PROJECT MANUAL

CHILLER REPLACEMENT
WESTERN GUILFORD HIGH SCHOOL

GUILFORD COUNTY SCHOOLS

OCTOBER 2021

SUD ASSOCIATES, P.A.

CONSULTING ENGINEERS

ASHEVILLE, NORTH CAROLINA

SET # _____

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Guilford County Schools
ADVERTISEMENT FOR BIDS

CHILLER REPLACEMENT WESTERN GUILFORD HIGH SCHOOL
409 FRIENDWAY ROAD, GREENSBORO, NC 27410

Sealed proposals will be received by the Guilford County School System until **2:00 PM, November 18th, 2021,** at 501 W. Washington Street room 100, Greensboro, NC 27401, and immediately thereafter opened. The bid tab will be distributed by GCS. The contractor may mail bids to be open at **2:00 PM** or email the bids, including all required supporting documentation, to furnish all materials and labor for the **CHILLER REPLACEMENT WESTERN GUILFORD HIGH SCHOOL PROJECT.**

Plans, specifications, and contract documents will be available for inspection during business hours from November 4th, 2021, until bids are opened, at the following locations: office of Sud Associates, P.A. 90 Southside Avenue, Suite 350, Asheville, NC; 828-255-4691. Electronic copies will be made available upon request. Bidders will be responsible for checking with the engineer for updates.

Questions regarding the bid should be directed msaenger@sudassociates.com

A brief description of work in the project follows:

The existing chiller will be removed and replaced.
New piping will be installed in mechanical room.
DDC controls will be removed and reinstalled with sequences verified.
Electrical will reuse existing power with some modifications.

A **mandatory pre-bid conference** will be held at the site at **10:00AM, November 4th, 2021.** Attendance at this conference is required for all potential bidders to examine the existing conditions and to discuss particular details of the project. Bids will not be accepted from contractors that were not represented at this meeting by an employee on their payroll staff. Bidders must be properly licensed for the work in accordance with Section 87 of the North Carolina General Statutes.

A 5% Bid Bond and 100% Performance and Labor and Material Payment Bonds are required for this project. Bids may not be withdrawn or changed for a period of 60 days after the scheduled closing time for the receipt of bids.

E-Verify Requirements: This project requires the awarded vendor to comply with the requirements of E-Verify. (U.S. law requiring companies to employ only individuals who may legally work in the United States – either U.S. citizens, or foreign citizens who have the necessary authorization.)

This project will be funded with ESSER funds and will require the contractor to follow the Guilford County Schools ESSER reporting requirements. See: 29 C.F.R. §§ 3.3, 5.5(a). https://www.dol.gov/agencies/whd/government-contracts/construction/forms

Minority businesses are encouraged to submit bids for this project. The appropriate forms from the section entitled "Participation by Women and Minority Owned Businesses" must be submitted with each bid to show good faith efforts to obtain Minority and Women Owned Business Enterprise participation.

The Guilford County Board of Education awards public contracts without regard to race, religion, color, creed, national origin, sex, age or handicapped condition as defined by North Carolina General Statutes, Section 168A-3. The Board reserves the right to reject any or all bids presented and to waive any informalities and irregularities.

Guilford County Schools
Shayla Parker
Purchasing Director

BID FORM Section 00 41 13.02

Contractor Initials & Date _____

Contract: Mechanical

Project: **Chiller Replacement, Western Guilford High School**
Guilford County Board of Education
Guilford County, NC

Bidder: _____

Date: _____

The undersigned, as bidder, hereby declares that the only person or persons interested in this proposal as principal or principals is or are named herein and that no other person than herein mentioned has any interest in this proposal or in the contract to be entered into; that this proposal is made without connection with any other person, company or parties making a bid or proposal; and that it is in all respects fair and in good faith without collusion or fraud.

The Bidder further declares that he has examined the site of the work and the contract documents relative thereto, has read all special and supplemental provisions furnished prior to the opening of bids, has satisfied himself relative to the work to be performed, and thereby proposes and agrees if this proposal is accepted, to furnish all necessary materials, equipment, machinery, tools, apparatus, means of transportation and labor necessary to complete the fabrication and delivery of the work, and other related work in full and complete accordance with the plans, specifications and contract documents, to the full and entire satisfaction of the Owner, with a definite understanding that no money will be allowed for extra work except as set forth in the General Conditions and other contract documents, on the **Chiller Replacement, Western Guilford High School, 409 Friendway Road, Greensboro, NC 27410.**

Bidders are advised that a notice to proceed may be issued upon approval by the Guilford County Board of Education, and in advance of the contract document.

The Bidder proposes and agrees, if this proposal is accepted, to execute a Contract within ten (10) days after notification of award, for the above work and for the below stated Compensation, in the form of AIA A107-2007 Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum., for the sum of:

BASE BID: _____

_____ Dollars ($_____)

ADDENDA:

The following addenda were received and used in computing this bid:

	Date	Initial
Addendum #1	_____	_____
Addendum #2	_____	_____
Addendum #3	_____	_____

The Bidder further proposes and agrees hereby to commence work under this contract on a date to be specified in a written order by the Owner or Designer and shall substantially complete the work on or before 180 days from the "Notice to Proceed" or the contract.

The undersigned further agrees that in the case of failure on his part to execute the said contract and the bond within ten (10) consecutive calendar days after written notice being given of the award of the contract, the certified check, cash or bid bond accompanying this bid shall be paid into the funds of the Owner's account set aside for the project, as liquidated damages for such failure; otherwise the certified check, cash or bid bond accompanying this proposal shall be returned to the undersigned. Attach certified check, cash or bid bond to this proposal.

RESPECTFULLY SUBMITTED this _____ day of _____, 2021.

_____
(Name of firm or corporation making bid)

By: _____

Title: _____
(Owner / Partner / President / Vice President)

License No. _____

Federal ID No. _____

WITNESS: (Proprietorship / Partnership)

By: