to Control Dust: Use watering trucks to apply water on exposed dirt which can become airborne dust. Use as often as necessary and required as deemed necessary and required by the Owner, Shelby County Schools Major Construction Manager, Contractors, and subcontractors to control dust on the site.

C. Cleaning Mud Off Construction Vehicles: Contractors, subcontractors, ALL other workers for this project MUST Clean-wash ALL Construction Vehicles and ALL other Contractor's Vehicles and Equipment OFF-SITE and NOT ON OWNER'S PROPERTY. Contractors and subcontractors MUST submit to the Owner, Shelby County Schools Major Construction Manager Contractor's and subcontractor's plan(s) showing use of a filtering device at each storm drain inlet on Owner's Property , and adjacent streets to prevent clogging the storm sewer pipes with mud, debris, excess cleaning solutions, products, etc.. If the adjacent road(s) becomes muddy, the Contractors and subcontractors must wash down the road(s) to the

satisfaction of the Owner. This cleaning shall extend as far as necessary to remove all mud and dirt generated by this project as well as protection of inlets of same roads. Use water trucks and sweeping trucks as necessary to provide water for washing roads.

D. Plan(s): Submit plan(s) for approval by the Owner, Shelby County Schools Manager of Design & Construction and Architect.

3.012 ROADS ON SITE: (NOT USED)

3.013 LAYDOWN AREA: (NOT USED)

3.014 TRAFFIC CONTROL PLAN: (NOT USED)

3.15 STORMWATER BUREAU LETTER OF INTENT: (NOT USED)

3.016 CONSTRUCTION STORM WATER GENERAL PERMIT: (NOT USED)

END OF SECTION

SECTION 01 70 00

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Closeout Procedures

B. Final Cleaning

C. Project Record Documents

D. Operation and Maintenance Data

E. Warranties and Bonds

F. As-Built Drawings With Auto Cad DWG **(NOT PDF-NOT SCANNED)** of Same As-Built Drawings

G. As-Built Drawings are to be Submitted with a Cover List of Each Specific Change – Sequential Numbering of Each Change - Corresponding Drawing Sheet Number where Change Occurred, Etc. and Including All As-Built Section Requirements Within this Project Manual.

1.02 RELATED REQUIREMENTS

A. Agreement Between Owner and Contractor.

B. Section 01 01 00 - Summary of Work.

C. Section 01 30 00 - Submittals: Submittal of Operation and Maintenance Data.

1.03 CLOSEOUT PROCEDURES

A. Comply with procedures stated in Construction Agreement for issuance of Certificate of Substantial Completion.

B. When Contractor considers. Work has reached final completion, submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with contract Documents and ready for the Owner, Shelby County Schools Shelby County Schools Manager of Design and Construction, and the Architect/Engineer's inspection(s).

C. In addition to submittals required by the Conditions of the Contract, provide submittals required by governing authorities, and submit a final Statement of Accounting giving total Adjusted Contract Sum, previous payments, and sum remaining due.

D. Owner will issue final Change Directive reflecting approved adjustments to Contract Sum not previously made by Change Directive.

E. Submit all closeout documents and products to the Architect.

1.04 FINAL CLEANING

A. Complete prior to final inspection.

B. Clean interior and exterior surfaces exposed to view; remove temporary labels, stains and foreign substances, clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.

C. Thoroughly clean all interior finishes including glass, gypsum wallboard, carpets, etc., to the satisfaction of the Owner, Shelby County Schools, Manager of Design and Construction, and the Architect.

D. Clean the glass behind the security screens on all exterior windows affected by the Work of this Contract. This means to remove those security screens which are not hinged, clean the entire glass, and replace the security screens securely. For those windows that have hinged screens, swing the screens back, clean the entire glass, and reposition the screen. Clean all windows on all floors, even windows that are translucent.

E. Identify, remove and dispose of all debris and hazardous waste from site. Dispose of materials in compliance with current local, state and federal environmental requirements.

1.05 OPERATION AND MAINTENANCE DATA

A. Provide data in accordance with Contract.

B. Provide names and addresses of manufacturers and suppliers of equipment and materials and general and subcontractors.

C. Provide data for:
   1. Mechanical Equipment and controls – Division 23.
   2. Electrical Equipment and Controls – Division 26.
   3. Any other items specifically identified in individual specification sections of this Project Manual.

D. Submit four (4) sets prior to final inspection, bound in 8-1/2" x 11" three-ring side binders with durable plastic covers, tabbed with permanent tab markers and identified on face and spine.
   1. Part 1: Directory, listing names, addresses and telephone numbers of Architect/Engineer and Contractor(s).
   2. Part 2: Operation and maintenance instructions arranged by system. For each system give names, addresses, and telephone numbers of subcontractors and suppliers. Provide the following:
      a. Appropriate design criteria.
      b. List of Equipment.
      c. Parts List.
      d. Operating Instructions.

e. Maintenance instructions, Equipment, including identifying required cleaning materials and solutions for removals of (i.e. graffiti, marker ink, efflorescence, Etc.)
f. Maintenance instructions, finishes, including identifying required cleaning materials and solutions for removals of (i.e. graffiti, marker ink, efflorescence, Etc.)
g. Shop drawings and product data.
h. Warranties.

1.06 ADDITIONAL DOCUMENTATION

A. Provide the following documentation in addition to that previously specified:
1. Consent of Surety to Final Payment.
2. Contractor's Affidavit of Release of Liens.
3. Contractor's Affidavit of Payment of Debts and Claims.
4. Occupancy Permit.
5. Lien Waiver from all Subcontractors.
6. Non-asbestos/lead Certification.
7. Paint Schedule.
8. Keying Schedule and Lock Pinning Code.
9. 20 Blank Keys, with Name, Address, and Phone Number of Local Supplier.

1.07 WARRANTIES AND BONDS

A. Provide duplicate, notarized copies. Execute Contractor's submittals and assemble documents executed by subcontractors, suppliers, and manufacturers. Provide table of contents and assemble in. binder with durable plastic cover.

B. Submit material prior to final application for payment. For equipment put into use with Owner's permission during construction, submit within 10-days after first operation. For items of Work delayed materially beyond Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing(s) of ALL Manufactures Warranties, date(s) of acceptance as start and end of warranty period(s).

C. Manufacturer's Warranties:
1. Contractor shall combine all warranties into single 3-ring binder and submit to Owner with Closeout Documents.

1.08 PRODUCT OVERAGE (Extra Stock)

A. Section 09 51 23, Acoustical Ceiling Panels: One sealed box for each type installed.

B. Section Ceramic Tile: 100 Sq. ft. for each color pattern installed. One sealed box of accessories (i.e. glue, trim, etc.)

C. Section 09 91 00, Paint: One gallon of each color.

D. Division 23, HVAC FILTERS: One complete set each type.

E. Division 26, Fuses: Three extras of each type.

F. Provide ALL Products Data with ALL other related product information to the Owner, Shelby County Schools Shelby County Schools Manager of Design and Construction, and the Architect to assist the Owner with the proper re-use of all Products utilized for this Project, which may be used on this Project Site and Project Building with regards to maintenance and repairs for future applications beyond warranty periods.

1.09 SPECIAL CERTIFICATION(S)

A. Provide duplicate, notarized copies.

B. Provide certification(s) that products and materials installed are free of asbestos and comply with current local, state and federal requirements regarding asbestos.

C. Provide certification(s) that products and. materials installed are free of lead and comply with current local, state and federal requirements regarding lead.

D. Provide copies of all environmentally related permits required, and fee receipts for disposal of hazardous materials from the construction site.

1.010 FINAL ACCEPTANCE AND PAYMENT

A. Conform to Contract.

PART 2 - PRODUCTS

2.01 NOT USED

PART 3 - EXECUTION

3.01 NOT USED

END OF SECTION

SECTION 01 72 00

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Throughout progress of the Work, maintain an accurate record of changes in the Job Set, per Paragraph 3.01, and, upon completion of the Work, transfer the recorded changes to the Final Project Record Documents, per Paragraph 3.02.

B. Related Work:
Documents affecting work of this Section include, but are not necessarily limited to, General Conditions, Supplementary Conditions, and Sections in Division 1 of these Specifications.
Other requirements affecting Final Project Record Documents may appear in other sections of these Specifications.

C. Pay Applications: Each pay application shall include a statement signed by both the Contractor and the Architect that the "Job Set" is current with any changes: such as location, material, manufacturer, etc. This covers both the drawings and the specifications.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01 30 00.

B. Prior to submitting each request for progress payment, secure the Architect's approval of the current status of the Job Set.

C. Prior to submitting request for final payment, submit the Final Project Record Documents to the Architect and secure his approval.

1.03 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Job Set to one person on the Contractor's staff as approved by the Architect.

B. Accuracy of records:
1. Thoroughly coordinate changes within the Job Set, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other Documents where such entry is required to show the change properly.
2. Accuracy of records shall be such that future searches for items shown in the Contract Documents may rely reasonably on information obtained from the approved Final Project Record Documents.
3. Make entries within 24 hours after receipt of information that the change has occurred.

1.04 DELIVERY, STORAGE AND HANDLING

A Maintain the Job Set completely protected from deterioration and from loss and damage until completion of the Work and transfer of all recorded data to the Final Project Record Documents.

B. In the event of loss of recorded data, use means necessary to again secure the data to the Architect's approval.
   1. Such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials.
   2. In such case, provide replacements to the standards originally required by the Contract Documents.

1.05 RECORD DOCUMENTS – AS-BUILT DRAWINGS AND PROJECT MANUAL

A. Job Set: Promptly following receipt of the Owner's Notice to Proceed, secure one complete set of all Documents comprising the Contract. Place in Field Office.

B. Final Project Record Documents: At a time nearing the completion of the Work, PREPARE AND PROVIDE ONE ELECTRONIC DWG CAD FILES ON CD of all drawings and specifications and two hard copies of the drawings and specifications. The electronic copy shall be as follows:
   1. Electronic copy of project "specifications" in Microsoft Word 2007.
   2. One hard-copy set of "Construction" and "As-Built" drawings with "Final" Architect/
   3. Engineer Seals.
   4. Hard copies of all "field" changes made by individual trades, especially Electrical, Plumbing and Mechanical.
   5. Electronic copies of "Construction" and "As-Built" drawings on CD's shall include the following in AutoCAD Release 2013 or greater.
      a. All xref's; Do not bind xref's.
      b. All plot files. May bind.
      c. No junk files.
      d. Each "Division" to be in separate folders, i.e. Architectural, Civil, etc..
      e. Each Division folder and Sheet to be named accordingly, i.e. "A3.01", including "Drawing Dates".
      f. All tif.'s and pdf.'s to have appropriate professional "Seal".
      g. Label each Disc with: Location Name, Project Name, Date, and number of disc, i.e. 1 of 3, etc.
      h. All xref.'s shall be loaded and attached to each drawing so that each drawing is viewable, when opened.
      i. As-Built Drawings With Auto CAD DWG (NOT PDF-NOT SCANNED) of Same As-Built Drawings
      j. As-Built Drawings are to be Submitted with a Cover List of Each Specific Change – Sequential Numbering of Each Change - Corresponding Drawing Sheet Number where Change Occurred, Etc. and Including All As-Built Section Requirements Within this Project Manual.

PART 2 - EXECUTION

2.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the Job Set described in Paragraph 2.1, A above, identify each of the Documents with the title, "RECORD DOCUMENTS - JOB SET".

B. Preservation:
   1. Considering the Contract completion time, the probable number of occasions upon which the Job Set must be taken out for new entries and for examination, and the conditions under which these activities will be performed, devise a suitable method for protecting the Job Set to the approval of the Architect.
   2. Do not use the Job Set for any purpose except entry of new data and for review by the Architect, until start of transfer of data to Final Project Record Documents.
   3. Maintain the Job Set at the Site Office.

C. Making entries on Job Set:
   1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required. This is for drawings and specifications.
   2. Date all entries.
   3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
   4. In the event of overlapping changes, use different colors for the overlapping changes.
   5. Make entries in the pertinent other Documents as-approved by the Architect.
   6. Mark-up new information which is recognized to be of importance to the Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date.
   7. Note related change order numbers where applicable.
   8. Markings shall be legible.

D. Conversion of schematic layouts:
   1. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items, is shown schematically and is not intended to portray precise physical layout.
   2. Final physical arrangement is determined by the Contractor, subject to the Architect's approval.
   3. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the Drawings.

E. Show on the Job Set, by dimension accurate to within one half inch.
   1. Clearly identify the item by accurate note such as "cast iron drain," or "gale Water," and the like.
   2. Show, by symbol or note, the vertical location of the item ("under slab," "in ceiling plenum," "exposed," and the like).
   3. Make all identification so descriptive that it may be related reliably to the Specifications.

F. Give particular attention to substitutions, selection of options, and similar information on work where is it concealed or otherwise cannot be discerned readily at a later date by direct observation. Note related record drawing information and product, where applicable.

2.02 FINAL PROJECT RECORD DOCUMENTS

A. The purpose of the Final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation and examination.

B. Approval of recorded data prior to transfer:
   1. Following receipt of the electronic copy of the contract drawings and specifications and prior to start of transfer of recorded data thereto, secure the Architect's approval of all recorded data.
   2. Make required revisions.

B. Transfer of data to Drawings:
   1. Carefully transfer change data shown on the Job Set to AUTOCAD Release 2013 or Greater DWG FILES ON CD, coordinating the changes as required.
   2. Clearly indicate at each affected detail and other Drawings a full description of changes made during construction and the actual location of items described in subparagraph 3.01 above.
   3. Call attention to each entry by drawing a "cloud" around the area or areas affected.
   4. Make changes neatly and consistently to assure clear plotting.

C. Transfer of data to Specifications: Make changes on MICROSOFT WORD 2010 of all sections. Show changes in bold with followed by the letters "FPRD" in parenthesis (for Final Project Record Documents). In the Table of Contents put the same letters (in bold) beside any section so changed.

D. Review and submittal:
   1. Submit the completed set of Final Project Record Documents to the Architect.
   2. Participate in review meetings as required.
   3. Make required changes and promptly deliver the Final Project Record Documents to the Architect.
   4. As-Built Drawings With Auto CAD DWG **(NOT PDF-NOT SCANNED)** of Same As-Built Drawings
   5. As-Built Drawings are to be Submitted with a Cover List of Each Specific Change – Sequential Numbering of Each Change - Corresponding Drawing Sheet Number where Change Occurred, Etc. and Including All As-Built Section Requirements Within this Project Manual.

2.03 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor has no responsibility for recording changes in the Work after Final Completion, except for changes resulting from work performed under Warranty.

END OF SECTION

SECTION 01 73 00

OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 NOT USED

PART 2 - PRODUCTS

2.01 INSTRUCTION MANUALS

A. To aid the continued instruction of operating and maintenance personnel and to provide a positive source of information regarding the products incorporated into the Work, furnish and deliver the data described in this Section and in other pertinent Sections of this Project Manual.

B. Format.
   1. Size: 8-112" x 11"
   2. Paper: White bond, at least 20 pound weight
   3. Text: Typewritten
   4. Drawings:
      a. Bind in with the text.
      b. Fold-out drawings are acceptable.
      c. Fold drawings larger than 8-1/2" x 14" and fit into a drawing pocket inside the rear cover of the manual.
   5. Flysheets:
      a. Separate each section of the manual with a flysheet that briefly describes the contents of the section.
      b. Flysheets may be in color.
   6. Binding:
      a. Provide heavy plastic or fiberboard covers with binding mechanisms concealed.
      b. Three (3) ring binders are acceptable.
   7. Measurements:
      a. Indicate all measurements in standard US units such as feet and. inches, pounds, and cubic feet per minute and so forth.
      b. Where items may be expected to be measured within ten (10) years in accordance with the metric formulae, provide additional measurements in the International.
   8. Provide front and back covers for each manual, using durable material approved by the Architect and clearly identified on or through the cover with at least the following information:
      a. OPERATING AND MAINTENANCE INSTRUCTIONS
      b. Name and address of Work.
      c. Name of contractor.
      d. General subject of this Manual.
      e. Space for approval signature of the Architect and approval date.

C. Contents:

1. Typewritten index.
2. Complete instructions regarding operation and maintenance of all materials involved, including:
   a. Removal and re-installation of existing adjacent materials that are in good and/or acceptable condition as deemed good and/or acceptable by Architect or Shelby County Major Construction Manager.
   b. Removal of existing adjacent materials and replacement of new adjacent materials which match removed adjacent materials which are acceptable as deemed acceptable by Architect or Shelby County Schools Major Construction Manager.
   c. Normal operating procedures or sequences and any special procedures required during seasonal changes.
   d. Complete explanation of all materials specifications, applications, warranties, etc..
   e. Normal maintenance cleaning and repair procedures requirements.
   f. Predicted service life of all materials subject to wear by normal seasonal conditions.
   g. Recommendation regarding use of graffiti removal chemicals, as well as what not to use regarding graffiti removal chemicals.
3. Complete nomenclature for all materials and equipment.
4. Manufacturer's bulletins, cuts, and descriptive data where pertinent, clearly indicating the precise items included in this installation and deleting or otherwise clearly indicating all manufacturer's data with which this installation is not concerned.
5. Such other data as required in pertinent Sections of these specifications.
6. Warranties, bonds or service agreements issued covering the materials which indicate:
   a. Material or product covered.
   b. Date the pertinent agreement started and the date the agreement will end.
   c. Owner maintenance required to maintain warranty, bond or service repair agreement.
   d. Instances which will void or otherwise affect the warranty, bond or service repair agreement.

PART 3 - EXECUTION

3.01 INSTRUCTION MANUALS

A. Preliminary:
   1. Prepare a preliminary draft of each proposed Manual.
   2. Show general arrangement, nature of contents in each portion, probable number of drawings showing the areas of work performed per the Scope of Work and their size and proposed method of binding and covering.
   3. Obtain the Architect's approval prior to proceeding.

B. Final:
   1. Comply with the pertinent provisions of Section 01700.
   2. Complete the manuals in strict accordance with the Architect's comments and information.
   3. Provide three (3) copies.

C. Revisions:
   1. Following the indoctrination and instruction of operation and. maintenance personnel, review all proposed revisions of the Project Manual with the Architect.
   2. If the Contractor is required, by the Architect to make substantial revisions to the previously

approved. Project Manual, additional compensation will be considered in accordance with the General Conditions of the Contract for Construction.

3.02 OWNER INSTRUCTION

A. After approval of the Maintenance Manuals but prior to Final Payment, provide a trained and experienced representative of the company contracted to provide cleaning services or work in the proper operation and maintenance of cleaning and/or repairing in-place or installed work, to identify and confirm on-site and per as-built drawings completion of all work by contract.

B. Provide the representative/s for not less than one (2) full work days for-proper instruction.

C. If required due to the complexity of operation or maintenance or by stipulations of warranty, provide a representative/s for each pertinent manufacturer to assist in the instruction and to answer questions and to explain how maintenance can affect or void warranty.

D. Provide a list of all company personnel dedicated to the contracted work for the duration of the work through the completion of the work with same personnel telephone numbers, cell phone numbers, respective fax numbers (if applicable) and any other information necessary to contact same personnel during and after completion (as deemed completed by the Architect) of contracted work.

E. Provide the Architect with an electronic AUTOCAD RELEASE 2013 OR GREATER DWG FILES ON At a time nearing the completion of the Work, PREPARE AND PROVIDE ONE ELECTRONCI DWG CAD FILES ON CD of all drawings and specifications and two hard copies of the drawings and specifications. The electronic copy shall be as follows:

1. Electronic copy of project "specifications" in Microsoft Word 2007.
2. One hard-copy set of "Construction" and "As-Built" drawings with "Final" Architect/
3. Engineer Seals.
4. Hard copies of all "field" changes made by individual trades, especially Electrical, Plumbing
5. and Mechanical.
6. Electronic copies of "Construction" and "As-Built" drawings on CD's shall include the
7. following in AutoCAD Release 2006 or greater.
   a. All xref.'s; Do not bind xref's.
   b. All plot files. May bind.
   c. No junk files.
   d. Each "Division" to be in separate folders, i.e. Architectural, Civil, etc..
   e. Each Division folder and Sheet to be named accordingly, i.e. "A3.01", including "Drawing Dates".
   f. All tif.'s and pdf.'s to have appropriate professional "Seal".
   g. Label each Disc with: Location Name, Project Name, Date, and number of disc, i.e. 1 of 3, etc.
   h. All xref.'s shall be loaded and attached to each drawing so that each drawing is viewable, when opened.
   i. As-Built Drawings With Auto Cad DWG (NOT PDF-NOT SCANNED) of Same As-Built Drawings
   j. As-Built Drawings are to be Submitted with a Cover List of Each Specific Change – Sequential Numbering of Each Change - Corresponding Drawing Sheet Number where Change Occurred, Etc. and Including All As-Built Section Requirements Within this

Project Manual.

8. Transfer of data to Drawings:
   a. Carefully transfer change data shown on the Job Set to AUTOCAD Release 2006 or Greater DWG FILES ON CD, coordinating the changes as required.
   b. Clearly indicate at each affected detail and other Drawings a full description of changes made during construction and the actual location of items described in subparagraph 3.01 above.
   c. Call attention to each entry by drawing a "cloud" around the area or areas affected.
   d. Make changes neatly and consistently to assure clear plotting.

B. Transfer of data to Specifications: Make changes on MICROSOFT WORD 2007 of all sections. Show changes in bold with followed by the letters "FPRD" in parenthesis (for Final Project Record Documents). In the Table of Contents put the same letters (in bold) beside any section so changed.

C. Review and submittal:
   1. Submit the completed set of Final Project Record Documents to the Architect.
   2. Participate in review meetings as required.
   3. Make required changes and promptly deliver the Final Project Record Documents to the Architect.

D. Electronic CD MUST AUTO-CAD DWG FORMAT of all as-built drawings of all areas of work performed **As-Built Drawings With Auto Cad DWG (NOT PDF-NOT SCANNED) of Same As-Built Drawings.**

E. As-Built Drawings are to be Submitted with a Cover List of Each Specific Change – Sequential Numbering of Each Change - Corresponding Drawing Sheet Number where Change Occurred, Etc. and Including All As-Built Section Requirements Within this Project Manual. MUST NOT BE PDF OR SCANNED OR READ –ONLY.

F. Provide the Architect with a complete set of Electronic CD AUTOCAD DWG As-Built Drawings that show all areas of contracted work completed for this project. Identify on same drawings all existing materials undisturbed and remain un-effected by the contracted, all new materials which replaced existing materials, all existing materials which were repaired with matching new materials, all new materials, etc.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Miscellaneous framing and sheathing.
- B. Roof curbs and perimeter nailers.
- C. Blocking in wall and roof openings.
- D. Wood furring.
- E. Concealed wood blocking for support of washroom accessories,.
- F. Wood treatment

1.2 RELATED SECTIONS
- A. Section 04200 - Unit Masonry: Masonry openings to receive wood blocking.
- B. Section 05120 – Structural Steel.

1.3 SUBMITTALS
- A. Fire Retardant Treatment: All wood will be fire-retardant treated. All other wood blocking, etc. shall be fire-treated.
- B. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for proper use of each type of treated material.
  - 1 Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative retained and conformance with applicable standards and complies with EPA requirements.
  - 2 For Water-borne Treatment: Include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

1.4 PRODUCT HANDLING
- A. Delivery and Storage: Keep materials dry at all times. Protect against exposure to weather and contact with, damp or wet surfaces. Stack lumber as well as plywood and other panels; provide air circulation within and around stacks and under temporary coverings including polyethylene and similar material.

1.5 PROJECT CONDITIONS
- A. Coordination: Fit carpentry to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 PRODUCTS

2.1 LUMBER, GENERAL
- A. Lumber Standards: Manufacture lumber to comply with PS 20 American Softwood Lumber Standard, and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.
- B. Inspection Agencies: Inspection agencies and the abbreviations used to reference with lumber grades and species include the following:

1 NLGA - National Lumber Grades Authority.
2 SPIB - Southern Pine Inspection Bureau.
3 WCLIB - West Coast Lumber Inspection Bureau.
4 WWPA - Western Wood Products Association.

C. Grade Stamps: Factory-mark each piece of lumber with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.
   1. For exposed lumber, apply grade stamps to ends or back of each piece, or omit grade stamps entirely and issue certificate of grade compliance from inspection agency in lieu of grade stamp.

D. Nominal sizes are indicated, except as shown by detail dimensions. Provide actual sizes as required by PS 20, for moisture content specified for each use.

2.2 MISCELLANEOUS LUMBER

A. Provide wood for support or attachment of other work including cant strips, nailers, blocking, furring, grounds, stripping and similar members. Provide lumber of sizes indicated, worked into shapes shown, and as follows:
   1. Moisture content 19% maximum for lumber items not specified to receive wood preservative treatment.

B. Grade: construction grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 boards per SPIC rules.

C. Construction Panels:
   1 Concealed APA Performance-Rated Panels: Where construction panels will be used for concealed types of applications, provide APA Performance-Rated Panels complying with requirements indicated for grade designation, span rating, exposure durability classification, edge detail (where applicable) and thickness.
   2 Plywood: At locations noted or shown on the drawings, or for electrical or telephone equipment, provide fire-retardant treated plywood panels with grade designation, APA C-D PLUGGED INT with exterior glue, in thickness indicated, or if not otherwise indicated, not less than 3/4".

D. Miscellaneous Materials:
   1. Fasteners and Anchorage: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

E. Wood Treatment by Pressure Process:
   1. Preservative Treatment: Where lumber or plywood is indicated as "TW", "Trt-Wd" or "Treated", or is specified herein to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark requirements.
      a. Pressure-treat above ground items with water-borne

preservatives complying with AWPB L-2. After treatment, kiln-dry to a maximum moisture content, respectively of 19% and 15%. Treat indicated items and the following:
1) Wood Cants, nailers, curbs, blocking, stripping, and similar members in connection with roofing, flashing, vapor bafflers and waterproofing.
2) Wood sills, sleepers, blocking, furring, stripping and similar concealed members in contact with masonry or concrete.

2. Complete fabrication of treated items prior to treatment, where possible. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment and to comply with AWPA M4. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.
   a. Fire-retardant Treatment: All unfinished wood materials shall be fire-retardant treated.
   b. Furnish all miscellaneous hardware required such as bolts, screws, nails, anchors, etc.

PART 3 EXECUTION

3.1 INSTALLATION, GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

D. Use common wire nails, except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where exposed side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; pre-drill as required.

3.2 WOOD GROUNDS, NAILERS AND BLOCKING

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with others involved.

B. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicate. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement.

END OF SECTION

SECTION 06 22 00 - WOOD CASEWORK

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes the following:

1. New wood casework to replace/supplement existing where indicated on drawings.
2. Shop finishing of casework.
3. Work includes wood furring, blocking, shims, and hanging strips unless concealed within other construction prior to casework installation.

1.02 RELATED SECTIONS

A. Section 06100 – Rough Carpentry: Framing and blocking in walls, floors, and ceiling to support casework.

C. Section 15010 – Basic Mechanical Requirements: Connections for drain lines, service piping, vents, plumbing fixtures, fixture traps, and tailpipes to service fixtures.

D. Section 16050 – Basic Materials and Methods: Connections for electrical service lines, wire and conduit to service fixtures.

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used.

C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large scale details, attachment devices, and other components.

D. Samples: For each finish indicated, one complete set of color chips representing manufacturer's full range of available colors and patterns.

1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
2. Lumber and panel products with shop-applied opaque finish, for each finish system and color, with exposed surface finished.
3. Plastic-laminates, for each type, color, pattern, and surface finish.

1.04 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining

temperature and relative humidity at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.01 PLYWOOD COMPONENTS

A. Exposed Plywood: Any exposed-to-view casework components shall be Grade A red oak plywood. This applies to all wood components: doors, drawers, shelves, body, etc. Press-wood, particle board, or any similar product shall not be specified.

B. Covered Plywood: Any covered casework components shall be Grade A plywood covered with plastic laminate. This applies to all covered wood components: doors, drawers, shelves, body, etc. Press-wood, particle board, or any similar product shall not be specified.

C. Mixed Component Use: These requirements are not meant to require that all components be of only one of the two options. These requirements allow the use of both options in a piece of casework.

2.02 BASE UNITS

A. Base Units: Replace entire length of base cabinets and countertop as a unit. Do not replace one unit within a grouping.

2.03 FINISHES

A. Plastic Laminate: Match the color and pattern of that on adjoining casework as close as possible.

B. Paint/Stain: Paint or stain to match color and finish of that on adjoining casework as close as possible.

2.04 HARDWARE

A. Provide cabinet hardware and accessory materials associated with architectural woodwork.

B. Hinges: Match the hinges on adjoining casework as close as possible.

C. Wire Pulls: Where indicated on new and existing, casework replace/provide with new ADA compliant back mounted solid metal wire pulls, satin stainless finish.

D. Magnetic Catches: Match the catches on adjoining casework as close as possible.

E. Drawer Slides: Side mounted; full extension type; epoxy-coated-steel with steel ball-bearings; of the type on adjacent casework.

F. Door Locks: BHMA A156.11, E07121.

G. Drawer Locks: BHMA A156.11, E07041.

H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Satin Stainless Steel: BHMA 630.

2.05 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire treated, kiln dried to less than 15 percent moisture content.

2.06 FABRICATION

A. General: Complete fabrication to maximum extent possible before shipment to Project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting within and abutting existing work.

1. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs. Seal edges of openings in countertops with a coat of varnish.

B. Wood Cabinets for Transparent Finish:

1. Cabinet Construction: Construction shall match that of adjoining casework in the immediate area.

C. Wood Cabinets for Opaque Finish:

1. Cabinet Construction: Construction shall match that of adjoining casework in the immediate area.

D. Plastic-Laminate Cabinets:

1. Cabinet Construction: Construction shall match that of adjoining casework in the immediate area.

2.07 SHOP FINISHING

A. Finish casework at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of casework, only if casework receives transparent or opaque paint finishes.

C. Transparent Finish: Comply with requirements for grade, finish system, staining, and sheen comparable to that of existing adjoining casework.

D. Opaque Finish: Comply with requirements for grade, finish system, color, effect and sheen comparable to that of existing adjoining casework.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Before installation, coordination casework to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. Install casework level, plumb, true and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.

C. Scribe and cut to fit adjoining casework, walls, etc. Refinish cut surfaces, and repair damaged finish at cuts.

D. Anchor casework to anchors or blocking built in or directly attach to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Install casework without distortion so doors and drawers fit openings properly and are accurately aligned with existing adjoining casework. Adjust hardware to center doors and drawers in opening and to provide unencumbered operation within limits of ADA requirements.

1. Fasten overhead wall cabinets through back, near top and bottom, at ends and not more than16 inches o.c. with No. 10 wafer-head screw sized for minimum 1 inch penetration into wood framing, blocking, or hanging strips; No. 10 wafer-head sheet metal screws through metal blocking or metal framing behind wall finish; or toggle bolts through metal blocking or metal framing behind wall finish or into masonry anchors into concrete or masonry construction.
2. Where overhead wall cabinets are required to be lowered to meet ADA requirements, it shall be the General Contractor's responsibility to provide infill patching and finishing of the substrate above to match that of adjoining surfaces.

E. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop. Caulk space between backsplash and wall with sealant specified in Division 7 Section 07900 – Joint Sealants.

END OF SECTION 06220

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior manual-swing entrance doors and door frame units.

1.2 PERFORMANCE REQUIREMENTS

A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.

2. Dimensional tolerances of building frame and other adjacent construction.

3. Failure includes the following:

a. Deflection exceeding specified limits.

b. Thermal stresses transferring to building structure.

c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.

d. Noise or vibration created by wind and by thermal and structural movements.

e. Loosening or weakening of fasteners, attachments, and other components.

f. Failure of operating units.

1.3 SUBMITTALS

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

B. Shop Drawings: For aluminum-entrance doors and framing systems. Include plans, elevations, sections, details, and attachments to other work.

1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.

C. Samples: For each type of exposed finish required.

D. Other Action Submittals:

1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams.

E. Product test reports.

F. Maintenance data.

G. Warranties: Sample of special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project and having a minimum of 5 years experience.

B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.

C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.

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

E. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

F. Source Limitations for Aluminum-Entrance Systems: Obtain from single source from single manufacturer.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes do not comply with requirements or that fail in materials or workmanship within specified warranty period. Warranty does not include normal weathering.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Kawneer Trafab VersaGlaze 451T Thermal Framing System or comparable product by one of the following:

B. Manufacturers: Subject to compliance with requirements,

1 Columbia Commercial Building Products.

2 EFCO Corporation.

3 Kawneer North America; an Alcoa company.

4 Tubelite.

5 United States Aluminum.

6 Vistawall Architectural Products; The Vistawall Group; a Bluescope Steel company.

7 YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

1 Sheet and Plate: ASTM B 209.

2 Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

3 Extruded Structural Pipe and Tubes: ASTM B 429.

4 Structural Profiles: ASTM B 308/B 308M.

5 Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.

B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.

1 Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
2 Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
3 Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

2.3 FRAMING SYSTEMS

A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Reference Division 8, Section - 08520.
3. Glazing Plane: Center.

B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration. Reinforce members as required to receive fastener threads. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.

E. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

1. Provide sealants for use inside of the weatherproofing system that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 GLAZING SYSTEMS

A. Glazing: As specified in Division 8 Section "Glazing."

B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, molded or extruded, of profile and hardness required to maintain watertight seal.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

2.5 ENTRANCE DOOR SYSTEMS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Medium stile; 3-1/2-inch nominal width.
   a. Accessible Doors: Smooth surfaced for width of door in area within 10 inches above floor or ground plane.

3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets.

   a. Provide nonremovable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in Division 8 Section "Door Hardware."

2.6 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:

1 Profiles that are sharp, straight, and free of defects or deformations.

2 Accurately fitted joints with ends coped or mitered.

3 Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.

4 Physical and thermal isolation of glazing from framing members.

5 Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

6 Provisions for field replacement of glazing from interior.

7 Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.7 ALUMINUM FINISHES

A. High-Performance Organic Finish 2-coat, thermocured system with fluoropolymer coats containing not less than 70 percent polyvinylidene fluoride resin by weight, complying with AAMA 2605-98.

1. Color and Gloss: To match existing renovation work

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1 Comply with manufacturer's written instructions.

2 Do not install damaged components.

3 Fit joints to produce hairline joints free of burrs and distortion.

4 Rigidly secure nonmovement joints.

5 Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.

6 Seal joints watertight unless otherwise indicated.

B. Metal Protection:

1 Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.

2 Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.

D. Set continuous sill members and flashing in full sealant bed using Dow Corning Contractor’s Weatherproofing Sealant (CWS) or approved equal, to produce weather tight installation.

E. Install components plumb and true in alignment with established lines and grades, and without warp or rack.

F. Install glazing as specified in Division 8 Section "Glazing."

G. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.

1 Exterior Doors: Install to produce weather tight enclosure and tight

fit at weather stripping.

2 Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

END OF SECTION 08411

SECTION 08 71 00 FINISH HARDWARE AND SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Hardware for wood, hollow steel doors and aluminum doors.
B. Thresholds.
C. Weather-stripping, seals and door gaskets.

1.2 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION
A. Section 08110 - Steel Doors and Frames: Furnish templates for frame preparation.
B. Section 08210 - Wood Doors: Furnish templates for door preparation.

1.3 RELATED SECTION
A. Section 08110 - Steel Doors and Frames.
B. Section 08210 - Wood Doors.
C. Section 16720 – Fire Alarm System: Electrical connection to activate door closers and release magnetic holders.

1.4 REFERENCES
A. ANSI A117.1 - Specification for Making Building and Facilities Accessible to and Usable by Physically Handicapped People.
B. ADA - American's with Disability Act, 1991 including latest amendments.
C. AWI - Architectural Woodwork Institute – Quality Standards
D. NFPA 80 - Fire doors and Windows.
E. NFPA 101 - Code of Safety to Life from Fire in Buildings and Structures.
F. NFPA 252 - Fire Tests of Door Assemblies.
G. UL 10B - Fire Tests of Door Assemblies.
H. UL 305 - Panic Hardware.

1.5 SUBMITTALS
A. Submit under provisions of Section 01300.
B. Hardware Schedule:
   1. All schedules shall be typewritten and prepared of the "vertical" type as opposed to the "horizontal" type.
   2. Provide hardware schedule listing hardware by set numbers giving the following information:
      a. List each architectural door number.
      b. Door location, size, hand, door and frame material.
      c. List each hardware item giving:
         1) Manufacturer's name.
         2) Catalog number with product data index number.
         3) Hardware size (if required), and finish type.
      d. Provide "Door Index" with hardware schedule listing each architectural door number in chronological order giving the respective hardware set number, item number (if used) and keyset number.
C. Product Data: Provide manufacturer's cut sheets on each different hardware item proposed and index it, with the use of numerals or letters or a combination of both, with the hardware schedule. The index numbers/letters are to be in the right hand column on the same line as the manufacturer's number. All

manufacturers' numbers shall be indexed even when appearing more than once.

D. Samples: The Designer may request samples illustrating style, color and finish of any or all materials proposed to be furnished and they will remain in his possession until the project is completed.
E. After submittals have been approved, this supplier shall make all corrections and resubmit for final approval.

1.6 OPERATION AND MAINTENANCE DATA
A. Submit under provisions of Section 01700.
B. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.7 QUALITY ASSURANCE
A. Perform work in accordance with the following requirements:
1. ANSI A 117.1 – Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.

1.8 QUALIFICATIONS
A. Hardware supplier must employ the services of a qualified Architectural Hardware Consultant (AHC). AHC may be employee of the hardware supplier to assist in the work of this section.

1.9 REGULATORY REQUIREMENTS
A. Fire Labeled Openings:
1. Door hardware for all labeled fire openings shall comply in all respects to the National Board of Fire Underwriter's requirements for the rating of the opening called for on the drawings. All locking and latching devices, closers and closer arms shall bear visible evidence of UL approval.
B. Americans with Disabilities Act:
1. Door openings, through which the disabled will pass or have access to, shall be in full compliance with Government codes and regulations.
a. A lever handle shall operate all passage latches and locksets.
b. The force required to open a door shall not exceed five foot pounds for interior doors and eight foot pounds for exterior doors. The opening force may vary depending on the type of HVAC system and the weather conditions.
c. Thresholds may not extend more than ½" above the finished floor.

1.10 DELIVERY, STORAGE AND HANDLING
A. Deliver, store, protect and handle products to site as per manufacturer's recommendations.
B. Package hardware items individually; label and identify package with door opening code to match hardware schedule.
C. Deliver all change and master keys as directed by Designer.
D. Protect hardware from theft by cataloging and storing in a secure area.

1.11 COORDINATION
A. This contractor shall cooperate and coordinate with other sections of this specification that are affected by the finish hardware and he shall be capable of interpreting all documents. During the construction period, this contractor shall make as many visits as may be required to consult with the various contractors, suppliers and trades concerning the proper installation of materials under this

section.

1.12 WARRANTY

A. Hardware will remain free from all defects and blemishes; and shall perform satisfactorily for minimum of one (1) year from date of Substantial Completion; and that failure to provide such performance will constitute repair or replacement and reinstallation to satisfaction of the Owner at no additional cost.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:
   1 Hager H
   2 Sargent S
   3 Rockwood R
   4 National Guard NG
   5 Rixon RI
B. Hinges:
   1 All butts to be size 4-1/2” x 4-1/2” except as noted otherwise. Hinges to be 0.180 inch thick, four ball bearings on exterior doors, metal doors, doors over 3’-0” wide. Furnish 3 hinges per door leaf up to, but not including 7’-6” in height and add one additional hinge for each 2’-6” or fraction thereof of height of door.
   2 All hinges on exterior doors and doors with closers to have Non-Removable Pins (NRP). Hinges on exterior doors shall have nonferrous base metal and shall have stainless steel pins.
C. Mortise Locks and Trim:
   1 For use on all exterior doors and other specialty doors where indicated on schedule.
   2 Shall be ANSI Grade 1, and shall have a heavy wrought steel case 5-7/8” high x 4-1/4” deep x 1”: wide, one (1) throw dead bolt with two steel insert, 0.750 inch throw solid brass three-piece mechanical anti-friction latch bolt, 2.750 inch backset and with an armored front size 8” x 1.250”.
   3 Lock Trim: Lever to be cast brass with plug only to show cylinder and through-bolted to the door with no exposed screws on the exterior.
   4 Cylinder to be machined from solid brass/bronze bar stock and with additional security provided by a setscrew mounted diagonally into the cylinder wall to prevent unauthorized removal of the cylinder without the use of the control key. Cylinder to have Interchangeable Core (IC).
   5 Mortise locks to be Sargent as per sets- No substitution.
D. Cylindrical Locks and Trim:- Not Used
E. Exit Devices:
   1. Single Non-Label Assemblies:
      a. Single non-labeled doors shall be equipped with a rim exit device and operated by a lever handle from the pull side.
      b. Approved Manufacturer: Sargent.- No Substitution.
   2. Double Non-Label Assemblies:
      a. The active door shall be equipped with a vertical rod exit device and operated by a lever handle from the pull side.
      b. The inactive door shall be equipped with a vertical rod exit device to match

the active door except there shall be no trim on the pull side.

F. Door Closers:
   1 All door closers shall be fastened to metal door using Phillips head machine screws. Furnish all-thread wood screws for fastening closers to wood doors. Fasten closers to metal frame using Phillips head machine screws.
   2 Door closers shall have high strength cast iron cylinders and one piece forged steel pistons. Main arm shall be forged steel for interior doors and forged steel "CUSH-N-STOP" main and fore arm on exterior doors. Furnish a smooth molded cover for closer body. Use full size cover.
   3 Door closers shall have two separately adjustable non-critical valves for closing speed and latching speed. There shall be two additional valves for adjusting the hydraulic backcheck.
   4 Parallel arm shall be used where closer is to be concealed from public view.
   5 Door closers to be Sargent as per sets- No substitution.

G. Kick Plates:
   1 Kick plates shall be 8" high x door width minus 2". Restroom doors and certain other doors shall have kick plates on both sides of the door.
   2 All plates shall be 0.050" thick.

H. Door Stops:
   1. Wall mounted stops: Where possible, use wall mounted doorstops. Fasten to the wall with a toggler.
      a. The diameter of the wall stop should be approximately 2-5/8", having a concave rubber bumper projecting ¾".
   2. Floor Stops: Where it is not possible to use a wall stop, the use of a floor stop is permitted. Fasten to the floor with a ¼-20 Machine Screw and Expansion Shield (MSES).
      a. The projection of the stop from the floor should be great enough for the door to strike approximately ½" of the top of the stop.

I. Thresholds, Weatherstrip, Drip Cap, Astragals
   1. Thresholds: Shall be as detailed on the drawings or as listed in the Hardware Group numbers. Furnish all thresholds with 1-1/4-20 Machine Screws and Expansion Shields (MSES).
      a. Thresholds shall be manufactured from extruded aluminum of commercial quality and shall meet the ADA regulations.
      b. Type: #896S (Silicone Bumper) x ½-20 MSES x Anti-Slip Surface (SIA), National Guard Products.
   2. Weatherstrip: Shall be UL approved for use on fire door assemblies and shall be made from a very good grade of silicone.
      a. `Series 160V, National Guard Products.
   3. Drip Caps: Shall be mounted to the head of exterior frames on the exterior side and shall extend the full width of the frame head and is to clear the top of the door approximately 1-1/4" maximum. Caulk between the cap and the head to prevent seepage of moisture.
      a. Shall be extruded from aluminum and be fastened to the frame head using sheet metal screws.
      b. Series 16AD.
   4. Silencers: Besides the door silencers that are shipped with the hollow metal frames, furnish door silencer as listed under this Section of the Specifications.
   5. Substitutions: Under provisions of Section 01600, certain items above are marked "No Substitution" and do not qualify under "Substitutions".

Substitution for other manufacturer's products must be received in writing five (5) working days before the bid date.

2.2 KEYING

A. Coordination with Memphis City Schools (MCS):

B. All keys, cylinders, locks and hardware accessories shall be coordinated with the locksmith Department of Memphis City Schools.

C. Keying Requirements:

1. All keying to be accomplished at the factory of the lock manufacturer.
2. Whenever possible with renovation and addition projects, try to match the cylinders and keywords with the existing master system at school.
3. Provide a (3-level) grand master, master and change key for every classroom door and general usage areas. Every floor, section, gym, general office area, and separate building should have a different sub-master key.
4. All office and storage areas shall be keyed to grand master and change keys (2-levels of keying). These should not be on floor or section master key.
5. All exterior doors to each separate building should be keyed to grand master and change key.
6. All gym, cafeteria and general office areas require their own separate sub-master key.
7. Kitchen area exterior doors shall be keyed to grand master and a change key for the cafeteria manager.
8. Any dry food storage (pantry) will require an individual key only (S.K.D.).
9. All doors between a cafeteria and the serving area should be keyed alike.
10. Key one (1) exterior door by general office to grand master and change key for office personnel.
11. All vestibule and corridor door from the auditorium shall be keyed alike.
12. All vestibule or corridor doors from gym shall be keyed alike.
13. All band practice room doors shall be keyed alike.
14. All teachers' lounge doors shall be keyed alike.
15. All rest room doors shall be keyed alike.

D. Cylinders:

1 Use cylinder type locksets only. Do not use any key-in-knob locksets.
2 All cylinders should be interchangeable cores, with 6-pins and a restricted keyway.
3 Supply only Sargent (Signature cylinders). All cylinders shall be from one manufacturer.
4 Furnish all cylinders keyed to a (3-level) grand master, master and change key system.
5 Furnish four (4) Grand Master Keys, eight (8) Master Keys, and two (2) Keys per lock, and one hundred (100) Key Blanks.

E. Construction Cylinders and Keying:

1 Furnish <u>all</u> locks construction master keyed with 6400 series brass cores which shall remain property of Memphis City Schools.
2 Supply ten (10) construction master keys for the project.
3 Supplier to include full cost of construction cores in bid.

F. Finish: The finish of cylinders should match the finish of the hardware on each door.

G. Key Control:

1 All keys (master and change keys) shall be sent by registered mail by the hardware supplier to Mr. Buddy Neahman, Facilities Support Manager, 1364

Farmville Road, Memphis, TN 38122.

2 All cylinders and keys shall be properly tagged to indicate their intended location, and to enable the Owner, with a minimum of effort, to establish his key control system.

3 Establish a visual key control by stamping all change keys and all cylinders (interchangeable cores) with key set symbol. Do not stamp key section or bitting number.

4 Furnish one (1) key cabinet with a capacity of one (1) hook per cylinder, plus an additional fifty (50%) percent for expansion.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that power supply is available to power operated devices.

C. Beginning installation means acceptance of existing conditions.

3.2 INSTALLATION

A. Deadlocks/Deadbolts: 48” from finished floor to center of cylinder.

B. Hardware Installation.

3.3 FIELD QUALITY CONTROL

A. Architectural Hardware Supplier shall inspect complete installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer’s instructions and as specified.

B. Provide certification. Reference Section 01700.

3.4 ADJUSTMENT

A. Check all hardware for correct hand and correct operation. Adjust all spring-loaded devices for operation against wind or draft conditions, friction from door coordinators and latch friction. Leave the complete hardware installation operating in conformity with the manufacturer’s design intent.

3.5 PROTECTION OF FINISHED WORK

A. Protect finished work before, during and after installation as required.

B. Do not permit adjacent work to damage hardware or finish

3.6 HARDWARE SETS

SET # 1

EXTERIOR PAIRS HOLLOW METAL DOORS WITH REMOTE LOCK/UNLOCK

EACH PAIR TO RECEIVE:

4 EA	HINGES	T4A3386 NRP 4 ½ X 4 ½	US32D
2 EA	ELECTRIFIED TRANSFER HINGE	CC4 T4A 3386 4 ½ X 4 ½	US32D
1 EA	KEY REMOVABLE MULLION	64-L980S USP	
1 EA	EXIT DEVICE	43-64-56-8804 X 826 X SNB	US32D

1 EA	EXIT DEVICE	43-8810 X 821 X SNB	US32D
2 EA	IC CORE 1	0-6300 US15	
2 EA	DOOR CLOSERS	351 CPS X TB	EN
2 EA	DOOR STOPS	466	US2C
1 EA	THRESHOLD	896V X OPENING WIDTH	ALUM
2 SETS	WEATHER-STRIP	160V- DW X DH	ALUM
2 EA	SWEEPS	C627A – DW	ALUM

SET # 2

CLASSROOMS & OFFICES

EACH TO HAVE:

3 EA.	HINGES	TA2714-4.5” X 4.5”	US26D
1 EA.	LOCK	64-8237-WTL	US26D
1 EA.	IC CORE	10-6300	US15
1 EA.	WALL STOP	409	US32D
3 EA.	SILENCERS	229A	GRAY

SET # 3

STORE ROOMS SINGLE DOORS

EACH TO HAVE:

3 EA.	HINGES	TA2714-4.5” X 4.5”	US26D
1 EA	LOCK	64-8225-WTL	US26D
1 EA.	IC CORE	10-6300	US15
1 EA.	WALL STOP	409	US32D
3 EA.	SILENCERS	1229A	GRAY

SET # 4

KITCHEN TO DINING DOORS

EACH TO HAVE:

6 EA	HINGES	TA2714 4 ½ X 4 ½	US26D
1 EA	LOCKSET	64-8237 WTL	US26D
1 EA	I.C. CORE	10-6300	US15
2 EA	FLUSH BOLTS	555- 12”	US26D
2 EA	PLUNGER HOLDER	459	US26D

SET # 5

DINING ROOM, AUDITORIUM

EACH TO HAVE:

6 EA.	HINGES	T4A3786-4.5” X 4.5”	US26D
1 EA	REMOVABLE MULLION	12-64-L980S X LAR	USP
2 EA	EXIT DEVICES	12-43-64-8843 – ETL	US32D
2 EA	IC CORES	10-6300	US15
2 EA.	CLOSERS	351-CPS X TB	EN
2 EA	KICK PLATES	K0050-10” X 2” LDW	US32D
2 EA.	DOOR STOPS	409	US32D
2 EA.	SILENCERS	1229A	GRAY

SET # 6

PUBLIC TOILETS

EACH TO HAVE:

3 EA.	HINGES	T4A3786	US26D
1 EA.	DEADLOCK	64-4877- 48” C/L A.F.F.	US26D (OMIT @ PUBLIC TOILETS)
1 EA	IC CORE	10-6300	US15
1 EA.	PUSH PLATE	70C 4X16	US32D
1 EA.	PULL PLATE	70C X126 4X16	US32D
1 EA.	CLOSER	351-CPS	EN
1 EA.	KICK PLATE	K0050-10” X 2” LDW	US32D
1 EA.	WALL STOP	409	US32D
3 EA.	SILENCERS	1229A	GRAY

SET # 7

UNISEX TOILETS

EACH TO HAVE:

3 EA.	HINGES	TA2714 4 ½” X 4 ½”	US26D
1 EA.	PRIVACY LATCH.	8266-WTL	US26D
1 EA.	KICK PLATE	K0050-10” X 2” LDW	US32D
1 EA.	WALL STOP	409	US32D
3 EA.	SILENCERS	1229A	GRAY

SECTION 08 80 00 – GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes glazing for the following products and applications, where glazing requirements are specified by reference to this Section.

B. Abrasion-resistant and Enhanced UV-resistant polycarbonate plastic glazing.

C. IECC 2006 compliant insulated glass units.

1.2 Related Sections

A. Section 08411 – Aluminum-Framed Entrances and Storefronts.

1.3 PERFORMANCE REQUIREMENTS

A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or polycarbonate sheet breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. References

1 ASTM Z 97.1 – American National Standard for Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Plastics.

2 ASTM D 256 – Standard Test Method for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

3 ASTM D 638 – Standard Test Method for Tensile Properties of plastics.

4 ASTN D 792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

5 ASTM D 1923 – Standard Test Method for Ignition Properties Plastics.

6 ASTM F 1233 – Standard Test Method for Security and Systems.

C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

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

D Thermal and Optical Performance Properties: Provide plastic glazing panels with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:

1. For UV-and Abrasion-Resistant Polycarbonate Vertical Glazing Sheet, properties are based on 3/8" (.375 inch) of thickness indicated for overall unit and for each lite.
2. Center-of-Panel Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
   a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.; Plastic's (Summer Heat Gain .83)(Winter Heat Loss .88).
   b. Solar Heat Gain Coefficient: NFRC 200 ;(60%).
   c. Solar Optical Properties: NFRC 300 ;(50%).

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1 Physical properties including data on material weight, wind load capacity, light transmission shading coefficient, and thermal expansion.
2 Preparation instructions and recommendations.
3 Storage and handling requirements and recommendations.
4 Installation methods and glazing procedures, including edge engagement guidelines.

B. Sample Selections: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

C. Verification Samples: Submit samples for each finish product specified, two samples, minimum size 6inches square, representing actual product and framed on two adjacent sides to show glazing system.

D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

1.5 QUALITY ASSURANCE

A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and framing member that will contact or affect elastomeric glazing sealants:

B. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

C. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. GANA Publications: GANA's "Glazing Manual."

D. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1 Build mockups as delineated in Section 01100, “SUMMARY FINAL”, Paragraph
2 Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 WARRANTY

A. Manufacturer's Special Warranty on Polycarbonate Plastic Sheet: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace polycarbonate vertical glazing lites that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Provide manufacturer’s written warranty covering breakage, abrasion resistance, coating failure, loss of light transmission, yellowing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver polycarbonate sheets on enclosed pallets.
B. Store products in manufacturer’s unopened packaging until ready for installation.
C. Store in dry, well- ventilated and covered areas at temperatures below 80 degrees F.
D. Handle polycarbonate sheets carefully to prevent damage; do not drop, slide, or drag.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

B. Requests for substitutions will be considered in accordance with provisions of Sections 01600.

2.2 POLYCARBONATE SHEET

A. GE, LEXAN® Margard MR10

B. Sheffield Plastics, Makrolon MAK 15

C. Polycarbonate Sheet-General: Comply with ANSI Z 97.1 and with properties as follows:

1. Specific gravity: 1.2 per ASTM D 792.
2. Tensile strength yield: 9,000 psi, per ASTM D 638.
3. Tensile strength, ultimate: 9,500 psi, per ASTM D638.
4. Tensile modulus: 345,000 psi, per ASTM D 638.
5. Flexural strength at 5 percent strain: 13,500 psi, per ASTM D 790.
6. Flexural modulus: 345,000 psi, per ASTM D 790.
7. Izod impact strength (0.125 inch notched): 12-16 ft. ib/in/in of notch, per ASTM D 256.
8. Self - ignition temperature: 1040 degrees F, per ASTM D 1929.
9. Flash ignition temperature: 800 degrees F, per ASTM D1929.

B. <u>UV and Abrasion Resistant Type</u>: Provide GE, LEXAN MR10, Sheffield Makrolon MAK 15 or approved equal, hard- coated plastic glazing sheet.

1 Thickness: as indicated on drawing.

2 Color: As selected by Owner from manufacturer's full range for each project location (bronze or gray).

C. <u>Obscure Polycarbonate Sheet Type</u>: Provide and incorporate with the UV and mar – resistant glazing sheet at all window locations of restrooms and privacy-required areas, Reference MCS Drawing #D-109-54-79 for Details.

1 Thickness: 0.125 inch nominal.

2 Color: Clear.

D. Sealed Insulating Glass Units: Vision glazing.

1. Application(s): All exterior glazing, unless otherwise indicated.
2. Outboard Lite (1/4” tempered laminated): Outer 1/8” tempered /.030 pvb inner-layer / inner 1/8” tempered float glass.
   a. Tint: Bronze or Gray, Color to be selected by Owner’s Representative.
   b. Coating: Low E coating.
3. ½” Innerspace with bronze spacer.

4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
5. Total Thickness: Nominal 1 inch.
6. Glazing Method: Gasket glazing.
7. Glazing Performance Requirements (unit calculations):
   a. Maximum .60 U Factor.
   b. Maximum .25 Solar Heat Gain Coefficient.
8. Heat strengthened: Glass Panes to be heat strengthened as required by manufacturer to meet performance and assembly descriptions.

E. Obscure Sealed Insulating Glass Units: Vision glazing.

1. Application(s): All exterior glazing unless otherwise indicated.
2. Outboard Lite (1/4" tempered laminated): Outer 1/8" tempered /.030 pvb inner-layer / inner 1/8" tempered float glass.
   a. Tint: Bronze or Gray, Color to be selected by Owner's Representative.
   b. Coating: Low E coating.
3. ½" Innerspace with bronze spacer.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Obscure coating: 3M Fasara (or equal) decorative window film, Essen pattern on interior side
5. Total Thickness: Nominal 1 inch.
6. Glazing Method: Gasket glazing.
7. Glazing Performance Requirements (unit calculations):
   a. Maximum .60 U Factor.
   b. Maximum .25 Solar Heat Gain Coefficient.
8. Heat strengthened: Glass Panes to be heat strengthened as required by manufacturer to meet performance and assembly descriptions.

F. Glazing Accessories: As recommended by manufacturer of plastic glazing sheet for wet and dry glazing installations.

2.3 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
   1 Neoprene, ASTM C 864.
   2 EPDM, ASTM C 864.
   3 Silicone, ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
   1 Neoprene.

2 EPDM.
3 Silicone.

2.4 GLAZING SEALANTS

A. General: Provide products of type indicated, complying with the following requirements:

1 Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
2 Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3 VOC Content: For sealants used inside of the weatherproofing system, not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
4 Colors of Exposed Glazing Sealants: As selected by Owner from manufacturer's full range.

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

1. Single-Component Neutral-Curing Silicone Glazing Sealants GS-GE Silpruf SCS 2000 or approved equal :

a. Products:
1. GE
2. Dow Corning

b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 50

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

2. Acid-Curing Silicone Glazing Sealants GS-:

a. Products:
1. GE

2. Dow Corning.
b. Type and Grade: S (single component) and NS (nonsag).

c. Class: 25.

d. Use Related to Exposure: NT (nontraffic).

e. Uses Related to Glazing Substrates: Aluminum, and, as applicable to glazing substrates.

f. Applications: Manufacturers recommendation**.**

2.5 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1 AAMA 804.3 tape, where indicated.

2 AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.

3 AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1 Type 1, for glazing applications in which tape acts as the primary sealant.

2 Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.6 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: **Elastomeric material of hardness needed to limit glass**

lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect pallets upon delivery for evidence of damage.

B. Inspect and verify that frame openings are correct size and conform to recommendations of the plastic glazing sheet manufacturer.

3.2 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the result for the substrate under the project conditions.

B. Clean frame contact surfaces with compatible solvent and wipe dry. Do not allow solvent to pool in glazing channels.

C. Immediately prior to installation, expose glazing edges of plastic sheet by peeling back factory-applied protective masking to a dimension sufficient for edge engagement.

3.1 GLAZING

A. General: Comply with combined written instructions of manufacturers of polycarbonate, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

1 Glazing channel dimensions, as indicated on Drawings, install plastic glazing in accordance with manufacturer's recommendations for edge engagement and expansion allowance. Provide necessary, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

2 Employ only sealants and glazing accessories that have been approved by manufacturer of plastic glazing sheet.

3 Remove protective masking immediately after all glazing operations

are completed.

4 Protect polycarbonate panels from damage during handling and installation. Remove damaged glazing panels from Project site and legally dispose of off Project site. Damaged plastic imperfections that, when installed, could weaken lite and impair performance and appearance.

5 Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

6 Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by plastic manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

7 Provide spacers for plastic lites where length plus width is larger than 50 inches.

8 Provide edge blocking where indicated or needed to prevent plastic lites from moving sideways in glazing channel, as recommended in writing by polycarbonate plastic manufacturer and according to requirements in referenced glazing publications.

B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

1 Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

2 Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

3 Apply heel bead of elastomeric sealant.

4 Center glazing lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

5 Apply cap bead of elastomeric sealant over exposed edge of tape.

C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

1 Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded

together at corners.

2 Center plastic lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weather tight seal without developing bending stresses in glazing lites. Seal gasket joints with sealant recommended by gasket manufacturer.

3 Install gaskets so they protrude past face of glazing stops.

D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glazing lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glazing channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

1 Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

2 Tool exposed surfaces of sealants to provide a substantial wash away from glazing lite.

3.2 CLEANING AND PROTECTION

A. Protect installed products until completion of project.

B. Affix polyethylene film or other covering approved by plastic glazing sheet manufacturer to framing members, as required to protect plastic glazing from other construction operations.

C. Remove and replace plastic glazing lites that are broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period, before Substantial completion.

END OF SECTION 08800

SECTION 09 26 00

GYPSUM BOARD SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnishing of and paying for all labor, services, appliances, materials and equipment necessary for execution, installation and completing of all work specified herein and as shown on drawings.

B. Section includes:

1. Metal stud wall framing, their accessories and installation (interior).
2. Metal furring channels, clips, angles, etc. as required to complete this work.
3. Sound attenuation fire blankets and firesafing insulation.
4. Fire rated and non-fire rated gypsum board wall assembly.
5. Gypsum wallboard.
6. Installation of various devices required within this work for use of others. Devices shall be furnished and accurately located with erection drawings by using section. Install as required for maximum rigidity.
7. Taping, mudding, sanding and finishing of all gypsum board walls and ceilings.
8. Trim accessories, polyurethane foam tape gaskets and caulking used within these systems.
9. Anchors, nails, devices and accessories required to install complete all gypsum materials specified herein.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. A123 - Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
2. A525 - Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
3. C36 - Specification for Gypsum Wallboard
4. C475 - Specification for Joint Treatment Materials of Gypsum Wallboard Construction
6. C514 - Specification for Nails for the Application of Gypsum Wallboard
7. C557 - Adhesives for Fastening Gypsum Wallboard to Wood Framing
8. C630 - Water-Resistant Gypsum Backing Board
9. C645 - Specification for Non-Load (Axial) Bearing Steel Studs, Runners (Track), and Rigid Furring Channels for Screw Application of Gypsum Board.
12. C754 - Specification for Installation of Framing Members to Receive Screw Attached Gypsum Wallboard, Backing Board, or Water Resistant Backing Board.

13. C1002 - Specification for Steel Drill Screws for the Application of Gypsum Board Material to Light Gauge Steel Studs
16. E90 - Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.
17. E119 - Method for Fire Tests of Building Construction and Materials.

B. Gypsum Association (GA)
1. GA-201 - Gypsum Board for Walls and Ceilings
2. GA-203 - Installation of Screw-Type Steel Framing Members to Receive Gypsum Board
3. GA-216 – Recommended Specifications for the Application and Finishing of Gypsum Board
4. GA-600 – Fire Resistance Design Manual

1.03 SUBMITTALS
A. Submit under provisions of Section 01300.
B. Product Data:
1. Framing: Provide data describing standard framing member material and finish, product criteria, load charts and limitations.
2. Gypsum Board System: Product data on gypsum board, joint material, sound attenuation insulation, acoustical sealant, joint material, gypsum finishing accessories, gaskets.

1.04 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01720.
B. Submittals

1.05 QUALITY ASSURANCE
A. Work under this section will be done in accord with the recommendation of USG "Drywall" Construction Handbook, latest edition, unless otherwise specified herein,

1.06 QUALIFICATIONS
A. Applicator shall have a minimum of three years experience in the installation of gypsum board systems.

1.07 DELIVERY, STORAGE AND HANDLING
A. Deliver, store, protect and handle product to site under provisions of Section 01600.
B. Delivery and Handling:
1. Deliver materials to the project site with manufacturer's labels intact and legible.
2. Handle materials with care to prevent damage.
3. Deliver fire rated materials bearing testing agency label and required fire classification numbers.
C. Storage:
1. Store materials inside under cover; stack flat, off floor.
2. Stack wallboard so that long lengths are not over short lengths.
3. Avoid overloading floor system.

4. Store adhesives in dry area, provide protection against freezing at all times.

1.08 ENVIRONMENTAL CONDITIONS

A. Temperature: During cold weather, in areas receiving wallboard installation, maintain temperature range between 55 degrees F to 70 degrees F for 24 hours before, during and after gypsum wallboard and joint treatment application.

B. Ventilation:

1. Provide ventilation during and following adhesives and joint treatment applications.
2. Use temporary air circulators in enclosed areas lacking natural ventilation.
3. Under slow drying conditions, allow additional drying time between coats of joint treatment.
4. Protect installed materials from drafts during hot, dry weather.

C. Protection: Protect adjacent surfaces against damage and stains.

1.09 COORDINATION

A. Coordinate work under provisions of Section 01731.

PART 2 PRODUCTS

2.01 MANUFACTURERS - FRAMING MATERIAL

A. United States Gypsum Company

B. Other acceptable manufacturers:

1. Southwest Metals, Inc., Carrollton, Texas
2. Dietrich Industries, Inc., Pittsburgh, Pennsylvania
3. Harrison Manufacturing Company, Memphis, Tennessee

C. Substitution: Under provisions of Section 01600.

2.02 FRAMING MATERIAL (INTERIOR WALLS)

A. Interior Drywall Studs and Accessories:

1. Interior Drywall Studs:
   a. Equivalent to USG "ST" Series, 25 gauge minimum thickness, galvanized interior stud. Stud gauge shall be based on a limiting height base on an allowable deflection of L/240 with type of wall system specified. Reference drawings for stud sizes, spacing and wall thickness.
   b. Equivalent to USG "ST" Series 20 gauge studs, at all door frames (double studs), all borrowed light frames (double studs), framing around various items that cannot be moved otherwise during the renovation, and at any and/or all other locations as specifically shown on drawings.
2. Interior Floor and Ceiling Runners:
   a. Equivalent to USG CR Galvanized Steel Runner. Same material and thickness as studs. Size as required to fit stud widths as shown on the drawings.

b. Provide extended leg ceiling runners where occur under structural members.

2.03 FRAMING ACCESSORIES

A. Furring and Bracing Members: Of same material as studs, thickness to suit purpose.

B. USG Cold Rolled Channels: 16 gauge steel, 3/4 inch with 1/2 inch flange, 1-1/2 inch with 17/32 inch flange. Channels shall have black asphaltum paint.

C. USG Metal Furring Channels: Roll formed, hat-shaped sections made of 25 gauge corrosion resistant steel.

D. USG Z-Furring Channels: 24 gauge minimum corrosion resistant steel.

E. Screws and Fasteners:

1. USG 7/16 inch Super Tite II for attaching metal studs to metal runners; use 5/8 inch where metal thickness exceeds standard 25 gauge.
2. All others per manufacturer's instructions.
3. Runner Fasteners: 5/32 inch diameter power driven type with a minimum of 1-1/4 inch minimum penetration into concrete.
4. Powder actuated fastener, such as nails, eye pin hangers, etc. as required.

F. Miscellaneous angles, expansion bellows, channels, attachment devices, girders, braces, etc. to be standard USG galvanized or as recommended or required for secure rigid attachment of condition encountered in strict accord with the latest USG Drywall installation manual.

G. Primer: FSTT-P-645, for touchup of galvanized surfaces.

2.04 FINISHES - FRAMING MATERIAL

A. Studs and Runners: Galvanize to G-60 coating class meeting the requirements of ASTM A446.

B. Accessories: Same finish as framing members or meeting ASTM A123 Hot-Dip Galvanized to 1.25 oz/sq. ft.

2.05 MANUFACTURER - GYPSUM BOARD MATERIAL

A. United States Gypsum Company

B. Other acceptable manufacturer: Georgia Pacific Corporation

C. Substitution: Under provisions of Section 01600.

2.06 GYPSUM BOARD MATERIAL

A. Fire Rated Gypsum Board: 5/8 USG "Sheetrock" Firecode "C" meeting ASTM C36, maximum permissible length, ends square cut, tapered edges. (Used in all wall construction requiring labeled and non-labeled construction as shown on the drawings.)

B. Moisture Resistant Fire Rated Gypsum Board: 5/8 USG W.R. Firecode "C" meeting ASTM C630, maximum permissible length, ends square cut, tapered edges. (Used in all walls or ceilings in toilets, janitor closets, showers, and behind ceramic tile where gypsum board is scheduled.)

2.07 ACCESSORIES

A. Sound Attenuation and Fire Blankets USG Thermafiber Sound Attenuation Fire Blankets in thickness required for the specified wall assembly. Refer to Art 3.13, Schedule – Wall,
Ceiling and Column Types.

B. Acoustical Sealant: USG Sheetrock Acoustical Sealant meeting requirements of ASTM C557, complies with ASTM C919. Provide W.R. Sealant where moisture resistant gypsum board occurs.

C. Joint Material:
   1. Joint Compounds: USG brand, type as recommended for the intended use.
      a. Sheetrock Setting-Type or Lightweight Setting-Type Joint Compound (20, 45, 90, 210, 300).
      b. Sheetrock Joint Compound (Taping, Topping, All Purpose).
      c. Sheetrock Ready-Mixed Joint Compound (Taping, Topping, All Purpose).
      d. Sheetrock Lightweight All Purpose Joint Compound Ready-Mixed (Plus 3).
   2. Joint Tape: USG Sheetrock Joint Tape
   3. All material for fire rated assembly shall conform to UL Design requirements.

D. All adhesives: As recommended by the manufacturer.

E. Finishing Accessories:
   1. Casing Bead: No. 200A Steel Series.
   2. Corner Beads: No. 101 Steel Dur-A-Bead.
   3. Taping: USG Perf-A-Tape System.
   4. Expansion Control: USG 093 in strict accord with manufacturer's instructions.
   5. Miscellaneous closure members, wall molds, edge strips, where as shown on drawings or required to be equivalent to "Fry Reglet Corp."

F. Fasteners: Conforming to ASTM C1002. USG 1 inch Super-Tite Drillers for one layer of 5/8 inch gypsum board. 1-5/8 inch Super-Tite Drillers for two layers.

G. Gaskets:
   1. To be polyurethane foam tape 1/8 inch thick x 2 inches wide continuous at all ceilings where gypsum partitions abut the ceiling or other materials as may be encountered.
   2. To be polyurethane foam tape 1/4 inch thick x 3/4 inch wide continuous where gypsum partitions abut exterior wall.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that site conditions are ready to receive work.
B. Verify that rough-in utilities are in proper location.
C. Verify that building components are ready to receive work.
D. Beginning of installation means acceptance of substrate.

3.02 INTERIOR STEEL STUD WALL INSTALLATION

A. Refer to Drawings for type of wall construction.
B. Refer to Drawings for indication of partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
C. Align all partitions accurately as shown on the drawings. Shape floor and ceiling runners as detailed on the drawings.
D. Attach steel runners at floor and ceiling to structural elements with suitable fasteners located 2 inches from each end and spaced 24 inches o.c.
E. Provide extended leg ceiling runners where occur under structural members. Allow 1/2 inch deflection allowance.
F. Embed floor runner in two continuous beads parallel with runner. Anchor runner 24 inches o.c. maximum to the floor between beads.
G. Secure 25 gauge studs to track using USG Lock Fastener Tool. Secure 20 gauge studs to tracks with low profile screws.
H. Stud splicing permissible. Splice studs with 8 inch minimum nested lap, secure each stud flange with flush head screw.
I. Construct corners using minimum three studs.
J. Double studs at wall openings, door, window jambs, and borrowed light frames, and not more than 2 inches each side of openings. Provide headers at opening to support all applicable loads.
K. Over openings, place horizontally a cut-to-length section of runner, with a web-flange bend at each end, and secure to strut-studs with two screws in each bent web.
L. Where drywall type door frames occur (Section 08100) rough opening shall be of correct dimensions in accordance with approved door frame shop drawings.
M. Brace stud framing system and make rigid.
N. Coordinate erection of studs with requirements of door and window frame supports and attachments.
O. Align stud web openings with adjacent studs.
P. Coordinate installation of bucks, anchors, and blocking with electrical and mechanical work to be placed in or behind stud framing.
Q. Blocking: Secure wood blocking to studs. Install blocking for anchorage of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories and hardware including wall mounted door stops.
R. Coordinate placement of insulation in stud spaces made inaccessible after stud framing erection.

3.03 WALL FURRING INSTALLATION

A. Erect wall furring for direct attachment to concrete block walls.
B. Erect furring channels horizontally. Secure in place on alternate channel flanges at maximum 24” o.c.
C. Secure in place on alternate channel flanges at maxim 24 inches o.c.
D. Space furring channels maximum 16 inches o.c.

3.04 CEILING ERECTION SYSTEM (CHANNEL FRAMING)

A. Space 8 gauge hanger wires 48 inches o.c. along carrying channels and within 6 inches of ends of carrying-channel run. Securely attach to structure.

B. Install 1-1/2 inch carrying channels 48 inches o.c., and within 6 inches of walls. Position channels for proper ceiling height, level, and secure with hanger wire saddle-tied along channel. Provide 1 inch clearance between runners and abutting walls and partitions. At channel splices, interlock flanges, overlap ends 12 inches and secure each end with doublestrand 18 gauge tie wire.

C. Erect 7/8" metal furring channels at right angles to 1-1/2 inch carrying channels or main supports. Space furring 16 inches o.c. and within 6 inches of walls. Provide 1 inch clearance between furring ends and abutting walls and partitions. Secure furring to carrying channels with clips or wire-tie to supports with double-strand 18 gauge wire. At splices, nest furring channels at least 8 inches and securely wire-tie each end with double strand 18 gauge wire.

D. At light troffers or any openings that interrupt the carrying of furring channels, install additional cross reinforcing to restore lateral stability or grillage.

E. Screw attach gypsum board to framing.

3.05 INSULATION INSTALLATION

A. Refer to drawings for location of wall or ceiling insulation.

B. Sound Attenuation Fire Blanket Installation (Interior Walls): Install Sound Attenuation Fire Blankets after gypsum panels are applied to one side of studs and before panels are applied to other side of studs. Insert the 16 inch wide blanket in the stud cavity, by bowing the blanket slightly. After inserting, make a vertical cut between the studs. Slit the blanket with a sharp utility or hookbill knife to ease the pressure of the blanket against the gypsum panels when they are installed. Butt ends of blankets closely together and fill all voids. Install blanket between all service boxes.

3.06 GYPSUM BOARD INSTALLATION

A. Position all ends and edges of all gypsum panels over framing members, except when joints are at right angles to framing members as in perpendicular application or when end joints are back-blocked.

B. Apply gypsum panels first to the ceiling (where scheduled) and then to the vertical walls. Extend ceiling board into corners and make firm contact with top plate. To minimize end joints, use panels of maximum practical lengths. Fit ends and edges closely, but not forced together. Stagger end joints in successive courses with joints on opposite sides of a partition placed on different studs.

C. Install gypsum board vertically in full sheets where possible. No short patch or scrap pieces will be permitted. Keep joints to a minimum. All joints must occur over a support. Avoid screw heads projecting outward thereby forcing misalignment or waves in gypsum surface.

D. Cut gypsum panels a minimum 1/4 inch shorter than the height required with 1/4 inch gap at floor for acoustical caulking. Use 1/4 inch thick shims at the floor to support panels until all screws are installed.

E. Attach panels to framing supports (Power Driven USG Screws). Space fasteners not less than 3/8 inch from edges and ends of panels and drive as recommended for specified fastening method. Drive fasteners in field of panels first, working toward ends and edges. Hold panel in firm contact with framing while driving fasteners. Drive fastener heads slightly below surface of gypsum panels in a uniform dimple without breaking face paper.

F. Cut ends, edges, scribe or make cutouts within field of panels in a workmanlike manner.

G. Trim Members:
   1. Install casing beads where gypsum board abuts dissimilar materials.
   2. Install corner beads on all exterior corners.
   3. Tape all interior corners.
   4. Tape joints and finish where new gypsum partitions abut or appear as a continuation of existing gypsum partitions.
   5. Install expansion joints in accord with manufacturer's instructions.

H. Bind all edges abutting material other than gypsum board with casing bead.

I. Install double layers of gypsum board where required and shown on the drawings for the walls indicated in full accord with the manufacturer's instructions.

J. Caulk floor, wall and ceiling perimeter as required to fire and acoustical requirements with acoustical caulking.

3.07 JOINT TREATMENT APPLICATION (INTERIOR)

A. Mix joint compound in strict accordance with manufacturer's instructions.

B. Apply taping and embedding compound in a thin uniform layer to all joints and angles to be reinforced. Immediately apply sheetrock joint tape centered over joint and seated into
compound. Follow immediately with a thin skim coat to embed tape, but not to function as a second coat. Fold and embed tape properly in all interior angles to provide a true angle. The tape or embedding coat must be thoroughly dry prior to application of second coat.

C. Apply second coat of joint compound over embedding coat filling panel taper flush with surface cover tape and feather out at least 2 inches beyond first coat. On joints with no taper, cover tape and feather out at least 4 inches on either side of tape. Allow second coat to dry thoroughly prior to application of finish coat.

D. Sand thoroughly and spread finish coat evenly over and extend at least 2 inches beyond second coat on all joints and feather to a smooth uniform finish. Over tapered edges, do not allow finished joint to protrude beyond plane of the surface. Apply a finish coat to cover tape. Apply taping compound at all taped angles and provide a true angle. Sand between coats and following the final application of compound, to provide a smooth surface ready for decoration.

E. Gypsum board material above ceilings are finished and taped, fastener depressions filled however final sanding is not required.

F. Finishing Fasteners: Apply a taping, all-purpose type compound to fastener depressions as the first coat. Follow with a minimum of two

additional coats of topping or all-purpose compound, leaving all depressions level with the plane of the surface.

G. Finishing Beads and Trims:
   1. Apply first coat to all bead and trim and properly feather out from ground to plane of surface. Compound must be thoroughly dry prior to application of second coat.
   2. Apply second coat in same manner as first coat, extending compound slightly beyond onto face of panel. Compound must be thoroughly dry prior to application of finish coat.
   3. Apply finish coat to all bead and trim, extending compound slightly beyond the second coat and properly feathering from ground to plane of surface. Sand finish coat as necessary to provide a flat smooth surface ready for decoration.

H. Apply "Surface Sealer" equal to that manufactured by USG to all gypsum surfaces within toilet room and/or wet locations. Apply sealer in accord with manufacturer's direction, after taping and finishing of all joints.

3.08 TOLERANCES

A. Maximum variation from true flatness 1/8 inch in 10 feet in any direction.

B. Maximum variation of any member from plane: 1/8 inch.

3.09 CLEANING

A. Clean soiled or discolored surfaces after installation.

B. Touch up scratches, abrasions, voids and other defects in gypsum surfaces.

C. Remove and replace damaged or improperly installed material and protect for painting. Reference Section 09900.

D. Remove all debris from work site and clean up all residue from this work.

END OF SECTION

SECTION 09 31 00 CERAMIC TILE

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnishing of and paying for all labor, services, appliances, materials and equipment necessary for execution, installation and completing of all work specified herein and as shown on drawings.

B. Section Includes:

1. All ceramic tile floors, base and walls, including trim members complete with all items incidental using the thin set application methods.

1.02 REFERENCES

A. American National Standards Institute (ANSI):

1 ANSI/A118.3-Epoxy – Portland Cement Mortar
2 ANSI/A118.6 – Ceramic Tile Grout
3 ANSI/A137.1 – Specification for Ceramic Tile

B. American Society for Testing and Materials (ASTM)

1 C144 – Standard Specification for Aggregate for Masonry Mortar
2 C150 – Standard Specification for Portland Cement
3 C207 – Standard Specification for Hydrated Lime for Masonry Purposes

C. TCA (Tile Council of America) – Handbook for Ceramic Tile Installation

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Indicate material specifications, characteristics and instructions for using adhesives and grouts.

C. Submit color samples for color selection. All colors and patterns will be selected by the Architect.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01720.

B. Submittals

1.05 QUALITY ASSURANCE

A. Conform to ANSI/TCA 137.1.

B. Conform to TCA Handbook for Ceramic Tile Installation.

C. Tile shall bear the seal of Tile Council of America, Inc. and be equal to or exceed Standard Grade.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle product to site under provisions of Section 01600.

B. Deliver materials in original, unopened, protective packaging with manufacturer's labels indicating brand name, pattern, size and thickness as applicable, legible and intact.

C. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.
D. Protect adhesive from freezing or overheating in accordance with manufacturer's instructions.
E. Do not begin installation until sufficient materials to complete a room are received.

1.07 ENVIRONMENTAL CONDITIONS
A. Set and grout tile when ambient temperature is at least 50 degrees F and rising and for seven (7) days after completion.

1.08 EXTRA MATERIAL
A. Furnish under provisions of Section 01700.
B. Supply to the Owner in clean marked cartons a supply if each type of ceramic tile and quarry tile used equivalent to 2 percent of total quantity of each color per building.

PART 2 PRODUCTS

2.01 MANUFACTURER – CERAMIC TILE
A. All tile materials are to be standard grade as manufactured by American Olean Tile Co.
B. Substitution: Under provision of Section 01600.

2.02 CERAMIC TILE MATERIAL
A. Floor Tile:
1. To be unglazed ceramic tile.
2. Provide 7-1/2 percent abrasive floor tile for all showers. Tile size shall be 4 1/4 inch x 4 1/4 inch.
3. Price Group II.

B Base Tile (without wall tile):
1. To be unglazed porcelain ceramic mosaic. Tile size shall be 4 1/4 inch x 4 1/4 inch.

C. Base Tile (with wall tile):
1. To be porcelain ceramic mosaic with a satin glazed finish. Tile size shall be 4 1/4 inch x 4 1/4 inch.

D. Wall Tile:
1. All wall tile shall be porcelain ceramic mosaic with a satin glazed finish. Tile shall be 4 1/4 inch x 4 1/4 inch modular with a cushion edge.

E. Ceramic Tile Trim:
1. Furnish size, color and shade to match ceramic mosaic field tile. Observe the following requirements:
a. Walls – In corners square, Out-corner Bullnose.
b. Bullnose cap on wainscot except provide regular tile where ceramic mosaic wall surface is flush with plaster wall above.
c. Floor – Cove base required.
d. Curbs – Bullnose and cove are required for smooth rounded surface.
e. Jambs – Bullnose where tilework projects from jamb.

2.03 MANUFACTURER – SETTING SYSTEMS, GROUT AND JOINT FILLER

A. All setting systems, grout and joint filler shall be manufactured by LATICRETE International, Inc., Bethany, CT.

B. Substitution: Under provision of Section 01600.

2.04 MATERIAL – SETTING SYSTEMS, GROUT AND JOINT FILLER

A. Setting Adhesive for Ceramic and Quarry Tile:

1. Thin-set ceramic tile (floors, walls and base): To be Latapoxy 300 Epoxy Adhesive (100% solid epoxy adhesive) as manufactured by Laticrete International, Inc. and conforming to ANSI-A118.3.

B Grout for Ceramix and Quarry Tile:

1. To be Latapoxy Epoxy Grout as manufactured by Laticrete International, Inc. conforming to ANSI A118.3.

2.06 MISCELLANEOUS MATERIALS

A. Cement (white or gray as noted) Standard Brand, Portland Type I, meeting ASTM C150.

B. Hydrated Lime: ASTM C206 or C207 Type S

C. Sand – White masonry, meeting ASTM C144. 100 percent passing #16 screen, 30 percent passing #50 screen.

D. Water – Clean, potable, from drinking water mains.

2.07 MORTAR AND GROUT MIX

A. Mix and proportion pre-mix setting bed and grout material in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to commencing the installation, the Contractor shall examine the areas to be covered and advise the Architect of any existing condition or surface contamination which will require correction before the work commences.

B. Beginning of installation means installer accepts condition of surfaces.

3.02 PREPARATION

A. Protect surrounding work from damage or disfiguration.

B. Areas to which tile will be grouted must be free of oils, from residue or materials that will affect bond capabilities of adhesives or grouts.

C. All surfaces must be thoroughly cleaned as recommended by adhesive or grouting manufacturer prior to tile installation.

D. Seal substrate surface cracks with filler. Level substrate surfaces to acceptable flatness tolerances.

3.03 INSTALLATION

A. Install materials in strict accord with manufacturer's directions.

B. All tile must be installed square with space, paralleled with enclosing walls,

symmetrical about center of space, with faces in same plane, level (except slope to drain) plumb, and straight. CAUTION – Where floor drains are shown in tile, tile must slope to drain as shown on drawings or 1 inch. Avoid pitting of floor directly at drains.

C. All wall tile will be installed with vertical units, including base and cap, stacked with joints running vertically (straight) from floor to ceiling, or cap as required.
D. All exterior and interior angles, corners, etc. will be made with proper manufactured bullnose or cove fitting.
E. All joints must be consistent in size. Lay out all work so that no tile less than half size occurs.
F. The use of a manufacturer's master set backing does not relieve the contractor from maintaining consistent joint widths at the perimeter of ceramic tile installations. Joints noticeably wider than adjacent field width joints will not be approved. Layout must consider wall conditions and alignment.
G. All tile must be soaked in water for approximately 20 minutes prior to setting and be moist (not wet) when set.
H. Setting Bed – Thin Set Ceramic Tile Floors:
   1. Prepare surface as specified above. Prime if required by manufacturer's instructions.
   2. Apply adhesive on concrete slab with notched trowel in accord with manufacturer's directions.
   3. Press tile into adhesive with wood block to true line.
   4. Grout joints.
I. Setting Bed – Thin set wall, base ceramic tile:
   1. Prepare surface as specified above. Prime if recommended by adhesive manufacturer.
   2. Apply adhesive in accord with manufacturer's directions. Apply sufficient amount to provide tile bed and to fill concrete block joints where block occurs.
   3. Press tile into place.
   4. Grout joints.

3.04 GROUTING

A. Follow grout manufacturer's instructions as to grouting procedures and precautions.
B. Do not grout inside wall corners of ceramic tile base and wall tile. Rake joints and leave open all inside wall corners for caulking as per Section 07920.
C. Remove all grout haze, observing grout manufacturer's instructions as to use of acid and chemical cleaners.
D. Rinse tilework thoroughly with clean water before and after chemical cleaners.

3.05 ERECTION TOLERANCES

A. Surfaces to receive ceramic tile shall be free from irregularities and level to within 1/8 inch in 10 ft except as required for slope to drains as indicated on the drawings.
B. Allowable tolerance of finished tile systems: Level within 1/8 inch in 10 feet

except where slope to drain is required, in which case floor is to be sloped from surrounding walls. Do not dish floor for drains.

3.10 CLEANING

A. Clean soiled or discolored surfaces after installation.
B. Repoint, regrout, and rework all defects in surfaces.
C. Remove and replace damaged or improperly installed units and protect all until accepted by the Owner
D. Remove all debris from work site.

3.11 PROTECTION OF FINISH WORK

A. Protect finish work under provisions of Section 01500.
B. Protection from construction dirt:
   1. Cover all tile floors with heavy-duty, non-staining construction paper, masked in place.
C. Protection from traffic:
   1. Prohibit all foot and wheel traffic from using newly tiled floors for as least 3 days, preferably 7 days.
   2. Place large, flat boards in walkways and wheelways for 7 days where use of newly tiles floors with cement type grout is unavoidable.

END OF SECTION

SECTION 09 51 00

ACOUSTICAL CELINGS

PART 1 GENERAL

1.01 SCOPE OF WORK
- A. The furnishing of and paying for all labor, material, services, appliances and equipment necessary for execution, installation and completion of all work specified herein and as shown on drawings.
- B. Section includes:
  - 1 Lay-in acoustical type ceiling tile board including installation complete with suspension system, grid, hangers, etc.
  - 2 Required metal molding, edge strips, hangers, screws, rivets, etc., required to complete the installation of all above.

1.02 RELATED SECTIONS
- A. Section 15800 - Heating, Ventilating and Air Conditioning
- B. Division 16 - Electrical: Lighting

1.03 REFERENCES
- A. American Society for Testing and Materials (ASTM)
  - 1 C635 - Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
  - 2 C636 - Practice for Installation of Metal Suspension System for Acoustical Tile and Lay-in Panels.
  - 3 E84 - Test Method for Surface Burning Characteristics of Building Materials
- B. Underwriters' Laboratories, Inc. (UL) Fire Resistance Directory Latest Edition
- C. Seismic Bracing of Ceiling: Standard Building Code 1997

1.04 SUBMITTALS
- A. Submit under provisions of Section 01300.
- B. Product Data: Provide data on metal grid system components and acoustic units.
- C. Samples:
  - 1 12 inch x 12 inch samples of each new acoustical unit to be used, matched or replaced.
  - 2 Submit sample of suspension system, main tees and cross tees, and hold down clips.

1.05 PROJECT RECORD DOCUMENTS
- A. Submit under provisions of Section 01720.
- B. Submittals

1.06 QUALIFICATIONS
- A. Grid Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years' experience.
- B. Acoustical Unit Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum five years documented experience.

C. Installer: Company specializing in performing the work of this section with a minimum of three years' documented experience.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Section 01600.
B. Deliver materials in original, unopened, protective packaging, with manufacturer's labels indicating brand name, pattern, size, thickness and fire rating as applicable, legible and intact.
C. Store materials in original protective packaging to prevent warping, soiling, physical damage or wetting.
D. Store cartons open at each end to stabilize moisture content and temperature.
E. Do not begin installation until sufficient materials to complete a room are received.
F. Ceiling material storage time at the job site should be as short as possible and environmental conditions should be as near as possible to those specified for occupancy.

1.08 ENVIRONMENTAL REQUIREMENTS

A. Before ceiling material is installed, units (panels of tile) shall reach room temperature and have a stabilized moisture content. Do not install in spaces where temperature or humidity conditions vary greatly from temperatures and conditions that will be normal in the occupied space.
B. Installation within the normal expected occupancy range of 60 to 85 degrees F. Relative humidity should be no more than 70 percent. All plastering, concrete, terrazzo, or any other wet work should be complete and dry. All windows and doors should be in place. The heating, ventilating, and air-conditioning systems shall be installed and operable where necessary to maintain proper temperatures before, during, and after installation of acoustical materials.

1.09 SCHEDULING

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
B. Install acoustical units after interior wet work is dry.

1.10 EXTRA MATERIALS

A. Furnish under provisions of Section 01700.
B. Provide in full carton lots a minimum of 12 pieces of each type Acoustic Tile used for the Owner's use, in undamaged and marked cartons. These shall not be used for replacement as stipulated in Article 3.05 herein for final acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS - SUSPENSION SYSTEM

A. Armstrong World Industries.

2.02 SUSPENSION SYSTEM MATERIAL

A. Non-fire Rated Prelude XL Grid: ASTM C635, exposed T; components die cut and interlocking.
B. Grid Materials: Commercial quality cold rolled steel with galvanized coating.

C. Exposed Grid Surface Width: 15/16 inch.
D. Grid Finish: White
E. Accessories: Clips, splices, edge moldings, hold down clips required for suspended grid system.
F. Hanger Wire: 12 gauge annealed galvanized. Uncoil and stretch before use.
G. Tie Wire: 18 gauge soft annealed. Uncoil and stretch before using.

2.03 MANUFACTURER - ACOUSTICAL UNITS
A. Armstrong World Industries.

2.04 ACOUSTIC UNITS MATERIAL
A. ACT 1: General Use Restrooms Armstrong Fine Fissured High NRC/CAC #1810 with Humiguard Plus Performance and BioBlock paint on front and back of tile
1. 24"x48"x3/4" square lay in
2. 15 Year Systems Warranty
3. Fine Fissured visual non directional
4. Humiguard Plus Performance
5. UL Classified NRC .70 CAC 40
6. Must have mold and mildew inhibitor
7. Light Reflectance Avg. .85
8. Installed on Armstrong Prelude XL 15/16" grid

B. ACT 2: Teacher Planning Restrooms Armstrong Clean Room VL #868 with Humiguard Plus Performance and BioBlock paint on front and back of tile
1. 24"x24"x5/8" square lay in
2. 15 Year Systems Warranty
3. Non perforated surface
4. Humiguard Plus Performance
5. UL Classified NRC .10 CAC 40
6. Must have mold and mildew inhibitor
7. Light Reflectance Avg. .80
8. Installed on Armstrong Prelude XL 15/16" grid

2.05 ACCESSORIES
A. Adhesives (where required): Adhesives to be as recommended by the manufacturer for the exact application encountered.
B. Touch-up Paint: Type and color to match acoustical and grid unit.

PART 3 EXECUTION

3.01 EXAMINATION
A. Verify site conditions under provisions of Section 01039.
B. Cooperate with all other subcontractors, particularly electrical, mechanical and sprinkler, in working to and locating their fixtures, grilles, heads, etc. Header around all such openings with tees or edge mould as required, to form proper grid opening for all items.
C. Verify that layout of hangers will not interfere with other work.
D. Provide all protection of adjacent material required by this operation and remove at completion.

3.02 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM
A. Ceiling suspension system shall be installed level using the "laser" method to the

heights as scheduled or shown on drawings.

B. Install suspension system in accordance with manufacturer's instructions and as supplemented in this section including seismic bracing as required by 1997 Standard Building Code.
C. Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
D. Locate system on room axis according to reflected plan.
E. Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
H. Do not support components on main runners or cross runners; support components independently as follows:
   1 Fixtures at ceiling: Provide additional hanger wires independent of ceiling support system to support light fixtures, heating diffusers, heating grilles, and audio speakers, either surface mounted or lay-in type.
   2 Lighting fixtures are to be secured in grid per NFPA requirements.
   3 Ceiling grid is to be supported and braced in full accord with Standard Building Code Seismic Requirements per details indicated on the drawings.
   4 Support required for items 3.02.H.1, 2 and 3 to be provided by section 09510, contractor.
I. Install edge molding at intersection of ceiling and vertical surfaces, using longest practical lengths. Miter corners. Provide edge moldings at junctions with other interruptions.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
C. Lay directional patterned units one way with pattern parallel to shortest room axis. Fit border trim neatly against abutting surfaces.
D. Install units after above ceiling work is complete.
E. Install acoustical units level, in uniform plane, and free from twist, warp and dents.
F. Cut panels to fit irregular grid and perimeter edge trim.
G. Install hold down clips on all existing ceiling to match existing and in accordance with UL assembly requirements where applicable.
H. Where ceiling diffusers and new sprinkler heads are installed in an existing tile grid, the contractor shall install new ceiling tile as specified with the entire room matching and not damaged.

3.04 ERECTION TOLERANCES

A. Maximum variation from flat and level surface: 1/8 inch in 10 feet.

3.05 REPLACEMENT

A. Before final acceptance, this contractor will be required to replace all soiled or damaged units and/or panels of all work specified herein.

3.06 CLEANING

A. Clean soiled or discolored unit surfaces after installation.
B. Touch up scratches, abrasions, voids, and other defects in painted surfaces.
C. Remove and replace damaged or improperly installed units.
D. Remove all equipment and excess material and have premise clean of all debris.

END OF SECTION

SECTION 09 62 40 - SYNTHETIC ATHLETIC FLOORING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related work specified under other sections.
   1. CONCRETE SUBFLOORS - SECTION 03_ _ _
      a. The general contractor shall furnish and install the concrete subfloors. The slab shall be steel troweled and finished smooth to a tolerance of 1/8" in any 10' radius. High spots shall be ground level, and low spots filled in with approved leveling compound. **No concrete curing or hardening agents shall be applied to concrete subfloor**.
   2. MEMBRANE WATERPROOFING - SECTION 07_ _ _
      a. Concrete subfloors on or below grade shall be adequately waterproofed beneath and at the perimeter walls and on earth side of below grade walls. It is the responsibility of the engineer to determine the extend of this need.
   3. THRESHOLDS - SECTION 08_ _ _

1.2 QUALITY ASSURANCE

A. MANUFACTURER: Manufacturer of resilient flooring shall be a firm specializing in manufacturing products specified in this section. Manufacturer/supplier shall be ISO 9001 certified and in the sports flooring business a minimum of 10 years.
B. INSTALLER:
   1. The complete installation of the flooring system, as described in the scope of these specifications, shall be carried out by an experienced installer (Flooring Contractor), and the work shall be performed in accordance with most recent installation instructions of the manufacturer.
   2. Installer (Flooring Contractor) shall be liable for all matters related to installation for a period of one year after the floor has been substantially installed and completed.

1.3 SUBMITTALS

A. Submit Connor ElastiRoll/ElastiMat™ specification sheets.
B. Sample - Submit one sample of specified system, if requested by Architect.
C. Maintenance Literature - Upon completion of floor installation, send to owner, attendants or individuals in charge and responsible for the upkeep of the building a Connor Synthetic Care & Maintenance Guide. These instructions shall be followed. Any variations, deviations or substitutions shall be submitted to Connor for approval.

1.4 WORKING CONDITIONS

A. Synthetic materials specified herein shall not be installed until all masonry, painting, plaster, tile, marble and terrazzo work is completed, and overhead mechanical trades and painters have finished in the synthetic floor areas. The building shall be enclosed and weather tight.
B. Permanent heat, light and ventilation shall be installed and operating during and after installation. Subfloors shall be clean, dry and free from dirt, dust, oil, grease, paint, alkali, concrete curing agents, hardening and parting compounds, old adhesive residue or other foreign materials. The general contractor shall provide an area where the stored materials can be maintained at a minimum of 55 degrees and under 50% relative humidity. Ideal installation and storage conditions are the same as those which will prevail when building is occupied. Moderate room temperature of 65 degrees or more shall be maintained for a week prior to, during and for 72 hours after installation.
C. Flooring installation shall not begin until all sub-contract work which would cause damage, dirt, dust or interruption of normal installation pace is completed. The installation area shall be closed to all traffic and activity for a period to be set by the flooring contractor.
D. Moisture vapor transmission of the concrete slab must not exceed 5.5 lbs per 1,000 square feet in 24 hours when using the Calcium Chloride Test as per ASTM 1869-98 or 85% RH as per ASTM F2170.
E. Environmental Limitations
   1. Comply with requirements of athletic flooring material supplier's requirements.
   2. Adhere to all MSDS requirements for materials employed in the work. Protect all persons

from exposure to hazardous materials.

F. After synthetic floors are installed and the game lines painted, area to be kept locked by general contractor to allow curing time for system. No other trades or personnel are allowed on floor until accepted by owner.

1.5 WARRANTY

A. Connor warrants that the materials it has supplied will be free from manufacturing defects for a period of one year. The foregoing warranty is in lieu of and excludes all other warranties not expressly set forth herein, whether expressed or implied in operation of law or otherwise, including, but not limited to, any implied warranties of merchantability or fitness. This warranty is expressly limited to the flooring materials (goods) supplied by Connor. This warranty does not cover floor damage caused (wholly or in part) by fire, winds, floods, moisture, other unfavorable atmospheric conditions or chemical action, nor does it apply to damage caused by ordinary wear, misuse, abuse, negligent or intentional misconduct, aging, faulty building construction, concrete slab separation, faulty or unsuitable subsurface or site preparation, settlement of the building walls or faulty or unprofessional installation of Connor flooring systems.

B. Connor shall not be liable for incidental or consequential losses, damages or expenses directly or indirectly arising from the sale, handling or use of the materials (goods) or from any other cause relating thereto, and their liability hereunder in any case is expressly limited to the replacement of materials (goods) not complying with this agreement or, at their election, to the repayment of, or crediting buyer with, an amount equal to the purchase price of such materials (goods), whether such claims are for breach of warranty or negligence. Any claim shall be deemed waived by buyer unless submitted to Connor in writing within 30 days from the date buyer discovered, or should have discovered any claimed breach.

<u>PART 2 - PRODUCTS</u>

2.1 MATERIALS

A. ElastiRoll/ElastiMat™ – Flooring consisting of polymeric bound VULCANIZED recycled rubber mixed with EPDM granules and Nike Grind.
   1. Colors – select from various colors.
   2. Physical Properties
      a. Density – Shore A
         (ASTM D-297). . . . . 0.67 min. g/cm^3
      b. Taber Abrasion
         (ASTM C-501 – 1kb wt. 7000 cycles) . . . . . 6% wt. loss
      c. Compression Set
         (ASTM D-395 method B) . . . . . 36% max
      d. Tensile Strength
         (ASTM D-412) . . . . . 247 min PSI
      e. Elongation
         (ASTM D-412) . . . . . 75% min
      f. Chemical Resistance
         (ASTM F-925) . . . . . .No change
      g. Acoustic Properties
         (ASTM E-423) . . . . . .NRC = 0.10
      h. Weight . . . . . 8mm= 2 lb/ft^2 i.
      Tear Resistance
         (ASTM D-624) . . . . . 79 min PPI
      j. Coefficient of Friction
         (ASTM D-2047) . . . . . 0.9 min, Wet or Dry
      k. Ozone Resistance
         (ASTM D-1149-50 pphm)
         (70 hours @ 104˚ F) . . . . . No effect
      l. Stain Resistance . . . . . .Good
      m. Spike Resistance . . . . . .Excellent

B. Sizes
   1. ElastiRoll™ – 4’ x 15’ to 50’
   2. ElastiMat™ – 36” x 36”

C. Thickness – 8mm
D. ElastiRoll/ElastiMat™ Adhesive – One-component urethane as supplied by Connor.
   1. Optional Adhesive ***(specify or delete)*** – Two-component epoxy for questionable substrates as directed.
E. Optional Base ***(specify or delete)*** - Vinyl wall base 4" high; select from supplier standard colors.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect concrete slab for proper tolerance and dryness. Test moisture vapor transmission of concrete flooring by means of a Calcium Chloride Test per ASTM 1869-98 or in-situ probes per ASTM F2170. Report any discrepancies to general contractor.
B. Concrete slab shall be broom cleaned by general contractor.
C. Installer (Flooring Contractor) shall approve and document all working conditions provided in General Specifications prior to commencement of installation.

3.2 INSTALLATION

A. ElastiMat™
   1. Square the room or area to be installed.
   2. Mark the floor off in quarters.
   3. Thoroughly mix the one-component urethane adhesive and apply directly to the concrete subfloor with notched trowel per manufacturer's instructions.
   4. Place tile firmly into adhesive and butt the adjacent tiles.
   5. Lay the tile in straight tile pattern or broken joint pattern.
   6. Only apply as much adhesive as can be covered in 20 minutes.
   7. Roll with medium size roller. When floor is complete, roll again.
   8. Wipe adhesive that oozes between seams with recommended solvent.
B. ElastiRoll™
   1. Unroll ElastiRoll™ and allow it to relax. Do not cut to final dimensions until laid into adhesive.
   2. Thoroughly mix the one-component urethane adhesive and apply directly to the concrete subfloor with a notched trowel per manufacturer's instructions.
   3. Install ElastiRoll™ into freshly applied adhesive wall to wall, scribing and fitting neatly at walls, around columns, and around door frames. Do not allow compression fit at any seams. Roll with medium size roller. When floor is complete, roll again.
   4. Wipe adhesive that oozes between seams with recommended solvent.
C. Wall base ***(optional)*** – Install vinyl base anchored to walls with base cement.
D. Remove all excess and waste materials from the area of work. Dispose of empty containers in accordance with federal and local statutes.

END OF SECTION 09 62 40

SECTION 09 90 00 PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The furnishing of and paying for all labor, materials, services, appliances and equipment necessary for the execution, installation, and completion of all work as specified herein and as shown on drawings.

B. Section includes:

1. Surface preparation, painting, staining, and varnishing of all items noted herein or as shown on drawings to be painted and all items normally painted including generally, but not limited to the following:
   a. Exterior metal: Do not paint aluminum or stainless steel, unless specifically so noted to paint.
   b. Mill, galvanized, and bonderized metal, interior and exterior.
   c. Interior ferrous metal work such as grilles, rails, stair rails, door frames, doors, borrowed light frames, etc. Do not paint aluminum or stainless steel unless so noted.
   d. Exposed mechanical equipment (not factory finished painted) including duct, conduit, etc., except that located in mechanical rooms or that painted under Division 15 and 16 of these specifications.
   e. Interior concrete block work.
   f. Interior gypsum board.
   g. Metal doors.
   h. Other work shown, specified or normally painted.
   i. Protection of adjacent and surrounding materials and finishes over or adjacent to which this contractor shall apply his materials. This shall include covering, cleaning, etc., as may be required to assure no damage, disfiguration or staining of adjacent or existing finishes or materials.

1.02 REFERENCES

A. American Society for Testing and Material (ASTM)
   1 D16 - Definitions of Terms Relating to Paint, Varnish, Lacquer and Related Products.
   2 D2016 - Test Method for Moisture Content of Wood

1.03 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Finish Schedule:

1. All schedules shall be typewritten
2. Provide Finish Schedule listing each finish by Finish Type in reference to Article 3.10 herein giving the following information:
   a. Manufacturer and type of product used
   b. Number of coats of material
   c. Luster
   d. Type of application

C. Product Data: Provide data on all finishing products and special coatings.

D. Samples: Submit paint manufacturer's "paint fan" illustrating range of colors available for each surface finishing product schedule for color

selection.

1.04 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01720.
B. Submittals

1.05 QUALIFICATIONS (APPLICATOR)
A. Applicator: Company specializing in performing the work of this section with minimum 5 years documented experience.
B. Superintendence: This Applicator shall keep a qualified foreman (may be a working foreman), satisfactory to the Owner and Architect, on this work at all times while painting is in progress with this work as his sole duty.
C. Employees: Employ skilled mechanics to ensure the very best workmanship. Quality workmanship is required. Material to be applied by craftsmen experienced in the use of the specific product involved.

1.06 MOCKUPS
A. Provide mockup under provisions of Section 01400.
B. Before proceeding with any painting prepare and finish a sample room, complete or in part, as directed by the Owner and Architect. Finish all areas or items in accordance with the specification and in colors selected by the Owner and Architect. When approved by the Owner and Architect, they shall serve as a standard for workmanship, appearance and materials approved for similar areas or items throughout this project.

1.07 DELIVERY, STORAGE AND HANDLING
A. Deliver, store, protect and handle products to site under provision of Section 01600.
B. All materials used on the project shall be stored in a single place as designated. Such storage space shall be kept clean and all damage thereto or to its surroundings shall be made good by the subcontractor.
C. Store materials at minimum ambient temperature of 50 degrees F and a maximum of 90 degrees F, in well ventilated area, and as required by manufacturer's instructions.
D. All soiled or used rags, waste and trash must be removed from the building every night and every precaution taken to avoid the danger of fire.
E. Restrict storage to paint and related equipment. Comply with health and fire regulations.
F. Paint Material:
1 Deliver paints and enamels ready-mixed to job site. All material must be delivered in their original containers with labels intact.
2 Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.

1.08 ENVIRONMENTAL REQUIREMENTS
A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 60 degrees F for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
B. Do not apply exterior coatings during rain or snow, or when relative

humidity is above 80 percent, unless required otherwise by manufacturer's instructions.

C. Contractor is to provide forced ventilation when painting within occupied spaces as necessary to prevent hazardous accumulations of dust, fumes, vapors or gases.

1.09 EXTRA MATERIAL

A. Furnish under provisions of Section 01700.
B. Provide a one gallon container of each color per building and surface texture to Owner.
C. Label each container with color, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURER - PAINT AND VARNISH

A. Sherwin-Williams
B. Farrell-Calhoun
C. Pratt and Lambert
D. ICI / Glidden
E. Substitution: Under provision of Section 01600

2.02 MANUFACTURER - ACCESSORIES MATERIAL

A. Thinners, Metal Surface Cleaners, Galvanized Treatment, Filling compounds, Turpentine and Primers - As recommended by paint manufacturer.

2.03 MATERIALS

A. Standards and Manufacturers (Painting)
   1 All paint materials must be equal or exceed Federal Specifications or other standards herein under "Materials" in applicable categories.
   2 Claims by the Contractor as to the unsuitability or unavailability of any materials specified or his inability to produce first-class results with same, will not be entertained unless such claims are made in writing prior to bidding.
   3 All paint materials shall be applied in accord with manufacturer's directions or as specified herein. As there is a slight variation in the recommended procedures of different manufacturers, such minor variations shall be taken into account in considering or making any proposal of material change.

2.04 FINISHES

A. Refer to Schedule, Article 3.10.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
C. Test shop applied primer for compatibility with subsequent cover materials.
D. Examination includes bond, moisture, and alkali testing as required or recommended by manufacturer. Moisture meter readings of back surfaces shall be less than 4 percent.
E. Beginning of installation means acceptance of surfaces.

3.02 PREPARATION - NEW SURFACES

A. Remove electrical plates, hardware, light fixture trim, and fittings prior to preparing surfaces for finishing.
B. Correct minor defects and clean surfaces which affect work of this section.
C. Shellac and seal marks which may bleed through surface finishes.
D. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
E. Gypsum Board Surfaces: Latex fill minor defects. Spot prime defects after repair.
F. Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
G. Unit Masonry Surfaces Scheduled to Receive Paint Finish: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of trisodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
H. Uncoated Steel and Iron Surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.
I. Shop Primed Steel Surfaces:
   1. Several items to receive a painter's finish under this specification will be furnished with a prime coat of paint. It is this contractor's responsibility to determine this by a study of all sections of this specification. As an aid, however, these items are generally as follows:
      a. All structural and miscellaneous steel
      b. Stair handrails, railings, etc.
      c. Steel doors, frames and borrowed light frames
      d. Steel access doors
      e. Heating grilles and diffusers in wall surfaces to be painted
         1 All primed surfaces shall be cleaned, sanded, touched up, and washed with turpentine prior to painting.
         2 If primer has become badly abraded, damaged, or rust formed, sand smooth and apply one coat of primer specified herein before proceeding with paint application specified.
         3 Galvanizing or bonderizing is not considered a primer.
J. Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

3.03 PROTECTION

A. This contractor is advised that he shall be totally responsible for protection of surfaces and finishes adjacent to or beneath his work to the extent that he shall totally clean or pay to have cleaned all surfaces, new or existing, damaged by his materials.
B. Concrete floors are finished floors and shall be totally covered and protected by this contractor during application of his materials within these areas. Extra care must be taken during this work, particularly during spray operation, to

provide complete finished floor surfaces without splotches, stains, etc.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

3.04 APPLICATION

A. Apply products in accordance with manufacturer's instructions.
B. All applications to be with brush or roller unless noted otherwise. Use proper roller or brush for application. Brush apply only all varnish. Reference paint finish specifications for more detail.
C. All material shall be evenly applied so as to be free from sags, runs, crawls, or other defects. All coats shall be of proper consistency and well brushed to show the minimum of brush marks, except lacquer and enamel which shall be uniformly flowed, or sprayed. All brushes shall be clean and in good condition.
D. The word "exposed" as used herein means exposed to normal view after completion of total construction. Does not include mechanical equipment ducts, etc. in equipment or mechanical rooms.
E. No work shall be done under conditions that are unsuitable for the production of good results.
F. All coats shall be thoroughly dry before the succeeding coat is applied. Allow at least 24 hrs. between coats, unless special paint is used that requires more or less time for drying.
G. Painting coats as specified are intended to cover surface perfectly. If surfaces are not covered, further coats shall be applied without cost to the Owner.
H. While the painting is being done, the building shall be closed and broom cleaned. Do not paint any area while dust conditions exist in that area, or under conditions of inadequate light.
I. The undercoats of paint and enamel shall be tinted to approximate shade of the final coat.
J. All finishes shall be uniform as to sheen, color and texture.
K. All materials shall be evenly spread and smooth flowed on without runs or sags.
L. All surfaces to be painted shall be cleaned free of loose dirt by brushing or wiping and wiping with a cloth after each sanding before painting.
M. Sand and wool all surfaces prior to painting and lightly sand and wool between all coats to produce smooth surface.
N. Do not paint damp, moist or uncured surfaces, use moisture meter to determine suitability.
O. This contractor shall furnish and place drop cloths for protection of finished floor and other finished work from damage during progress of the work. The contractor shall be responsible for damage caused by him. Reference Article 3.03 Protection above herein.
P. Where fluid unavoidably contacts glass, hardware, or other finished surfaces, it shall be immediately removed while moist.
Q. Where fluid solder flux has been used on metal work, clean thoroughly with benzene before further application.
R. Unprimed steel shall be primed immediately upon delivery to the site.

3.05 APPLICATION - WOOD AND MILLWORK ITEMS

A. Priming and Sealing Wood:
   1. Exposed Surfaces:
      a. All interior exposed wood millwork items, upon delivery and after

tempering period,. shall receive one coat of sanding sealer reduced 1-3 or 1-4 (as determined) over all surfaces including tops, bottoms and edges of all members by this Contractor.

b. The sealer used must be approved for compatibility by the painting contractor and paint or varnish manufacturer before its use. If not approved, this contractor uses any other material at his own risk.

2. Concealed Surfaces:
   a. Prime back surfaces of all interior and exterior woodwork with prime paint.
   b. Prime back surfaces of all interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

B. Staining, Sealing and Finishing of Wood Doors:
   1 After fitting doors to frame opening and machining doors for hardware by Section 06100, this contractor must completely block sand doors in a horizontal position with not less than 150 grit sand paper to remove all handling marks and raised grain.
   2 Top, bottom, opening and hardware recess edges must be sealed after fitting of doors with at least two coats of oil-based paint, varnish or lacquer as specified.
   3 Water based stains, paint or latex primers are not acceptable.
   4 Do not use steel wool on oak veneer or fire rated doors.
   5 A wash coat (thin sealer) to be applied prior to the use of a stain to avoid a splotchy appearance or sharp contract in color.

3.06 CLEANING

A. As work proceeds, promptly remove paint where spilled, splashed or spattered.
B. During progress of work, maintain premises free of unnecessary accumulation of tools, equipment, surplus materials and debris.
C. Collect cotton waste, cloths and material which may constitute a fire hazard; place in closed metal containers and remove daily from site.
D. Inspect all surfaces for skips, blemishes or imperfections. Repaint or repair as required to first class appearance.
E. Clean all adjacent surfaces, hardware, and accessory items damaged by this work. Replace if damage cannot be repaired.
F. Remove all debris from the work site.

3.07 PROTECTION OF FINISH WORK

A. Protect finished work under provisions of Section 01500.

3.08 DETERMINATION OF FINISHES

A. To determine the required types of painter's finish for various areas and surfaces, this contractor shall review the following:
   1 Paint finish or specified numbers on the Room Finish Schedule.
   2 Paint finish or specified numbers on the Door schedule.
   3 The general title designation of material covered under each paint finish description herein.
   4 Example: Paint Finish No. I-1 (interior gypsum board) 1 coat, etc. 1 coat etc. Indicates that all interior gypsum board receives this finish unless schedules are noted otherwise. If the room finish schedule carries the notation "NONE", this area or surface receives no painter's finish.

3.09 PAINT FINISH TYPES

A. Interior:
   1 Paint Finish I-1 - Wood Shelving Priming and Sealing - As per Article 3.06. 1st Coat – Sherwin Williams Wood Classic Stain A48 Series 2nd Coat – Sherwin Williams Wood Classic Polyurethane Varnish A67 Series 3rd Coat – Sherwin Williams Wood Classic Polyurethane Varnish A67 Series
   2 Paint Finish I-2 - Interior Gypsum Board (except Housekeeping Rooms, Kitchen, Culinary Arts Lab and Toilets): 1st Coat – Sherwin Williams Latex Wall Primer B28W200 2nd Coat – Sherwin Williams Promar 400 Latex Semi-Gloss Enamel 3rd Coat – Sherwin Williams Promar 400 Latex Semi-Gloss Enamel
   3 Paint Finish I-3 - Concrete Block (except Housekeeping Rooms, Kitchen, Culinary Arts Lab and Toilets): 1st Coat – Sherwin Williams PrepRite Block Filler 2nd Coat – Sherwin Williams Promar 400 Latex Semi-Gloss Enamel 3rd Coat – Sherwin Williams Promar 400 Latex Semi-Gloss Enamel
   4 Paint Finish I-4 – Exposed Roof Deck, Bar Joists, Ductwork, Sprinkler Piping, Water Piping, Gas Piping, and all exposed electrical conduit: Treat galvanized surfaces. Remove all grease and foreign materials prior to painting.Two coats (to cover) Sherwin Williams Waterborne Acrylic Dryfall (Flat)
   5 Paint Finish I-5 – Metal Work including Doors, Frames, Handrails, Trim, etc. Factory or shop primed items (Reference Article 3.02): 1st Coat – Sherwin Williams Universal Primer B50NZ (touch up only) 2nd Coat – Sherwin Williams Alkyd Semi-Gloss Enamel B34W200 Series 3rd Coat – Sherwin Williams Alkyd Semi-Gloss Enamel B34W200 Series
   6 Paint Finish I-6 – Gypsum Board and Concrete Block at Housekeeping Rooms, Kitchen, Culinary Arts Lab and Toilets: 1st Coat – Primer or block filler 2nd Coat – Sherwin Williams Water Based Catalyzed Epoxy, B70/B60V25, Semi-Gloss 3rd Coat – Sherwin Williams Water Based Catalyzed Epoxy, B70/B60V25, Semi-Gloss (8 mils wet, 3 mils dry per coat)

B. Exterior:
   1 Paint Finish E-1 - All Exposed Exterior Metal Work on building and on roof including hollow metal doors, frames, windows, frames and miscellaneous metal items such as lintels, trim, roof metal galvanized flashing, etc. (Do not paint pre-finished metal roof, parapet caps, gutters, scuppers, heads and/or prefinished rooftop equipment.): 1st Coat – Sherwin Williams Universal Primer B50NZ 2nd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series 3rd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series ***OR*** Factory or shop primed items (Reference Article 3.02): 1st Coat – Sherwin Williams Universal Primer B50NZ (touch-up only) 2nd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) 3rd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) ***OR*** Galvanized metal items: 1st Coat – Sherwin Williams Galvite B50W3 2nd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) 3rd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) Do not paint prefinished items.
   2 Paint Finish E-2 - Exterior Steel Railings, Pipe Bollards, Gutter Boots, etc. Factory or shop primed items (Reference Article 3.02.): 1st Coat – Sherwin Williams Universal Primer B50NZ 2nd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) 3rd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss)
   3 Paint Finish E-3 - Roof Mounted HVAC Equipment (not pre-finished): All

equipment to be free of grease, dirt, etc. Touch up factory primer as required or treat if galvanized. 1st Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss) 2nd Coat – Sherwin Williams Industrial Enamel Alkyd B54 Series (gloss)

4 Paint Finish E-4 - Roof-Top Piping: 2 coats Sherwin Williams Silver-Brite Heavy Duty Rust Resistant Aluminum Paint (B5952)

END OF SECTION

SECTION 10 17 10

HIGH DENSITY POLYMER PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY
- A. Section includes: High-density polymer plastic toilet compartments including required fittings, hardware, and accessories.

1.2 RELATED SECTIONS
- A. Section 09250 - Gypsum Board Systems: Blocking in metal stud partitions for wall anchorage of toilet compartments.
- B. Section 10810 - Toilet and Bath Accessories: Accessories mounted on toilet compartments.

1.3 REFERENCES
- A. Americans with Disabilities (ADA) Standards for Accessible Design.
- B. ANSI A117.1 - American National Standard for Buildings and Facilities - Providing Accessibility - and Usability for Physically Handicapped People.
- C. ASTM A167 **-**Stainless and Heat Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM E84 - Surface Burning Characteristics of Building Materials.
- E. UFAS - Uniform Federal Accessibility Standards.

1.4 SUBMITTALS
- A. Provide in accordance with Section 01300 – Submittals.
  - 1 Product data for compartments, panels, finishes, hardware, and accessories.
  - 2 Shop drawings showing partition plans, elevations, dimensions, door swings, details for supports, and method of anchorage.
  - 3 Samples of manufacturer's finishes for selection by Architect.
  - 4 Installation instructions.
  - 5 Maintenance instructions.
  - 6 Copy of warranty required by Paragraph 1.5 for review by Architect.

1.5 QUALITY ASSURANCE: Products and installation shall comply with ADA Standard in the North Carolina Handicapped Code.

1.6 WARRANTY: In accordance with Section 01700 – Contract Closeout, provide 15-year warranty to cover panels, doors, and pilasters against breakage, delamination, and corrosion. 1 Year Workmanship. PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
- A. General Partitions Manufacturing Corporation, P. 0. Box 8370, Erie, Pennsylvania; 814-833-1154.
- B. Accurate Solid Plastic Partitions.
- C. Manufacturers of equivalent products submitted and approved in accordance with Section 01600 -Product Substitution Procedures.

2.2 TOILET COMPARTMENTS: Panels supported by pilasters anchored to floor and

braced overhead with head rail.

2.3 PANELS

A Material: Molded under pressure from high-density polymer resin with uniform color throughout.
  1 Resistant to delamination, water, steam, corrosion, soaps, detergents, and mildew. Does not absorb odors.
  2 Self-lubricating surface that is graffiti resistant to markings from pen, pencil, marker, and paint.
  3 Edges: Machine radius eliminating sharp edges.
  4 Surface texture: Orange peel.
  5 Fire hazard: Class C in accordance with ASTM EM.

B. Heat sinks: Attach 1/8-inch aluminum strips with screws to bottom edges of panels and doors to protect panel from being ignited by vandals.

C. Minimum thickness:
  1 Panels: 1 inch.
  2 Doors: 1 inch.
  3 Pilasters: 1 inch.

D. Equip bottom end of pilasters with 1/2 inch thick stainless steel bar anchored to high density polymer core with threaded stainless steel anchors, stainless steel set pins, and stainless steel spacers. Bar to accept two threaded stainless steel studs and stainless steel leveling nuts used for anchoring pilaster to floor. Any insert in the concrete floor shall be stainless steel.

E. Sizes: Bottom of the panel shall be 12” above the floor. Top of the panel shall be 6’-0” AFF.
  1 In swinging door: 24 inches wide.
  2 Out swinging door for use by persons with physical handicaps: Width to provide 32 inches clear opening.
  3 Pilaster: Width to suit compartment size.

2.4 FITTINGS

A. Head rail: Extruded aluminum channel with anti-grip shape, designed to fit over top of pilasters, 1- 7/8 by 1-1/32 inches. This head rail shall be used over any end panels also.

B. Attachment hardware: Chrome plated, one-way vandal proof hex bolts and No. 14 stainless steel metal screws of length recommended by manufacturer.

C. Connection brackets: Heavy duty continuous extruded aluminum, 55 inches high.

D. Pilaster trim: Minimum 3 inches high 0.031 inch thick stainless steel shoe, ASTM A167.

2.5 HARDWARE

A. Hinges: Stainless steel hinges, full length of doors.

B. Combination coat hook and rubber bumper: Cast alloy, chrome plated.

C. NO LATCH.

D. Doorstop with rubber bumper: Extruded aluminum.

E. Door pull: Heavy duty Cast alloy, chrome plated, straight loop design. For door to handicapped stall provide door pull on each side of door.

2.6 COLOR: Single color selected by Architect from manufacturers range.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.
B. Verify correct spacing of plumbing fixtures.

3.2 INSTALLATION

A. Install partitions secure, plumb, and level in accordance with manufacturer's instructions.
B. Maintain 3/8 to 1 inch uniform space between wall and panels and between wall and end pilasters.
C. Attach panel brackets securely to walls using anchor devices recommended by manufacturer.
D. Attach panels and pilasters to brackets with stainless steel screws.
E. Brace pilasters with overhead rail. Locate head rail joints at pilaster centerlines.
F. Anchor pilaster to floor with heavy-duty stainless steel angle plate, stainless steel metal, stainless steel screws, and stainless steel anchors. Conceal floor fastenings with stainless steel pilaster shoes.
G. Door installation: Hang doors from pilasters. Equip each door with doorstop and door bumper. Install door pull on both sides of out swinging doors.

3.3 ERECTION TOLERANCES

A. Maximum variation from true position: 1/4 inch.
B. Maximum variation from plumb: 1/8 inch.

3.4 ADJUSTING

A Replace significantly damaged, deeply scratched, or broken panels.
B. Adjust hinges to locate in swinging doors in closed position and out swinging doors in closed position when at rest
C. Adjust and align hardware to uniform clearance at vertical edge of doors.

3.5 CLEANING: Clean surfaces with liquid spray furniture or counter top polish. Do not use abrasives.

END OF SECTION

SECTION 10 44 10
NON-ILLUMINATED INTERIOR SIGN SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Interior non-illuminated directional, control, and information surface mounted signage as complete integrated modular system.

B. This section applies to Sign Types A, B, C, D, E, F, G1, G2, J & K.

C. Excluded signage: Exterior signs and non-illuminated directories.

1.02 STANDARDS REFERENCED

A. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336, (ADA).

B. American National Standards Institute (ANSI) A117.1: Providing Accessibility and Useable Buildings and Facilities, 1998 edition.

C. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 36: Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, Final Rule, July 26, 1991.

D. Federal Register Part II, Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1191: Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Amendment to Final Guidelines, September 6, 1991.

1.03 DEFINITION

A. Terms:

1 Braille: Grade 2 Braille including 189 part-word or whole word contractions in addition to Grade 1 Braille 63 characters. Tactile is required whenever Braille is required; see SYSTEM DESCRIPTION Article below.

2 Non-tactile: Letters and numbers on signs with width-55% minimum and 110% maximum of the height of the character with the width based on uppercase “O” and height based on uppercase “I”. Visual Characters shall have a stroke thickness, which is 10% minimum, and 30% maximum of the height of the character, based on uppercase “I”. Upper and lower case lettering is permitted; conventional serif typestyles are permitted. See SYSTEM DESCRIPTION Article below.

3 Symbols: Symbol itself is not required to be tactile but equivalent verbal description is required both in tactile letters and Braille.

4 Tactile: 1/32" raised capital letters without serifs at least 5/8" height and

not more than 2" height based on upper case "I". Tactile characters shall have a stroke thickness, which is 10% and 15% maximum of the height of the character, based on the uppercase letter “I”. Braille is required beneath tactile characters whenever tactile is required; see SYSTEM DESCRIPTION Article below.

1.04 SYSTEM DESCRIPTION

A. Signage under this section shall include items for identification, direction, control, and information of building where installed as complete integrated system. Signage shall be from a single manufacturer.

B. ADA design requirements:

1. Signage requiring tactile graphics includes wall mounted signs designating permanent rooms and spaces such as, room numbers and restroom, department, office, and fire exit identifications.
2 Individually applied characters are prohibited.
3. Signage not requiring tactile graphics but requiring compliance to other ADA requirements: All other signs providing direction to or information about function of space such as, directional signs (signs with arrow), informational signs (operating hours, policies, etc.), regulatory signs (no smoking, do not enter), and ceiling and projected wall mount signs.

C. Tactile graphics signs mounting requirements:

1 Single doors: Characters shall be 48 inches minimum and 60 inches maximum above finished floor and on wall adjacent to latch side of door, measured from the baseline of the characters.
2 No wall space adjacent latch side of door, opening, or double doors: Mount on nearest adjacent wall.

D. Manufacturer shall appoint a Sign Planner to this Project to develop the Sign Schedule. Sign Planner will meet with the Owner’s designated representative prior to issuing submittals, to develop numbering system for rooms and to finalize room designations. Final Sign Schedule to be submitted as part of Shop Drawings.

1.05 SUBMITTALS

A. Product data:

1 Manufacturer's signed statement regarding compliance with QUALITY ASSURANCE Article.
2 Manufacturer's product literature indicating units and designs selected.
3 Evidence of manufacturer's computerized data retrieval program for tracking of Project for sign typography, message strip requirements and other pertinent data from schedule input to final computerized typography on finished product.

B. Shop drawings:

1 Indicate materials, sizes, configurations, and applicable substrate

mountings.

2 Typography sample for message strips and headers copy.

3 Complete schedule for messages; include floor plans locating all signs. Two copies of color-coded floor plan (s) showing all types of signs using same letter designation as on matrix herein.

4 Submit list of Spanish translations of room names. Manufacturer shall propose the Spanish translations for Owner approval during the shop drawing approval stage.

5 Proofs of floor plans for Type J Emergency Plans. Note: Orientations may differ according to placement.

6 Matrix: Room Number, Room Name (English, Spanish), Type of Sign, International Symbol, Message. Include a matrix showing all of this information.

C. Samples

1 Full size samples for holder, insert, and copy in colors specified. Provide sample of Type A Classroom Sign and SignWord Paper and Software. Samples will not be returned for use in Project.

2 Standard color palette. Each school may select a different color, but only one color will be used within a single school. Even a school with multiple buildings will use only one color within the campus.

D. Contract close out:

1 Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for five years for ordering new signage required by Owner.

2 Maintenance data and cleaning requirements for exterior surfaces.

3 Furnish one complete SignWord Pro software package in Owner selected format for IBM PC, or IBM/Compatible PC type computer.

4 Furnish one complete packaged SignWord paper Color system matching the color selected for the school.

1.06 MANUFACTURER

A. Work required under this section from manufacturers regularly engaged in work of this magnitude and scope for minimum of five years.

B. Maintain computer link between schedule input and computerized typography production.

C. Approved Manufacturers:

1 APCO Graphics, Inc.: 388 Grant St. SE, Atlanta, GA 30312; Ph: 404-688-9000

2 System 2/90, Inc.: 5350 Corporate Grove Blvd, Grand Rapids, MI 49512; Ph: 616-656-4510

1.07 TRAINING

A. Provide computer training for a designated MCS staff person for producing

message strips.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Provide the following assemblies; locate where indicated in Sign Type Drawings: Interior sign system: Combination of injected molded components, consisting of holder unit mounted to substrate and insert panels secured to holder providing graphic and visual information.

B. Design units with selected components below.

2.02 COMPONENTS

A. Holder:

1. Material: Integrally colored injection molded high impact UV resistant, colorfast, plastic alloy complete with mounting system; ready for insert installation.
2. Corners: Radius.
3. Mounting:
   a. Surface: Wall or vertical surface.
   b. Fastening: MFH Mechanical Fasteners (concealed) on all surfaces. Vinyl tape mounting is not approved.
   c. Sizes: as shown on sign drawings.
4. Color: Selected by Architect from manufacturer's standard eight colors.

B. Insert:

1. Non-tactile signs: Integrally colored injection molded high impact plastic with computer generated photographic silk-screen process surface printing chemically bonded to self-aligning reveal insert material; insert corner same type as holder.
2. ADA tactile signs: 1/32" thickness computer generated photo-etched rubberized surface material chemically bonded to self-aligning reveal ClearLens or 1/8” thick phenolic with fused photopolymer face insert material; insert corner same type as holder; silk-screen colors surface applied.
3. ClearLens inserts are special configured molded inserts provided with same corner configuration as the molded holder. This insert allows graphic to be seen beneath surface.
   a. SignWordPro IBM Windows 95/98/ME/NT/2000 Version or later software provided for IM System.
   b. Paper Inserts provided in sizes: 1 1/2” x 8”, 1” x 6”, 1” x 8”, 4” x 4”, 4” x 8”, 6” x 6”, 8” x 8”, 6” x 12”.
   c. Radius or Square corner configuration.
   d. Paper shall be 65-lb. uncoated cover stock, bright white, inked on an offset press in A47 (gray), A78 (pearl), A81 (Harvard green), A43 (putty), and A72 (bone white). Microperfed to fit precisely in radius molded holders.
4. Mounting of inserts: VT Vinyl Tape for permanent messages, PL

PresLock for changeable messages, CL ClearLens tab retainer.

5. Sizes: 6”x6”, 8”x8”, 6”x12”, 12”x12”.
6. Color: Selected by Architect from manufacturer's standard eight colors.
7. Furnish the following accessories where indicated in Sign Type Drawings
   a. ADA Band on ClearLens.
   b. Changeable slide insert.
   c. Window for 3”x5” photograph.

C. Graphics:

1 Type sizes: Selected from manufacturer's standard sizes indicated in Sign Type Drawings for particular units; meet ADA requirements for letter proportions and sizes where tactile units are used.
2 Type style or styles: Universe 55, Universe 67, Universe 57, Universe 47.
3 Furnish Grade 2 Braille characters for tactile signs; same text as letter designations and symbol translation indicated in DEFINITIONS Article.
4 Type code or codes: Combination. Indicated in Sign Type Drawings.
5 Imprint colors: Selected by Architect from manufacturer's standard 44 non-glare screening ink colors per unit and indicated in SCHEDULES Article; color contrast background colors in accord with ADA requirements.

2.03 EMERGENCY PLAN

A. Holder:
1 Manufacturer's standard 12" by 12" radius corner holders with MFH mechanical fasteners.
2 Window insert cover with standard header and blank base ready for insertion of paper floor map; attach to holder with rigid plastic fastener allowing removal with manufacturer's special tool.
3 Paper floor map to be provided by signage contractor. Owner to provide electronic drawing file for base art.

B. Header and base:
1 Furnish header and base inserts in color selected by Architect from manufacturer's standard colors; attach to holder with rigid plastic fastener allowing cover removal with manufacturer's special tool.
2 Copy for header or base: Computer generated photo silk-screen copy.
3 Type size, style, and code: Indicated in Sign Type Drawings from manufacturer's standards.
4 Imprint color: Selected by Architect from manufacturer's standard 44 non-glare screening ink colors per unit.

C. Acrylic cover:
1. Manufacturer's standard protective clear acrylic plastic cover sized to fit over entire face of specified holder units; attach to holder with rigid plastic fastener allowing cover removal with manufacturer's special tool.
2. Furnish integral header and base in color selected by Architect from manufacturer's standard colors.
3. Copy for integral header or base: Computer generated photo silk-screen copy.
4. Type size, style, and code:

a. Meet ADA requirements for letter proportions and sizes.
b. Indicated in Sign Type Drawings from manufacturer's standards.
5. Imprint color: Selected by Architect from manufacturer's standard 44 non-glare screening ink colors per unit and indicated in Sign Type Drawings; colors contrast background colors in accord with ADA requirements.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Examine areas to receive signage; notify Architect in writing of unacceptable substrate.

B. Beginning work indicates acceptance of substrate. Subsequent modifications to substrate or signage becomes this section's complete responsibility.

3.02 INSTALLATION

A. Install signage holders in locations with mechanical fasteners in accord with reviewed shop drawings. Square, plumb, and level units. No signage shall be attached with vinyl tape.

B. Conform to ADA requirements for tactile graphics signage.

3.03 CLEANING

A. Clean exposed surfaces in accord with manufacturer's written cleaning instructions.

3.04 SIGN TYPE DRAWINGS AND SCHEDULES

A. See attached Sign Types A, B, C, D, E, F, G1, G2, J & K for basic graphic design. A full range of sign types will be made available by MCS.
B. Provide 1 sign identifying each room or space with the sign located adjacent the to door, group of doors, or door opening. Sign types A, B, C, D, E, F and K.
C. Provide a minimum of 30 directional signs. Sign types G1and G2.
D. Provide 1 sign type J to be located at main entrance.

END OF SECTION

SECTION 10 50 30
Athletic Series

Part 1: General

1.1 Construction Requirements: All lockers shall be powder – coated steel as design and manufactured by WEC, Memphis, Tennessee. WEC will furnish all labor and materials for the completion of work in this section as shown in the approved drawings and specifications.

1.2 Qualifications of alternative lockers: Will be evaluated only if they are submitted with supporting documents to show that they are equal or better than these specification standards.

1.3 Warranty: Lockers are warranted for a lifetime against defective parts and workmanship, excluding vandalism and improper installation and use.

1.4 ADA Lockers: Lockers are to meet the Americans with Disabilities Act, accessibility guidelines. They shall have recessed handles and shall be single tier or lower opening of a double tier locker. Locker bottom shall be a minimum of 15" off the floor, or an extra shelf placed 15" off the floor. Single tier lockers shall have a shelf 48" off the floor. Doors assigned for handicapped use shall have an appropriate symbol sign.

1.5 Submittals: Shop drawing shall show the following: Dimensioned drawings including plans, elevations, and sections to show locker locations and interfaces with adjacent substrates. Color charts will be provided representing manufactures full range of available colors and finishes.

1.6 Delivery, Storage & Handling: Store products in manufacture's unopened packaging until ready for installation to protect the locker finish and adjacent surfaces from damage.

Part 2: Specified Product Detail Athletic Knock-Down Series

2.1 Acceptable Product: WEC Athletic Series, knock-down locker.

2.2 Acceptable Manufacturer: WEC, which is located at: P.O. Box 38190, Germantown, TN 38183; Phone: 901-367-3922; Fax: 901-367-3922; Email: sales@itswec.com; Web: www.itswec.com

2.3 Material: Steel parts shall be mild cold-rolled commercial quality steel, capable of taking a high grade enamel finish.

2.3.1 Rivets: Steel mandrel rivets.

2.3.2 Bolts and Nuts: Zinc plated truss fin head bolts and hex nuts.

2.4 Knockdown Construction: Lockers shall be built on a unit principle with common intermediate uprights separating units. Locker body assembly using rivets and/or nuts and

bolts.

2.4.1 Fabricate lockers square, rigid, without warp, with metal faces flat and free of distortion.

2.5 Door Frames: Shall be 16 gauge formed in a channel shape.

2.6 Ventilation: Front panel to have a pattern of mini louvers, Security Box door solid with diamond perforated sides. Optional ventilation patterns available upon request.

2.7 Body: Hole spacing in locker body construction: not exceeding 9". Steel specially formed for added strength and rigidity and to ensure tight joints at fastening points.

2.7.1 Bottoms: 16 gauge sheet steel, with three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.

2.7.2 Tops: 16 gauge sheet steel, with three sides formed 90 degrees, the front offset formed to be flush with horizontal frame member.

2.7.3 Sides: 16 gauge sheet steel

2.7.4 Backs: 18 gauge sheet steel

2.7.5 Shelves: 16 gauge sheet steel. Shelves with four sides formed to 90 degrees, front edge having a second bend.

2.8 Interior Equipment: Full width shelf, coat rod, and two single prong hooks.

2.8.1 Box Lockers Security Box: Above Shelf. Door shall be 14 gauge steel, punched for built in lock or padlock. Lock hole cover with door pull shall be provided for padlock use. Hinges Shall be 16 gauge continuous and riveted to 16 gauge welded frame

2.8.2 Foot Locker: with hinged bench seat, padlock hasp and stainless steel strike. Hinge 16 gauge continuous and riveted to horizontal panel.

2.9 Number Plates: Provide holes for attaching number plates. Each locker shall have a polished aluminum number plate riveted to door face with black numerals 1/2" high.

2.10 Finish: All components shall have a 2mm hybrid epoxy/polyester power, electro statically applied to ensure a uniform finished and baked to cure.

2.11 Color: Doors and all body parts shall be selected from WEC's standard color range.

2.11.1 Custom colors optional.

<u>Part 3:</u> Built In Standard Superior Quiet Locker Features:

3.1 Silencing For Schools: We Feature Technology Leading Quiet Doors:

3.1.1. The Design Specification: The key to the sound dampening is the solid interior welded double strength plate welded to the door. This one piece is fabricated from 16 gauge or 18 gauge steel sheet; formed into channel shape with double a bend at vertical edges and with a right-angle single bend at the horizontal edges. The doors can be equipped with quiet handles and silencing latches.

3.1.2. Quiet Handles: stainless steel recessed handle with plastic-protected lifting trigger, designed to accept padlock or built in locks.

3.1.3. Silencing Latches: nearly silent multi-point latching on heavy gauge frame hooks with rubber buffers that smoothly reduce noise and contact. There is a concealed quiet lock bar that is locked into place and restricts metal-to-metal noise contact by polyethylene glides.

3.1.4. U Shape Channel Glide: The spider plastic component tops the inside the galvanized latch channels so there is no rattling within the latch bar cavity.

3.2 Additional Option. Sound-Dampening Panels: WEC Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening design and material; welded to inner face of doors. These sound-dampening panels are attached horizontally or vertically depending upon the design of the locker.

Part 4: Accessories & Options

4.1 Zee Bases for Knock Down Lockers: 14 gauge, steel flanged outward at top for support of lockers, flanged inward at bottom for anchoring to floor.

4.2 Continuous Sloped Hoods: 18 gauge steel, slope rise equal to 1/3 of the locker depth (18.5 degrees), plus a 1" vertical rise at front. Supplied in 72" lengths only. Slip joints without visible fasteners at splice locations. Provide necessary end closures and finish to match lockers.

4.3 16 Gauge Exposed End Panels: Minimum 16 gauge steel formed to match locker depth and height. Punched with perimeter holes only.

4.4 Finished Box End Panels: Minimum 16 gauge steel formed to match locker depth and height, 1" edge dimension; finish to match lockers; install with concealed fasteners.

4.5 Front Fillers: 20 gauge steel formed in an angle shape, with 20 gauge slip joint angles formed in an angle shape with double bend on one leg forming a pocket to provide adjustable mating with angle filler. Attachment by means of concealed fasteners. Finish to match lockers.

4.6 Top Fillers: 20 gauge steel. Cover gasp between tops of lockers. They overlap the locker tops and can be field cut.

4.7 Recess Trim: 18 gauge steel, 3" face dimension. Vertical and/or horizontal as required.

Standard lengths as long as practical; attaches to lockers with concealed clips. Provide necessary finish caps and splices. Finish to match lockers.

4.8 Benches: Laminated selected hardwood, 1-1/4" full finished thickness, corners rounded and sanded, surfaces finished with two coats of clear lacquer.

Heavy Duty Bench Pedestals: Steel tubing with 10 gauge steel flanges welded to each end, 16-1/4" high, and finish to match lockers.**Stainless Steel Free-Standing Bench Pedestal:** 2" diameter brushed 16 gauge stainless steel formed into a trapezoid, 14" wide bottom with two 5/16" diameter holes, top flange with four 5/16" diameter holes for fastening to bench.

4.9 Padlocks: Master keyed three number dialing combination type padlocks; provide master key. Mechanism must be resistant to "shimming".

Part 5. Execution

5.1 Preparation: Verify that base is level. Do not begin installation until base has been properly prepared.

5.1.1 Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

5.2 Installation: Lockers shall be installed in compliance with WEC's installation instructions and shall be level and plumb with flush surfaces and rigid attachment to anchoring surfaces.

5.2.1 Bolt adjoining locker units together to provide rigid installation.

5.2.2 Install sloping tops and metal fillers using concealed fasteners. Provide flush hairline joints against adjacent surfaces.

5.2.3 Install benches by fastening bench tops to pedestals and securely anchoring to the floor using appropriate anchors for the floor material.

5.3 Anchoring: Anchor lockers to floor and wall.

5.4 Assembly: Assembly by bolting is acceptable, WEC recommends assembly by riveting. Rivets provide solid permanent fastening but allow for faster removal by drilling where future rearrangement of lockers or replacement of damage parts may be required.

5.5 Adjust and Clean: Adjust doors and latches to operate without bidding. Verify that latches are operating satisfactory.

5.5.1 Adjust built in locks to prevent binding of dial or key and ensure smooth operation prior to substantial completion.

5.6 Touch up: With factory supplied paint and repair or replace damage products before substantial completion.

5.7 Protection: Protect installed products until completion of project.

End of Section

SECTION 10 80 00

TOILET ROOM ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES
- A. Toilet, shower and washroom accessories.
- B. Grab bars.
- C. Attachment hardware.
- E. Shower curtain and rod

1.2 RELATED SECTIONS
- A. Section 04200 – Unit Masonry.
- B. Section 06100 – Rough Carpentry.
- C. Section 08800 – Glazing: Wall Mirrors.
- D. Section 09310 – Ceramic Tile.

1.3 SUBMITTALS
- A. Submit under provisions of Section 01300.
- B. Product Data: Submit data on accessories describing size, finish, details of function and attachment
- C. Installation Instructions: Submit printed manufacturer's installation instructions.

1.4 REGULATORY REQUIREMENTS
- A. Conform to ANSI A117.1 and local codes for access for the handicapped.

1.5 FIELD MEASUREMENTS
- A. Verify that field measurements are as indicated on product data.

1.6 DELIVERY, STORAGE AND HANDLING
- A. Deliver products to site under provisions or Section 01600.
- B. Do not deliver accessories to site until rooms in which they are to be installed are ready to receive them.
- C. Pack accessories individually in a manner to protect accessory and its finish.

1.7 PROTECTION
- A. Protect adjacent or adjoining finished surfaces and work from damage during installation of work of this section.

PART 2 PRODUCTS

2.1 TOILET ACCESSORIES
- A. Acceptable Manufacturers:
  - 1 Manufacturer: Bobrick Washroom Equipment, Inc.
  - 2 Substitutions: Permitted under provisions of Section 01600.

2.2 MATERIALS

A. Stainless Steel Sheet ASTM A167, Type 304.
B. Stainless Steel Tubing: ASTM A269.
C. Adhesive: Contact cement, waterproof.
D. Fasteners, Screws and Botts: stainless steel.
E. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.3 FINISHES
A. Chrome/Nickel Plating: ASTM 8456, Type SC2, Satin finish.
B. Stainless Steel: No. 4 satin luster finish.

2.4 FABRICATION
A. Weld and grind smooth joints of fabricated components.
B. Form exposed surfaces from one sheet of stock, free of joints.
C. Provide steel anchor plates and anchor components for installation on building finishes.
D. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
E. Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges.
F. Back paint components where contact is made with building finishes to prevent electrolysis.
G. Hot-dip galvanize ferrous metal anchors or stainless steel and fastening devices.
H. Shop assemble components and package complete with anchors and fittings.

PART 3 EXECUTION

3.1 PREPARATION
A. Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates and rough-in measurements as required.
B. Before starting work notify Architect in writing of any conflicts detrimental to installation or operation of units.
C. Verify exact location of accessories for installation.

3.2 INSTALLATION
A Install fixtures, accessories and items in accordance with manufacturer's instructions.
B. Install true, plumb, and level, securely and rigidly anchored to substrate.
C. Use tamper-proof fasteners.
D. Establish heights of accessories according to barrier-free requirements.

3.3 TOILET ACCESSORY SCHEDULE

ITEM NO. NO..	ITEM DESCRIPTION	MODEL	LOCATION
T-01	Surface mounted Toilet paper dispenser	O.F.C.I.	at every water closet
T-02	Surface mounted soap	O.F.C.I	@ each. Lavatory

	dispenser		
T-03	Wall mounted paper dispenser	O.F.C.I.	1 per restroom
T-04	42” Toilet Grab Bar	B-68060.99 x 42 C.F.C.I.	as indicated
T-05	36” Toilet Grab bar	B-68060.99 x 36 C.F.C.I.	as indicated
T-06	Sanitary Napkin Disposal	B-254, C.F.C.I.	Teacher Planning Kitchen Unisex
T-07	24” x 36” Framed Mirror	B-290 2435, C.F.C.I.	as indicated

0.F.C.I. = Owner Furnished Contractor Installed C.F.C.I. = Contactor Furnished Contractor Installed

END OF SECTION

SECTION 12 30 00 FIXED SEATING

Part 1: General Specifications

1.1 Summary:

Deliver and install approximately 1,600 fixed chairs as specified, floor mounted, with self-lifting seat that rises to a uniform ¾-safety fold position.
Seating to be floor mounted over existing concrete that will be refinished with all existing anchors removed for new anchor installation.

1.2 Submittals:

A. Product data for each chair model specified to include construction details, material descriptions and finish options

B. LEED:

1. Product data for MR Credit 4 documenting recycled content.

C. Seating layout (shop drawings) developed from the contract drawings which show aisle widths, chair spacing for each row, row-lettering and chair-numbering scheme, chair dimensions and back pitch. Layout drawings to also include locations for accessories, including left- and right-hand tablet arms, electrical devices, accessibility provisions and attachments to other work.

D. Samples for verification & finish selection to include:

1. Initial finish selections to be made from manufacturer's standard color and fabric guides.

2. Final powder coat selection to be approved from manufacturers standard-sized samples not less than 1" x 3".

3. Final plastic color selection to be approved from manufacturers standard-sized samples not less than 2" x 3".

4. Final laminate selection to be approved from manufacturers standard-sized samples not less than 2" x 2".

E. Maintenance instructions and inspection guidelines furnished for each chair model specified.

F. Manufacturers standard warranty.

1.3 Quality Assurance:

A. Source Limitations:

1. Obtain each type of fixed seating required, including accessories and mounting components, from a single manufacturer.

B. Build sample chairs for each model required to demonstrate aesthetic effects and set quality standards for fabrication.

1.4 Project Conditions:

A. Environmental Limitations:

Do not deliver or install seating until spaces are enclosed and weather tight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary or permanent HVAC system is operating and maintaining ambient temperature and humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements:
Take field measurements to verify or supplement dimensions indicated on contract drawings prior to manufacturing.

1.5 Project Coordination:

A. Do not deliver or install seating until space is free of lifts and/or scaffolding used by other trades which may interfere with installation and/or damage seating.

B. Coordinate layout and installation of electrical wiring and devices with electrical contractor to ensure that floor junction boxes for electrical devices are accurately located for final connection to the building's power supply by the electrical contractor.

C. Coordinate layout and installation of seating with HVAC contractor to ensure that ventsare located in a manner that will not interfere with seating installation.

D. Coordinate concrete requirements needed for proper installation.

1.6 Warranty:

A. Provide a manufacturer's warranty covering the material and workmanship for the specified warranty period from date of final acceptance.

B. Warranty Periods:

1. Structural Components: Five Years.

2. Operating Mechanisms: Five Years.

3. Plastic, Wood and Painted Components: Five Years.

Part 2: Products

2.1 Materials and Finishes:

A. Steel shall meet requirements for ASTM A 36/A 36M plates, shapes, and bars; ASTM A513 mechanical tubing; ASTM A 1008/A 1008M cold-rolled sheet; and ASTM A 1011 hot-rolled sheet and strip.

B Colors shall be chosen from manufacturer's standard offering.

C. Molded Plastics:

1. Structural components shall be mar and dent resistant high density glass-filled polypropylene with UV stabilizers.

2. Decorative components shall be mar and dent resistant high density polyethylene (HDPE) with UV stabilizers.

3. Plastic components shall [be chosen from manufacturer's standard offering.

D. Medium-density fiberboard shall meet requirements for ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.

E. Maple hardwood lumber shall be free of visible defects. Exposed wood shall be sanded smooth and lacquered to compliment plastic laminate surface.

F. Plastic Laminate shall meet requirements NEMA LD 3, Grade VGS for vertical surfaces and Grade HGS for horizontal surfaces. Color and pattern to be chosen from manufacturer's standard offering.

2.2 Fixed Audience Seating:

A. Permanent arrangement of fixed audience seating as shown on seating layout drawings.

1. Approved manufacturers subject to compliance with requirements outlined herein.

2. Basis-of-design for fixed audience seating is Irwin Seating Company model **30.52.36.30** Patriot or comparable product by one of the following:

B. Chair support columns shall be a formed 1" x 2-1/2" 14 gauge (.0747") steel column with a welded back wing plate. Brackets for seat attachment shall be 7 gauge (.1875") steel for superior strength, formed with an integral support buttress. Floor attachment foot shall be 1/4" thick steel plate. All steel components are to be MIG welded. The standard shall be fabricated to be compatible with the floor incline, and to maintain proper seat and back height and angle.

C. Aisle end panels shall be constructed of medium density fiberboard (MDF) and surfaced with plastic laminate specified and a lacquered edge to match the dominant color of the laminate. Panels shall be provided with a seat bracket recess for precise location and support of the panel. Panel is secured to a 14 gauge formed steel bracket bolted to the top of the support column and directly to the support column with the use of a spacer. Panel bracket assembly is concealed behind a steel shroud attached with a tamper resistant screw.

D. Back components shall be one-piece, double-wall blow-molded plastic with an ergonomic compound curve. Plastic must be high density, high impact-resistant linear polyethylene with a smooth finish. The face of the back shall feature a decorative recess molded around the perimeter of the back and a recess for a seat number plate. The blow-molded plastic shall be designed to be a sturdy structural component with threaded inserts molded into the rear of the back for attachment of 14 gauge steel wings. The back assembly shall be certified through routine ISO testing to withstand a 250 lb. static load test applied approximately 16" above the seat assembly and a 100,000 cycle 40 lb. swing impact test.

E. Molded Plastic Seat:

1. The seat components shall be one-piece, double-wall construction formed with impact-resistant, blow-molded, (HDPE) high density polyethylene plastic, with a smooth surface. The tops of the seats shall be formed to provide even, comfortable support for the seated individual by properly contouring to the shape of the human form. Seat components shall be molded to avoid sharp, pressure-generating ridges by gently falling away at the front of the seat. The underside of the seat shall be recessed to provide support of the seat surface. Structural seat-lift arms shall transfer the occupant load to the cast iron pivot and the chair's support structure (standards). Seat-lift arms shall be formed from engineered injection-molded, glass-filled nylon plastic, and colored to blend aesthetically with the blow-molded plastic.

2. Seats shall lift automatically to a uniform three-quarter fold position when unoccupied, and shall rotate on two molded, structural, glass-filled nylon hinge rods in internally molded channels with integral down-stops for exceptional strength. Seat-lift shall be accomplished by compression springs and lubricated, high-tech plastic cams, providing

quiet, gentle seat uplift. Seats shall self-rise to a uniform position when unoccupied. The mechanism shall be certified through routine ISO testing to exceed 300,000 cycles during ASTM Designation F851-87 Test Method for Self-Rising Seat Mechanism. In addition, the seat shall withstand as a 600 lb. static load test applied approximately 3" from the front edge of the seat assembly and a 50,000 cycle 125 lb. vertical drop impact test.

F. Chair width shall vary to accommodate sightlines and row lengths.
Chairs to be minimum width of **20, 21 and 22".**
19" wide chairs will not be allowed.

G. Back height shall be 32" above a level floor.

H. Back pitch shall be fixed as shown on seating layout drawings.

I. Armrests shall be solid hardwood with plastic laminate on their top surface. Armrests shall have two keyhole slots in the bottom to securely lock on to steel lugs at the top of the standard. Further, one security screw shall be utilized.

J. Tablet arms shall be provided for chairs as designated on the contract drawings, right hand or left hand as shown. Tablet arms shall be designed to provide a strong, stable work surface capable of supporting a 320 lbs. load at the center, and shall smoothly and quietly fold to a storage position when not in use. The hinge assembly shall be formed from 12 gauge steel and utilize a 5/8" pivot rod. A 7 gauge steel plate shall be MIG welded to the hinge assembly for attachment of the writing surface which is constructed of 5/8" thick 9-ply hardwood plywood. The writing tablet shall be surfaced with decorative plastic laminate on the top and bottom surfaces, edges shall be treated with decorative lacquer colored to compliment the dominant color of the laminate. The solid steel stop mechanism shall utilize neoprene cushions to reduce noise. Retrieval of tablet arms shall be accomplished by the occupant without unnecessary bending, stooping, or reaching. When stored, the tablet arm shall be positioned parallel to, and beneath, the armrest, exposing a full and complete armrest; while concealing all attaching hardware and support structure.

K. All Tablet Arms to be supplied with **Anti-Panic Springs**. Total of **540** tablet arms to be provide per layout. See seating layout for locations of tablet arms.

L. Row-lettering and chair-numbering shall be provided for identification of all chairs as shown on approved seating layout drawings. Number plates shall be 1-3/4" x 2-3/4" aluminum with a clear finish and black Bauhaus Bold numerals. Number plates shall be placed in back recess, and attached by two (2) pop rivets. Letter plates shall be 5/8" x 1-5/8" with a clear finish and black Bauhaus Bold letters placed in recess of aisle standard armrest by two (2) escutcheon pins. Attaching hardware shall have a finish compatible to plates.

M. Accessible Seating:

1. Shall be designated on the seating layout drawings and designed to allow an individual to transfer from a wheelchair to the theatre chair. The aisle standard shall be equipped with an armrest capable of lifting to a position parallel with the support column, opening sideways access to the seat. Aisle standards so equipped shall be provided with a label, displaying an easily recognizable "handicapped" symbol. Decorative requirements of aisle standards are waived for the handicapped access standards.

N. Furnish extra materials from the same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. **Attic Stock for Owner**: Furnish complete seat and back assemblies equal to **1%** of amount installed for each type and size of chair seat and back.

2.3 Fabrication:

A. Fabricate floor attachment plates to conform to floor slope, if any, so that standards are plumb and chairs are maintained at same angular relationship to vertical throughout project.

Part 3: Execution

3.1 Examination

A. Prior to layout and installation examine floors, risers, and other adjacent work and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the work including, but not limited to, plumb of riser faces and concrete conditions.

B. Examine locations of electrical connections.

C. Examine locations of HVAC supply ducts.

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

3.2 Installation

A. Install seating in locations indicated and fastened securely to substrates according to manufacturer's written installation instructions.

B. Use installation methods and fasteners that produce fixed audience seating assemblies with individual chairs capable of supporting an evenly distributed 600-lb static load applied 3” from front edge of the seat without failure or other conditions that might impair the chair's usefulness.

C. Install seating with chair end standards aligned from first to last row and with backs and seats varied in width and spacing to optimize sightlines.

D. Install riser-mounted attachments to maintain uniform chair heights above floor.

E. Install chairs in curved rows at a smooth radius.

F. Install seating so moving components operates smoothly and quietly.

G. Install wiring conductors and cables concealed in components of seating and accessible for servicing.

3.3 Field Quality Control

A. Perform tests and inspections.

B. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust chair backs so that they are properly aligned with each other.

B. Adjust self-rising seat mechanisms so seats in each row are aligned when in upright position.

C. Verify that all components and devices are operating properly.

D. Repair minor abrasions and imperfections in finishes with coating that matches factory-applied finish.

E. Replace upholstery fabric damaged during installation.

End of Section

SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 ADDITIONAL REQUIREMENTS FOR POLYPHASE MOTORS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width-modulated inverters.
2. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 05 13

SECTION 23 05 23.12

BALL VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
3. ASME B16.18 for solder-joint connections.
4. ASME B31.1 for power piping valves.
5. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

E. Valve Sizes: Same as upstream piping unless otherwise indicated.

F. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4.

G. Valves in Insulated Piping:

1. Include 2-inch stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

H. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded Ends:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:
1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Press.
f. Seats: PTFE or RPTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.
j. O-Ring Seal: Buna-N or EPDM.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Bronze or Brass Trim, Threaded Ends:
1. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.

e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.3 HEATING-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller: Brass or bronze ball valves, two piece, with brass trim, and full port.

END OF SECTION 23 05 23.12

SECTION 23 05 29

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.4 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

2.2 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psi or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi minimum compressive strength.

B. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

C. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

D. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

D. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-58. Install hangers and attachments as required to properly support piping from building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

   a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
   b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
   c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

   a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   b. NPS 4: 12 inches long and 0.06 inch thick.
   c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
   d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
   e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and attachments for general service applications.

F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

G. Use padded hangers for piping that is subject to scratching.

H. Use thermal-hanger shield inserts for insulated piping and tubing.

I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.

5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is unnecessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is unnecessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

N. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

O. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

P. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 23 05 29

SECTION 23 05 93

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

   a. Constant-volume air systems.
   b. Variable-air-volume systems.

2. Balancing Hydronic Piping Systems:

   a. Constant-flow hydronic systems.
   b. Variable-flow hydronic systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

1.3 ACTION SUBMITTALS

A. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.5 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures for balancing the systems.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

   a. Duct systems are complete with terminals installed.
   b. Volume, smoke, and fire dampers are open and functional.
   c. Clean filters are installed.

d. Fans are operating, free of vibration, and rotating in correct direction.
e. Variable-frequency controllers' startup is complete and safeties are verified.
f. Automatic temperature-control systems are operational.
g. Ceilings are installed.
h. Windows and doors are installed.
i. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete with terminals installed.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning per the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

G. Verify that motor starters are equipped with properly sized thermal protection.

H. Check dampers for proper position to achieve desired airflow path.

I. Check for airflow blockages.

J. Check condensate drains for proper connections and functioning.

K. Check for proper sealing of air-handling-unit components.

L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

A. Adjust the variable-air-volume systems as follows:

1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
2. Verify that the system is under static pressure control.
3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:

a. Adjust controls so that terminal is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.

b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
d. Adjust controls so that terminal is calling for minimum airflow.
e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.

5. After terminals have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

6. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.

a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
b. Verify that terminal units are meeting design airflow under system maximum flow.

8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
9. Verify final system conditions as follows:

a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
b. Re-measure and confirm that total airflow is within design.
c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
d. Mark final settings.
e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
f. Verify tracking between supply and return fans.

3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.

B. Prepare schematic diagrams of systems' "as-built" piping layouts.

C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:

1. Check liquid level in expansion tank.
2. Check highest vent for adequate pressure.
3. Check flow-control valves for proper position.
4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
c. Convert pressure to head and correct for differences in gage heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow, and verify that the pump has the intended impeller size.

e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at terminals for each space to design water flows.

1. Measure flow at terminals.
2. Adjust each terminal to design flow.
3. Re-measure each terminal after it is adjusted.
4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
5. Perform temperature tests after flows have been balanced.

D. For systems with pressure-independent valves at terminals:

1. Measure differential pressure and verify that it is within manufacturer's specified range.
2. Perform temperature tests after flows have been verified.

E. For systems without pressure-independent valves or flow-measuring devices at terminals:

1. Measure and balance coils by either coil pressure drop or temperature method.
2. If balanced by coil pressure drop, perform temperature tests after flows have been verified.

F. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

G. Verify that memory stops have been set.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.

3.10 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.
3. Heating-Water Flow Rate: Plus or minus 10 percent.
4. Cooling-Water Flow Rate: Plus or minus 10 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.
5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.

c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Terminal units.
6. Balancing stations.
7. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.

2. Motor Data:

    a. Motor make, and frame type and size.
    b. Horsepower and rpm.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.

e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Filter static-pressure differential in inches wg.
f. Preheat-coil static-pressure differential in inches wg.
g. Cooling-coil static-pressure differential in inches wg.
h. Heating-coil static-pressure differential in inches wg.
i. Outdoor airflow in cfm.
j. Return airflow in cfm.
k. Outdoor-air damper position.
l. Return-air damper position.
m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch o.c.
f. Make and model number.
g. Face area in sq. ft..
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Average face velocity in fpm.
c. Air pressure drop in inches wg.
d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
e. Return-air, wet- and dry-bulb temperatures in deg F.
f. Entering-air, wet- and dry-bulb temperatures in deg F.
g. Leaving-air, wet- and dry-bulb temperatures in deg F.
h. Water flow rate in gpm.
i. Water pressure differential in feet of head or psig.
j. Entering-water temperature in deg F.
k. Leaving-water temperature in deg F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in psig.
n. Refrigerant suction temperature in deg F.

o. Inlet steam pressure in psig.

G. Gas- and Oil-Fired Heat Apparatus Test Reports: In addition to manufacturer's factory startup equipment reports, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and unit size.
e. Manufacturer's serial number.
f. Fuel type in input data.
g. Output capacity in Btu/h.
h. Ignition type.
i. Burner-control types.
j. Motor horsepower and rpm.
k. Motor volts, phase, and hertz.
l. Motor full-load amperage and service factor.
m. Sheave make, size in inches, and bore.
n. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Entering-air temperature in deg F.
c. Leaving-air temperature in deg F.
d. Air temperature differential in deg F.
e. Entering-air static pressure in inches wg.
f. Leaving-air static pressure in inches wg.
g. Air static-pressure differential in inches wg.
h. Low-fire fuel input in Btu/h.
i. High-fire fuel input in Btu/h.
j. Manifold pressure in psig.
k. High-temperature-limit setting in deg F.
l. Operating set point in Btu/h.
m. Motor voltage at each connection.
n. Motor amperage for each phase.
o. Heating value of fuel in Btu/h.

H. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h.
e. Number of stages.

f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm.
i. Face area in sq. ft..
j. Minimum face velocity in fpm.

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h.
b. Airflow rate in cfm.
c. Air velocity in fpm.
d. Entering-air temperature in deg F.
e. Leaving-air temperature in deg F.
f. Voltage at each connection.
g. Amperage for each phase.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm.
b. Total system static pressure in inches wg.
c. Fan rpm.
d. Discharge static pressure in inches wg.
e. Suction static pressure in inches wg.

J. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

    a. System and air-handling-unit number.
    b. Location and zone.
    c. Traverse air temperature in deg F.
    d. Duct static pressure in inches wg.
    e. Duct size in inches.
    f. Duct area in sq. ft..
    g. Indicated airflow rate in cfm.
    h. Indicated velocity in fpm.
    i. Actual airflow rate in cfm.
    j. Actual average velocity in fpm.
    k. Barometric pressure in psig.

K. Air-Terminal-Device Reports:

1. Unit Data:

    a. System and air-handling unit identification.
    b. Location and zone.
    c. Apparatus used for test.
    d. Area served.
    e. Make.
    f. Number from system diagram.
    g. Type and model number.
    h. Size.
    i. Effective area in sq. ft..

2. Test Data (Indicated and Actual Values):

    a. Airflow rate in cfm.
    b. Air velocity in fpm.
    c. Preliminary airflow rate as needed in cfm.
    d. Preliminary velocity as needed in fpm.
    e. Final airflow rate in cfm.
    f. Final velocity in fpm.
    g. Space temperature in deg F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:

1. Unit Data:

    a. System and air-handling-unit identification.
    b. Location and zone.
    c. Room or riser served.
    d. Coil make and size.
    e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm.
b. Entering-water temperature in deg F.
c. Leaving-water temperature in deg F.
d. Water pressure drop in feet of head or psig.
e. Entering-air temperature in deg F.
f. Leaving-air temperature in deg F.

M. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm.
g. Water pressure differential in feet of head or psig.
h. Required net positive suction head in feet of head or psig.
i. Pump rpm.
j. Impeller diameter in inches.
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig.
b. Pump shutoff pressure in feet of head or psig.
c. Actual impeller size in inches.
d. Full-open flow rate in gpm.
e. Full-open pressure in feet of head or psig.
f. Final discharge pressure in feet of head or psig.
g. Final suction pressure in feet of head or psig.
h. Final total pressure in feet of head or psig.
i. Final water flow rate in gpm.
j. Voltage at each connection.
k. Amperage for each phase.

N. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.

d. Dates of use.
e. Dates of calibration.

3.12 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and fitting materials and joining methods for the following:

1. Steel pipe and fittings.
2. Joining materials.
3. Transition fittings.
4. Dielectric fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Pipe.
2. Fittings.
3. Joining materials.

B. Delegated-Design Submittal:

1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
2. Locations of pipe anchors and alignment guides and expansion joints and loops.
3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
4. Locations of and details for penetration and firestopping for fire- and smoke-rated wall and floor and ceiling assemblies.

1.3 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. Hot-Water Heating Piping: 100 psig at 200 deg F.
2. Condensate-Drain Piping: 150 deg F.
3. Air-Vent Piping: 180 deg F.

2.2 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.

B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.

C. DWV Copper Tubing: ASTM B 306, Type DWV.

D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
1. Grooved-End Copper Fittings: ASTM B 75, copper tube or ASTM B 584, bronze casting.
2. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, prelubricated EPDM gasket rated for minimum 230 deg F for use with housing, and steel bolts and nuts.

E. Wrought-Copper Unions: ASME B16.22.

2.3 STEEL PIPE AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.

B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.

C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.

D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.

E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.

F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:

1. Material Group: 1.1.
2. End Connections: Butt welding.
3. Facings: Raised face.

G. Grooved Mechanical-Joint Fittings and Couplings:
1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
2. Couplings: Ductile- or malleable-iron housing and EPDM or nitrile gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

H. Plain-End Mechanical-Joint Couplings:
1. Housing: ASTM A-536 Grade 65-45-12 segmented ductile iron or type 304 stainless steel.
2. Housing Coating: None.
3. Gasket: EPDM.
4. Sealing Mechanism: Double-lip sealing system or carbon steel case-hardened jaws.
5. Bolts, hex nuts, washers, or lock bars based on manufacturer's design.
6. Minimum Pressure Rating: Equal to that of the joined pipes.

2.4 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless otherwise indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

E. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
1. Description:

a. Standard: ASSE 1079.
b. Pressure Rating: 125 psig minimum at 180 deg F.
c. End Connections: Solder-joint copper alloy and threaded ferrous.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40, Grade B steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
3. Schedule 40 steel pipe, plain-end mechanical-coupled joints.
4. Schedule 40 CPVC plastic pipe and fittings and solvent-welded joints.

C. Condensate-Drain Piping: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

D. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

3.2 PIPING INSTALLATIONS

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Select system components with pressure rating equal to or greater than system operating pressure.

K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.

N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.

O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.

P. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.

Q. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.

R. Install shutoff valve immediately upstream of each dielectric fitting.

S. Install sleeves for piping penetrations of walls, ceilings, and floors. Fireseal all rated walls equal to the rating.

3.3 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flange kits.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.4 HANGERS AND SUPPORTS

A. Comply with requirements in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment" for hanger, support, and anchor devices. Comply with the following requirements for maximum spacing of supports.

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 7 feet.
2. NPS 1: Maximum span, 7 feet.
3. NPS 1-1/2: Maximum span, 9 feet.
4. NPS 2: Maximum span, 10 feet.
5. NPS 2-1/2: Maximum span, 11 feet.
6. NPS 3 and Larger: Maximum span, 12 feet.

D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:

1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. NPS 1-1/4 Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
7. NPS 3 and Larger: Maximum span, 10 feet; minimum rod size, 3/8 inch.

E. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

F. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.

G. Plain-End Mechanical-Coupled Joints: Prepare, assemble, and test joints in accordance with manufacturer's written installation instructions.

H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 TERMINAL EQUIPMENT CONNECTIONS

A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

B. Install control valves in accessible locations close to connected equipment.

C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.

3.7 FIELD QUALITY CONTROL

A. Prepare hydronic piping according to ASME B31.9 and as follows:

1. Leave joints, including welds, uninsulated and exposed for examination during test.
2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

B. Perform the following tests on hydronic piping:

1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
3. Isolate expansion tanks and determine that hydronic system is full of water.
4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
7. Verify lubrication of motors and bearings.

END OF SECTION 23 21 13

SECTION 23 21 16

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hydronic specialty valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

B. Related Requirements:
1. Section 23 05 23.12 "Ball Valves for HVAC Piping" for specification and installation requirements for ball valves common to most piping systems.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Include construction details and material descriptions for hydronic piping specialties.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Automatic Flow-Control Valves:
1. Body: Brass or ferrous metal.
2. Flow Control Assembly, provide either of the following:

a. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.

b. Elastomeric Diaphragm and Polyphenylsulfone Orifice Plate: Operating ranges within 2- to 80-psig differential pressure.

3. Combination Assemblies: Include bonze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow within plus or minus 10 percent regardless of system pressure fluctuations.
7. Minimum CWP Rating: 175 psig.
8. Maximum Operating Temperature: 200 deg F.

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: Stainless-steel, 20-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig.

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

END OF SECTION 23 21 16

SECTION 232123 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Close-coupled, end-suction centrifugal pumps.
3. Separately coupled, horizontally mounted, in-line centrifugal pumps.
4. Separately coupled, vertically mounted, in-line centrifugal pumps.
5. Separately coupled, base-mounted, end-suction centrifugal pumps.
6. Automatic condensate pump units.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of pump.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 SEPARATELY COUPLED, BASE-MOUNTED, END-SUCTION CENTRIFUGAL PUMPS

A. Manufacturers
1. Armstrong Pumps, Inc.
2. Bell and Gossett, Inc.

B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, drain plug at bottom and air vent at top of volute, and **flanged** connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps not frequency-drive controlled, trim impeller to match specified performance.
3. Pump Shaft: **Stainless steel**.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and **Buna-N** bellows and gasket.
5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing with grease fittings.

D. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. **Couplings shall be drop-out type to allow disassembly and removal without removing pump shaft or motor.**

E. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

F. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

G. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. See section 230513.

2.2 PUMP SPECIALTY FITTINGS

A. Suction Diffuser:

1. Angle pattern.
2. **175-psig (1204-kPa** pressure rating, **cast**-iron body and end cap, pump-inlet fitting.
3. Bronze startup and bronze or stainless-steel permanent strainers.
4. Bronze or stainless-steel straightening vanes.
5. Drain plug.
6. Factory-fabricated support.

B. Triple-Duty Valve:

1. Angle or straight pattern.
2. **175-psig (1204-kPa)** pressure rating, **cast**-iron body, pump-discharge fitting.
3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Equipment Mounting:

1. Install base-mounted pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in **Section 033000 "Cast-in-Place Concrete."**
2. Comply with requirements for vibration isolation and seismic control devices shown on details

3.2 ALIGNMENT

A. **Perform** alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to pump, allow space for service and maintenance.

C. Connect piping to pumps. Install valves that are same size as piping shown connected to pumps.

D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

E. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gage with multiple-input selector valve.

END OF SECTION 232123

SECTION 236416 - CENTRIFUGAL WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Packaged, water-cooled, electric-motor-driven centrifugal chillers.

B. Related Requirements:

1. Section 284400 "Refrigerant Detection and Alarm" for refrigerant monitors, alarms, supplemental breathing apparatus, and ventilation equipment interlocks.

1.2 DEFINITIONS

A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input, using consistent units for any given set of rating conditions.

B. DDC: Direct digital control.

C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.

D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit for a single chiller calculated according to the method defined by AHRI 550/590 and referenced to AHRI standard rating conditions.

E. kVAR: Kilovolt-ampere reactive.

F. kW/Ton (kW/kW): The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons (kW) at any given set of rating conditions.

G. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit for a single chiller calculated according to the method defined by AHRI 550/590 and intended for operating conditions other than the AHRI standard rating conditions.

H. SCCR: Short-circuit current rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, load distribution, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

1. Drawings, drawn to scale:

B. Certificates: For certification required in "Quality Assurance" Article.

C. Seismic Qualification Data: Certificates, for chillers, accessories, and components, from manufacturer.

D. Source quality-control reports.

E. Field Quality-Control Reports: Startup service reports.

F. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

A. AHRI Certification: Certify chiller according to AHRI 550 certification program.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.

1. Warranty Period: **Five** years from date of Substantial Completion. Warranty shall include parts, labor, refrigerant. Include 5 year chiller maintenance contract. Provide quarterly and yearly maintenance report including oil/refrigerant test and brushing tubes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Seismic Performance: Centrifugal chillers shall withstand the effects of earthquake motions determined according to **ASCE/SEI 7**.

1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
2. Component Importance Factor: **1.0**.

B. Condenser-Fluid Temperature Performance:

1. Startup Condenser-Fluid Temperature: Chiller shall be capable of starting with an entering condenser-fluid temperature of **55 deg F (13 deg C)** and providing stable operation until the system temperature is elevated to the minimum operating entering condenser-fluid temperature.
2. Minimum Operating Condenser-Fluid Temperature: Chiller shall be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of **60 deg F (16 deg C)** and 95 deg F (35 deg C).
3. Make factory modifications to standard chiller design if necessary to comply with performance indicated.

C. Site Altitude: Chiller shall be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

D. ASHRAE Compliance:

1. ASHRAE 15 for safety code for mechanical refrigeration.

E. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

F. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, as applicable to chiller design. For chillers charged with R-134a refrigerant, include an ASME U-stamp and nameplate certifying compliance.

G. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Comply with requirements of Underwriters Laboratories Inc., and include label by a qualified testing agency showing compliance.

I. Operation Following Loss of Normal Power:

1. Equipment, associated factory- and field-installed controls, and associated electrical equipment and power supply connected to backup power system shall automatically return equipment and associated controls to the operating state occurring immediately before loss of normal power without need for manual intervention by an operator when power is restored either through a backup power source, or through normal power if restored before backup power is brought online.
2. Refer to Drawings for equipment served by back-up power systems.
3. Provide means and methods required to satisfy requirement, even if not explicitly indicated.

2.2 MANUFACTURERS

A. Trane

B. York/JCI

C. Daikin

2.3 MANUFACTURED UNIT

A. Description: Factory-assembled and -tested chiller complete with compressor, compressor motor, compressor motor controller, **lubrication system,** evaporator, condenser, controls, interconnecting unit piping and wiring, and indicated accessories.

B. Fabricate chiller mounting base with reinforcement strong enough to resist chiller movement during a seismic event when chiller is anchored to field support structure.

2.4 COMPRESSOR-DRIVE ASSEMBLY

A. Description: Single-stage or multistage, variable- or dynamic-displacement, centrifugal-type compressor driven by an electric motor.

B. Oil-Free Technology:

1. Compressors may have oil-free technology.

C. Compressor:

1. Casing: Cast iron, precision ground.
2. Impeller: High-strength cast-aluminum or cast-aluminum alloy on carbon- or alloy-steel shaft.

D. Drive: **Direct- or gear-drive, open or hermetic** design, using an electric motor as the driver.

1. Gear Drives:

a. For chillers with oil-lubricated gear drives, provide single- or double-helical gear design continuously coated with oil while chiller is operating.
b. For chillers with oil-free technology, gear drives shall be of single- or double-helical gear design without the need for oil while chiller is operating, starting, and stopping.
c. Gears shall comply with American Gear Manufacturer Association standards.

2. Drive Coupling: For chillers with open drives, provide flexible disc with all-metal construction and no wearing parts to ensure long life without the need for lubrication.
3. Seals: Seal drive assembly to prevent refrigerant leakage.

E. Compressor Motor:

1. Continuous-duty, squirrel-cage, induction-type, two-pole motor with energy efficiency required to suit chiller energy efficiency indicated.
2. Factory mounted, aligned, and balanced as part of compressor assembly before shipping.
3. Motor shall be of sufficient capacity to drive compressor throughout entire operating range without overload and with sufficient capacity to start and accelerate compressor without damage.
4. For chillers with open drives, provide motor with **open-dripproof** enclosure.
5. For Hermetic Motor Design - Provide motor with thermistor or RTD in **each of three-phase motor windings** to monitor temperature and report information to chiller control panel.
6. For Hermetic Motor Design - Provide motor with thermistor or RTD to monitor bearing temperature and report information to chiller control panel.
7. Provide open-drive motor with internal electric heater, internally powered from chiller power supply.

F. Vibration Balance: Balance chiller compressor and drive assembly to provide a precision balance that is free of noticeable vibration over the entire operating range.

1. Overspeed Test: At least **20** percent above design operating speed.
2. Vibration Limits: Velocities not to exceed 0.15 inches/s (3.8 mm/s) and 0.8 mils (0.02 mm) peak to peak on all axes.

G. Service: Easily accessible for inspection and service.

1. Compressor's internal components shall be accessible without having to remove compressor-drive assembly from chiller.
2. Provide lifting lugs or eyebolts attached to casing.

H. Economizers: For multistage chillers, provide interstage economizers.

I. Capacity Control: Modulating, variable-inlet, guide-vane assembly combined with hot-gas bypass, if necessary, to achieve performance indicated.

1. Maintain stable operation that is free of surge, cavitation, and vibration throughout range of operation. Configure to achieve most energy-efficient operation possible.
2. Operating Range: From 100 to **10** percent of design capacity.
3. Avoid use of hot-gas bypass if other options are available to achieve performance indicated. Apply hot-gas bypass according to ASHRAE/IES 90.1 and governing codes.

J. Oil Lubrication System: Consisting of pump, filtration, cooler, factory-wired power connection, and controls.

1. Bearings, gears, and other rotating surfaces shall be lubricated at all operating, startup, coast down, and standby conditions, including power failure.
2. **Manufacturer's standard method** to remove refrigerant from oil.
3. **Oil filter** shall be the easily replaceable cartridge type, minimum **0.3**-micron efficiency, with means of positive isolation while servicing.
4. **Refrigerant - or water**-cooled oil cooler.
5. Factory-installed and pressure-tested piping with isolation valves and accessories.
6. Oil compatible with refrigerant and chiller components.
7. Positive visual indication of oil level.

2.5 REFRIGERATION

A. Refrigerant:

1. Type: **R-134a OR R-513** (R-123 not acceptable).
2. Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.

B. Refrigerant Flow Control: Manufacturer's standard refrigerant flow-control device satisfying performance requirements indicated.

C. Pressure Relief Device:

1. Comply with requirements in ASHRAE 15, ASHRAE 147, and applicable portions of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
2. Select and configure pressure relief devices to protect against corrosion and inadvertent release of refrigerant.
3. Where dual pressure relief devices are installed in series, provide a sensor with indicator between devices to indicate refrigerant release past first device.
4. For Chillers Using R-134a: ASME-rated, spring-loaded, pressure relief valve; single- or multiple-reseating type. Pressure relief valve(s) shall be provided for each heat exchanger. Condenser shall have dual valves with one being redundant and configured to allow either valve to be replaced without loss of refrigerant.

D. Refrigeration Transfer: Provide service valves and other factory-installed accessories required to facilitate transfer of refrigerant from chiller to a remote refrigerant storage and recycling system. Comply with requirements in ASHRAE 15 and ASHRAE 147.

E. Refrigerant Isolation for Chillers Using R-134a:

1. Factory install **positive shutoff, manual or automatic** isolation valves in the compressor discharge line to the condenser and the refrigerant liquid line leaving the condenser to allow for isolation and storage of full refrigerant charge in the chiller condenser shell.
2. Suction side of compressor from evaporator shall have an isolation valve to allow for isolation and storage of full refrigerant charge in the chiller evaporator shell.

F. Purge System:

1. For chillers operating at subatmospheric pressures (using R-123 refrigerant), factory install an automatic purge system for collection and return of refrigerant and lubricating oil and for removal of noncondensables, including, but not limited to, water, water vapor, and noncondensable gases.
2. System shall be of thermal purge design, refrigerant or air cooled, and equipped with a carbon filter that includes an automatic regeneration cycle.
3. Factory wire to chiller's main power supply and system complete with controls, piping, and refrigerant valves to isolate the purge system from the chiller.
4. Construct components of noncorrodible materials.
5. Controls shall interface with chiller control panel to indicate modes of operation, set points, data reports, diagnostics, and alarms.
6. Efficiency of not more than 0.02 lb of refrigerant per pound of air (9 g of refrigerant per gram of air) when rated according to AHRI 580.

7. Operation independent of chiller according to ASHRAE 147.

G. Positive-Pressure System:

1. For chillers operating at subatmospheric pressures, factory install an automatic positive-pressure system.
2. During nonoperational periods, positive-pressure system shall automatically maintain a positive pressure for atmosphere in the refrigerant-pressure vessel of not less than 0.5 psig (3 kPa) adjustable up to a pressure that remains within the vessel design pressure limits.
3. System shall be factory wired and include controller, electric heat, pressure transmitter, or switch.

2.6 EVAPORATOR

A. Description: Shell-and-tube design, with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from condenser.

B. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.

C. Designed to prevent liquid refrigerant carryover from entering compressor.

D. Evaporator shall have sight glass or other form of positive visual verification of liquid-refrigerant level.

E. Tubes:

1. Individually replaceable from either end and without damage to tube sheets and other tubes.
2. Mechanically expanded into end sheets and **physically attached to** intermediate tube sheets.
3. Material: **Copper**.
4. Nominal OD: **Manufacturer's choice.**
5. In "Minimum Wall Thickness" Subparagraph below, first option gives manufacturer the choice of wall thickness; second, third, and fourth options limit thickness. Second option is current standard of listed manufacturers but is subject to change. Third and fourth options are upgrades. If using materials other than copper, wall thickness may vary. See the Evaluations.
6. Minimum Wall Thickness: **0.028 inch (0.71 mm)**.
7. External Finish: Manufacturer's standard.
8. Internal Finish: **Enhanced or smooth**.

F. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes, with positive seal between fluid in tubes and refrigerant in shell.

G. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear**, but not more than 4 feet (1.2 m) apart**.

H. Water Box:

1. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
2. **Standard** type for water box with piping connections; standard type for water box without piping connections.
3. Provide water boxes with lifting lugs or eyebolts.
4. Nozzle Pipe Connections: **Grooved with mechanical-joint coupling and flange adapter**.
5. Thermistor or RTD temperature sensor factory installed in each nozzle.
6. Fit each water box with **3/4-inch (19-mm)** drain connection at low point and vent connection at high point, each with threaded plug.

I. Additional Corrosion Protection:

1. Electrolytic corrosion-inhibitor anode, **zinc or magnesium**.
2. Coat wetted surfaces with a corrosion-resistant finish.
3. Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

J. Flow Sensor: Thermal dispersion type, factory calibrated for project-specific application.

2.7 CONDENSER

A. Description: Shell-and-tube design, with water in tubes and refrigerant surrounding tubes within shell. Shell is separate from evaporator.

B. Shell Material: Carbon-steel rolled plates with continuously welded seams or seamless pipe.

C. Designed to prevent direct impingement of high-velocity hot gas from compressor discharge on tubes.

D. Condenser shall have sight glass or other form of positive visual verification of refrigerant charge and condition.

E. Tubes:

1. Individually replaceable from either end and without damage to tube sheets and other tubes.
2. Mechanically expanded into end sheets and intermediate tube sheets.
3. Material: **Copper**.
4. Nominal OD: **Manufacturer's choice**
5. Minimum Wall Thickness: **0.028 inch (0.71 mm)**]
6. External Finish: Manufacturer's standard.
7. Internal Finish: **Smooth**.

F. End Tube Sheets: Continuously welded to each end of shell; drilled and reamed to accommodate tubes, with positive seal between fluid in tubes and refrigerant in shell.

G. Intermediate Tube Sheets: Installed in shell and spaced along length of tube at intervals required to eliminate vibration and to avoid contact of tubes resulting in abrasion and wear**, but not more than 4 feet (1.2 m) apart**.

H. Water Box:

1. Cast-iron or carbon-steel construction; arranged to provide visual inspection and cleaning of tubes from either end without disturbing refrigerant in shell.
2. **Standard** type for water box with piping connections. Standard type for water box without piping connections.
3. Water boxes shall have lifting lugs or eyebolts.

4. Nozzle Pipe Connections: **Grooved with mechanical-joint coupling and flange adapter**.
5. Thermistor or RTD temperature sensor factory installed in each nozzle.
6. Fit each water box with **3/4-inch (19-mm)** drain connection at low point and vent connection at high point, each with threaded plug.

I. Additional Corrosion Protection:

1. Electrolytic corrosion-inhibitor anode, **zinc or magnesium**.
2. Coat wetted surfaces with a corrosion-resistant finish.
3. Using same material as tubes, clad surfaces of end tube sheets in contact with fluid. Coat other wetted surfaces, including water boxes, with a corrosion-resistant finish.

J. Flow Sensor: Thermal dispersion type, factory calibrated for project-specific application.

2.8 INSULATION

A. Closed-cell, flexible elastomeric thermal insulation complying with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

1. Thickness: **3/4 inch (19 mm)**.

B. Adhesive: As recommended by insulation manufacturer.

C. Factory-applied insulation over all cold surfaces of chiller capable of forming condensation. Components shall include, but not be limited to, evaporator shell and end tube sheets, evaporator water boxes including nozzles, refrigerant suction pipe from evaporator to compressor, cold surfaces of compressor, refrigerant-cooled motor, and auxiliary piping.

1. Apply adhesive to 100 percent of insulation contact surface.
2. Before insulating steel surfaces, prepare surfaces for paint, and prime and paint as indicated for other painted components. Do not insulate unpainted steel surfaces.
3. Seal seams and joints to provide a vapor barrier.
4. After adhesive has fully cured, paint exposed surfaces of insulation to match other painted parts.
5. Manufacturer has option to factory or field insulate chiller components installed in multiple pieces to reduce potential for damage during installation.
6. Manufacturer has option to factory or field insulate water boxes and nozzles to reduce potential for damage during installation.

D. Field-Applied Insulation:

1. Components that are not factory insulated shall be field insulated to comply with requirements indicated.
2. Manufacturer shall be responsible for chiller insulation whether factory or field installed, to ensure manufacturer is the single point of responsibility for chillers.
3. Manufacturer factory-authorized service representative shall instruct and supervise installation of field-applied insulation.
4. After field-applied insulation is complete, paint insulation to match factory-applied finish.

2.9 ELECTRICAL

A. Factory installed and wired, and functionally tested at factory before shipment.

B. Single-point, field-power connection to **NEMA AB-1 Door-interlocked, instantaneous-trip circuit breaker with lockable handle.** Minimum short circuit current rating (SCCR) according to UL 508 shall be as required by electrical power distribution system, but not less than **65,000** A.

1. Branch power circuit to each motor, electric heater, dedicated electrical load, and control, with **circuit breaker or disconnect switch** having SCCR to match main disconnecting means.
   a. NEMA AB 1, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.

2. NEMA ICS 2-rated motor controller for auxiliary motors, hand-off-auto switch, and overcurrent protection for each motor.
3. Control-circuit transformer with primary and secondary side fuses.

C. Terminal blocks with numbered wiring to match wiring diagram. Spare wiring terminal block for connection to external controls or equipment.

D. Factory-installed wiring located outside of enclosures shall be installed in metal raceway, and terminal connections shall be made with not more than a 24-inch (610-mm) length of **liquid tight or flexible metallic** conduit.

E. Factory install and wire capacitor bank for the purpose of power factor correction to **0.95 all operating conditions**.

1. If capacitors are mounted in a dedicated enclosure, use same NEMA enclosure type as that for motor controller. Provide enclosure with service entrance knockouts and bushings for conduit.
2. Capacitors shall be of non-PCB dielectric fluid, metallized electrode design, with low loss with low-temperature rise. The kVAR ratings shall be indicated and shall not exceed the maximum limitations set by NFPA 70. Provide individual cells as required.
3. Provide each cell with current-limiting replaceable fuses and carbon-film discharge resistors to reduce residual voltage to less than 50 V within one minute after de-energizing.
4. Provide a ground terminal and a terminal block or individual connectors for phase connection.

2.10 VARIABLE-FREQUENCY CONTROLLER

A. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.

B. Description: NEMA ICS 2; listed and labeled according to UL 508 as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.

C. Enclosure: Unit mounted, NEMA 250, **Type 4x**, with hinged full-front access door with lock and key.

D. Technology: Pulse width modulated (PWM) output with insulated gate bipolar transistors; suitable for variable torque loads.

E. Controller shall consist of a rectifier converter section, a digital/analog driver regulator section, and an inverter output section.

1. Rectifier section shall be a full-wave diode bridge that changes fixed-voltage, fixed-frequency, ac line power to a fixed dc voltage. Silicon controller rectifiers, current source inverters, and paralleling of devices are unacceptable. Rectifier shall be insensitive to phase rotation of the ac line.
2. Regulator shall provide full digital control of frequency and voltage.
3. Inverter section shall change fixed dc voltage to variable-frequency, variable ac voltage for application to a squirrel-cage motor. Inverter shall produce a sine-coded, PWM output waveform and shall conduct no RFI back to the input power supply.

F. Output Rating: Three phase, with voltage proportional to frequency throughout voltage range.

G. Operating Requirements:

1. Input AC Voltage Tolerance: **460-V ac, plus 10 percent or 506 V maximum**.
2. Input frequency tolerance of 60 Hz, plus or minus 2 Hz.
3. Capable of driving full load, without derating, under the following conditions:

   a. Ambient Temperature: **50** deg C.
   b. Relative Humidity: Up to **95** percent (noncondensing).
   c. Altitude: Up to **3300 feet (1005 m)**

4. Minimum Efficiency: 96 percent at 60 Hz, full load.
5. Minimum Displacement Primary-Side Power Factor: 95 percent without harmonic filter; 98 percent with harmonic filter.
6. Overload Capability: 1.05 times the full-load current for seven seconds.
7. Starting Torque: As required by compressor-drive assembly.
8. Speed Regulation: Plus or minus 1 percent.
9. Isolated control interface to allow controller to follow control signal over a 10:1 speed range.
10. To avoid equipment resonant vibrations, provide critical speed lockout circuitry to allow bands of operating frequency at which controller shall not operate continuously.
11. Capable of being restarted into a motor coasting in either the forward or reverse direction without tripping.

H. Internal Adjustability Capabilities: Integral to controller or through chiller control panel.

1. Minimum Output Frequency: 6 Hz.
2. Maximum Output Frequency: 60 Hz.
3. Acceleration: Two seconds to a minimum of 60 seconds.
4. Deceleration: Two seconds to a minimum of 60 seconds.
5. Current Limit: 30 percent to a minimum of 100 percent of maximum rating.

I. Self-Protection and Reliability Features: Subjecting the controller to any of the following conditions shall not result in component failure or the need for replacement:

1. Overtemperature.
2. Short circuit at controller output.
3. Ground fault at controller output. Variable-frequency controller shall be able to start a grounded motor.
4. Open circuit at controller output.
5. Input undervoltage.
6. Input overvoltage.
7. Loss of input phase.
8. Reverse phase.
9. AC line switching transients.
10. Instantaneous overload, line to line or line to ground.
11. Sustained overload exceeding 100 percent of controller-rated current.
12. Starting a rotating motor.

J. Motor Protection: Controller shall protect motor against overvoltage and undervoltage, phase loss, reverse phase, overcurrent, overtemperature, and ground fault.

K. Automatic Reset and Restart:

1. Capable of **three** restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction.
2. Controller shall be capable of automatic restart on phase-loss and overvoltage and undervoltage trips.

L. Visual Indication: On face of controller enclosure or chiller control enclosure. indicating the following conditions:

1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.
7. Motor speed (percent).
8. Fault or alarm status (code).
9. DC-link voltage.
10. Motor output voltage.
11. Input kilovolt amperes.
12. Total power factor.
13. Input kilowatts.

14. Input kilowatt-hours.
15. Three-phase input voltage.
16. Three-phase output voltage.
17. Three-phase input current.
18. Three-phase output current.
19. Three-phase input voltage THD.
20. Three-phase input current THD.
21. Output frequency (Hertz).
22. Elapsed operating time (hours).
23. Diagnostic and service parameters.

M. Operator Interface: At controller or chiller control panel; with start-stop and auto-manual selector with manual-speed-control potentiometer.

N. Control Signal Interface:

1. Electric Input Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4-20 mA) and six programmable digital inputs.
2. Manufacturer has option to incorporate control signal interface into chiller control panel.

O. Active Harmonic Distortion Filter:

1. Factory mounted and wired to limit total voltage and current distortion to **5** percent.

P. Accessories: Devices shall be factory installed in controller enclosure unless otherwise indicated.

1. Control Relays: Auxiliary and adjustable time-delay relays.

Q. Chiller Capacity Control Interface: Equip chiller with adaptive control logic to automatically adjust the compressor motor speed and the compressor pre-rotation inlet vane position independently to achieve maximum part-load efficiency in response to sensor inputs that are integral to the chiller controls.

2.11 CONTROLS

A. Control: Standalone and microprocessor based, with all memory stored in nonvolatile memory, so that reprogramming is not required on loss of electrical power.

B. Enclosure: Unit mounted, NEMA 250, **Type 4x**, hinged or lockable, factory wired with a single-point, with field-power connection and a separate control circuit.

C. Factory-installed wiring outside of enclosures shall be in a NFPA 70-approved raceway. **Make terminal connections with liquidtight or flexible metallic conduit.**

D. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front of control enclosure. In either imperial or metric units selectable through the interface, display the following information:

1. Date and time.
2. Operating or alarm status.
3. Fault history with not less than last 10 faults displayed.
4. Set points of controllable parameters.
5. Trend data.
6. Operating hours.
7. Number of chiller starts.
8. Outdoor-air temperature or space temperature if required for chilled-water reset.
9. Entering- and leaving-fluid temperatures of evaporator and condenser.
10. Difference in fluid temperatures of evaporator and condenser.
11. Fluid flow of evaporator and condenser.
12. Fluid-pressure drop of evaporator and condenser.
13. Refrigerant pressures in evaporator and condenser.
14. Refrigerant saturation temperature in evaporator and condenser shell.
15. Compressor refrigerant suction and discharge temperature.
16. Compressor bearing temperature.
17. Motor bearing temperature.
18. Motor winding temperature.
19. Oil temperature.
20. Oil discharge pressure.
21. Phase current.
22. Percentage of motor-rated load amperage.
23. Phase voltage.
24. Demand power (kilowatts).
25. Energy use (kilowatt-hours).
26. Power factor.
27. For chillers equipped with variable-frequency controllers and harmonic filters, include the following:

    a. Output voltage and frequency.
    b. Voltage THD for each phase.
    c. Supply current TDD for each phase.
    d. Inlet vane position.
    e. Controller internal ambient temperature.
    f. Heatsink temperature.

28. Purge suction temperature if purge system is provided.
29. Purge elapsed time if purge system is provided.

E. Control Functions:

1. Manual or automatic startup and shutdown time schedule.
2. Entering and leaving chilled-water temperatures, control set points, and motor load limits.
3. Current limit and demand limit.
4. Condenser-fluid temperature.
5. External chiller emergency stop.
6. Variable evaporator flow.

F. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:

1. Low evaporator **pressure**; high condenser pressure.
2. Low evaporator-fluid temperature.
3. Low oil differential pressure.
4. High or low oil pressure.
5. High oil temperature.
6. High compressor-discharge temperature.
7. Loss of condenser-fluid flow.
8. Loss of evaporator-fluid flow.
9. Motor overcurrent.
10. Motor overvoltage.
11. Motor undervoltage.
12. Motor phase reversal.
13. Motor phase failure.
14. Sensor- or detection-circuit fault.
15. Processor communication loss.
16. Motor controller fault.
17. Extended compressor surge.
18. Excessive air-leakage detection for chillers using R-123 refrigerant.

G. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.

H. Security Access: Provide electronic security access to controls through identification and password, with at least three levels of access: view only; view and operate; and view, operate, and service.

I. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.

J. Communication Port: RS-232 port, USB 2.0 port or higher, or equivalent connection capable of connecting a printer.

K. **BAS** Interface: Factory install hardware and software to enable system to monitor, control, and display chiller status and alarms. BACnet MSTP.

1. Hardwired I/O Points:

   a. Monitoring: On-off status, **common trouble alarm**, ele**ctrical power demand (kilowatts)**, **electrical power consumption (kilowatt-hours), power factor.**
   b. Control: On-off operation, **chilled-water, discharge temperature set-point adjustment, electrical power demand limit**.

2. Communication Interface: **ASHRAE 135 (BACnet)** communication interface shall enable control system operator to remotely control and monitor the chiller from an operator workstation.

   a. Control features and monitoring points displayed locally at chiller control panel shall be available through the control system, including, as a minimum, the following:

      1) Start-stop command from remote source.

2) Unit control source, local, analog, digital or modem.
3) Chiller control panel start-stop.
4) Accumulated operating hours.
5) Accumulated starts.
6) Compressor motor status.
7) Unit operation code.
8) Unit safety fault code.
9) Unit cycling fault code.
10) Chilled-water pump status.
11) Chilled-water flow proof.
12) Chilled-water entering temperature.
13) Chilled-water leaving temperature.
14) Chilled-water leaving temperature set-point adjustment from remote source.
15) Condenser(s) water entering temperature.
16) Condenser(s) water leaving temperature.
17) Evaporator refrigerant pressure.
18) Condenser(s) refrigerant pressure.
19) Evaporator refrigerant saturation temperature.
20) Condenser(s) refrigerant saturation temperature.
21) Refrigerant discharge temperature.
22) Refrigerant level.
23) Refrigerant liquid level set point.
24) Oil pressure differential.
25) Oil sump pressure.
26) Oil pump pressure.
27) Oil sump temperature.
28) High-speed thrust bearing proximity position.
29) High-speed thrust bearing proximity reference.
30) Motor current percent of full-load amps.
31) Motor current phase A.
32) Motor current phase B.
33) Motor current phase C.
34) Motor current set-point adjustment from remote source.
35) Motor bearing shaft end vibration.
36) Motor bearing opposite shaft end vibration.
37) Motor bearing shaft end temperature.
38) Motor bearing opposite shaft end temperature.
39) Motor average winding temperature.
40) Variable-frequency controller selection, auto or fixed.
41) Variable-frequency controller output voltage.
42) Variable-frequency controller input power, rate.
43) Variable-frequency controller input power, consumption.
44) Variable-frequency controller DC bus voltage.
45) Variable-frequency controller inverter link current.
46) Variable-frequency controller output frequency.
47) Variable-frequency controller internal ambient temperature.
48) Variable-frequency controller converter heatsink temperature.
49) Variable-frequency controller harmonic filter installed, true or false.
50) Harmonic Filter THD at maximum voltage, percent.
51) Harmonic filter total demand distortion at maximum current, percent.

52) Harmonic filter total supply kVA.
53) Anti-recycle time remaining.
54) Liquid line solenoid.
55) Pre-rotation vanes position.
56) Adaptive capacity control valve surge map installed, true or false.
57) Adaptive capacity control new surge point, true or false.
58) Adaptive capacity control surge type, pressure differential or current.
59) Adaptive capacity control surge count.
60) Adaptive capacity control PRV position.
61) Adaptive capacity control output frequency.

L. Quick-Start Feature:

1. Automatically restore chiller operation up to **100** percent capacity within **five** minutes after a **15** -second power interruption.
2. Quick-start feature shall ensure guide vanes remain open following a power interruption event and quick ramp-up speed logic is employed to facilitate shortest time to deliver chilled water at set-point temperature.
3. Chiller manufacturer shall provide integral UPS unit(s) with chiller controls if required to keep chiller integral controls operational to comply with requirement.
4. Chiller manufacturer shall demonstrate chiller start time with the quick-start feature enabled while simulating power fault, power service return, restart time, and capacity control, to produce desired chilled-water temperature at load indicated.

2.12 ACCESSORIES

A. Flow Switches:

1. Chiller manufacturer shall furnish a switch for each evaporator and condenser and verify field-mounting location before installation.
2. Thermal Dispersion:

   a. Provide factory mounted and wired thermal dispersion flow sensors for both evaporator and condenser.
   b. Paddle flow switches are not acceptable.

B. Vibration Isolation:

1. Chiller manufacturer shall furnish vibration isolation for each chiller.
2. Neoprene Pad:

   a. Two layers of 0.375-inch- (10-mm-) thick, ribbed- or waffle-pattern neoprene pads separated by a 16-gage, stainless-steel plate.
   b. Fabricate pads from 40- to **60** -durometer neoprene.
   c. Provide stainless-steel square bearing plate to load the pad uniformly between 20 and 40 psig (138 and 276 kPa) with a 0.12- to 0.16-inch (3- to 4-mm) deflection.

2.13 SOURCE QUALITY CONTROL

A. Perform functional **run** tests of chillers before shipping.

B. Factory Performance Testing:

1. Factory performance test chillers, before shipping, according to AHRI 550/590.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

A. Equipment Mounting:

1. Install chillers on cast-in-place concrete equipment bases.

B. Maintain manufacturer's recommended clearances for service and maintenance.

C. Maintain clearances required by governing code.

D. Chiller manufacturer's factory-trained service personnel shall charge chiller with refrigerant and fill with oil if not factory installed.

E. Install separate devices furnished by manufacturer and not factory installed.

1. Chillers shipped in multiple major assemblies shall be field assembled by chiller manufacturer's factory-trained service personnel.

3.2 PIPING CONNECTIONS

A. Where installing piping adjacent to chillers, allow space for service and maintenance.

B. Evaporator-Fluid Connections:

1. Connect to evaporator inlet with shutoff valve, thermometer, and plugged tee with pressure gage.
2. Connect to evaporator outlet with shutoff valve, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve.
3. Make connections to chiller with a **mechanical coupling**.

C. Condenser-Fluid Connections:

1. Connect to condenser inlet with shutoff valve, thermometer, and plugged tee with pressure gage.
2. Connect to condenser outlet with shutoff valve, thermometer, plugged tee with shutoff valve and pressure gage, and drain connection with valve.
3. Make connections to chiller with a **mechanical coupling**.

D. Refrigerant-Pressure Relief Device Connections:

1. For chillers installed indoors, extend **vent piping** to the outdoors without valves or restrictions.
2. Comply with ASHRAE 15.
3. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.

E. For chillers equipped with a purge system, extend **purge vent piping** to the outdoors. Comply with ASHRAE 15 and ASHRAE 147.

F. Connect each chiller drain connection with a drain valve, which is full size of drain connection. **Connect drain pipe to drain valve with union, and extend drain pipe to terminate over floor drain.**

G. Connect each chiller water box vent connection with a **manual** vent, which is full size of vent connection.

3.3 ELECTRICAL POWER CONNECTIONS

A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.4 CONTROLS CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring between chillers and other equipment to interlock operation as required to provide a complete and functioning system.

C. Install nameplate on face of chiller control panel indicating the control equipment designation serving chiller and the I/O point designation for each control connection. Nameplate shall be laminated phenolic layers of black with engraved white letters at least 0.5 inches high.

3.5 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 236416

SECTION 284400 - REFRIGERANT DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant monitors and notification appliances.

1.2 ACTION SUBMITTALS

A. Product Data:

1. For each type of refrigerant monitor, include refrigerant sensing range in ppm, temperature and humidity range, alarm outputs, display range, furnished specialties, installation requirements, and electric power requirement.

B. Shop Drawings:

1. Air-Sampling Tubing: Size, routing, and termination including elevation above finished floor.
2. Wiring Diagrams: Power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 REFRIGERANT MONITOR

A. Description: Sensor shall be factory tested, calibrated, and certified to continuously measure and display the specific gas concentration and shall be capable of indicating, alarming and automatically activating ventilation system.

B. Standard: Monitoring system shall comply with ASHRAE 15.

C. Performance:

1. Refrigerant to Be Monitored: **R-134a OR R-513.**

2. Range: 0 to 1000 ppm.
3. Sensitivity:

    a. Minimum Detectability: 20 ppm.
    b. Accuracy: 0 to 50 ppm; plus or minus 1 ppm. 51 to 1000 ppm; plus or minus 10 percent of reading.
    c. Repeatability: Plus or minus 1 percent of full scale.
    d. Response: Maximum **10** seconds per sample.
    e. Detection Level Set Points:

        1) Detection Level 1: **10** ppm.
        2) Detection **Level 2**: **50** ppm.
        3) Detection **Level 3**: **250** ppm.

4. Sensitivity:

    a. Minimum Detectability: **20** ppm.
    b. Accuracy: 0 to 100 ppm; plus or minus 20 ppm, 100 to 1000 ppm; plus or minus 5 percent of reading.
    c. Repeatability: Plus or minus 1 percent of full scale.
    d. Response: 50 percent of a step change in 60 seconds.
    e. Detection Level Set Points:

        1) Detection Level 1: **20** ppm.
        2) Detection **Level 2**: **50** ppm.
        3) Detection **Level 3**: **250** ppm.

5. Operating Temperature: 32 to 104 deg F.
6. Relative Humidity: 20 to 95 percent, noncondensing over the operating temperature range. Compensate sensor for relative humidity.
7. Site Elevation: Maximum **6560 feet (2000 m)**.

D. Input/Output Features:

1. Maximum Power Input: 120-V ac, 60 Hz, 75 W.
2. Number of Air-Sampling Points: Two
3. Air-Sampling Point Inlet Filter: 0.10-micron filter element for each sampling point.
4. Air-Sampling Point Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms matched to sensor output.
5. Alarm Relays: Minimum **4** relays at a minimum of 5-A resistive load each.
6. Alarm Set Points: Displayed and adjustable through keypad on front of meter.
7. Alarm Silence Switch: Mount in the front panel of the monitor to stop audible and visual notification appliances, but alarm LED remains illuminated.
8. Alarm Manual Reset: Momentary-contact push button in the front panel of the monitor stops audible and visual notification appliances, extinguishes alarm LED, and returns monitor to detection mode at current detection levels.
9. Display: Alphanumeric LCD, LED indicating lights for each detection level; acknowledge switch and test switch mounted on front panel; alarm status LEDs and service fault/trouble LEDs.
10. Audible Output: Minimum 75 dB at 10 feet (3 m).

11. Visible Output: Strobe light.
12. Sensor Analog Output: 0- to 10-V dc into 2k ohms, or 4- to 20-mA into 1k ohms.
13. Serial Output: RS-232 or RS-485 or as **compatible with HVAC controls**.
14. Enclosure: NEMA 250, with locking quarter-turn latch and key.
15. Provide Infra-Red refrigerant sensors. One sensor on each end of the chiller.

2.2 MONITOR ALARM SEQUENCE

A. Detection Level 1: Notify HVAC control workstation of detection in the refrigeration equipment room on a rise of refrigerant concentration to this level. Start ventilation system at full speed. Cycle exhaust fan off on a reduction in concentration below this level. Cycle blue strobe lights on and off with the fan.

B. Detection **Level 2**: Notify the HVAC control workstation of the detection in the refrigeration equipment room on a rise or fall of refrigerant concentration to this level. Run ventilation system at full speed on a rise in concentration to this level,. Operate the ventilation system at high speed for a minimum of five minutes. Cycle amber strobe lights.

C. Detection **Level 3**: Notify the HVAC control workstation of the detection in the refrigeration equipment room on a rise or fall of refrigerant concentration to this level. Sound alarm horns and cycle red strobe lights inside and outside refrigeration equipment room. Terminate operation of any combustion-process equipment located in the refrigeration equipment room or adjacent boiler room. Provide manual reset for this detection level.

D. Sensor Fault/Trouble: Notify HVAC control workstation of fault/trouble detection in monitor.

2.3 NOTIFICATION APPLIANCES

A. Horns: Comply with UL 464; electric-vibrating-polarized type, listed by a qualified testing agency with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet (3 m) from the horn.

B. Visible Alarm Devices: Comply with UL 1971; three color xenon strobe lights, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The words "REFRIGERANT DETECTION" printed in minimum 1/2-inch- (13-mm-) high letters on the lens.

2.4 AIR-SAMPLING TUBING

A. Annealed-Temper Copper Tubing: ASTM B 88, Type L.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with ASHRAE 15.

B. Floor mount diffusion-type monitor, sensor/transmitters, or air-sampling inlets on slotted channel frame 12 to 18 inches (300 to 450 mm) above the floor in a location near the refrigerant source or between the refrigerant source and the ventilation duct inlet.

C. Run air-sampling tubing from monitor to air-sampling point, in size as required by monitor manufacturer. Install tubing with maximum unsupported length of 36 inches (915 mm), for tubing exposed to view. Terminate air-sampling tubing at sampling point with filter recommended by monitor manufacturer.

D. Install air-sampling tubing with sufficient slack and flexible connections to allow for vibration of tubing and movement of equipment.

E. Purge air-sampling tubing with dry, oil-free compressed air before connecting to monitor.

F. Number-code or color-code air-sampling tubing for future identification and service of air-sampling multiple-point monitors.

G. Extend air-sampling tubing from exhaust part of multiple-point monitors to outside.

H. Place warning signs inside and outside each door to the refrigeration equipment room. Sample wording: "AUDIBLE AND VISUAL ALARM SOUNDING INDICATES REFRIGERANT DETECTION - ENTRY REQUIRES SELF-CONTAINED BREATHING APPARATUS."

I. Audible Alarm-Indicating Devices: Install at each entry door to refrigeration equipment room, and position not less than 6 inches (150 mm) below the ceiling. Install horns on flush-mounted back boxes. Visible Alarm-Indicating Devices: Install adjacent to each alarm horn at each entry door to refrigeration equipment room, and position at least 6 inches (150 mm) below the ceiling.

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.

B. Perform tests and inspections and prepare test reports.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Inspect field-assembled components, equipment installation, and electrical connections for compliance with requirements.
2. Test and adjust controls and safeties.
3. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Repair or replace malfunctioning units and retest as specified above.

END OF SECTION 284400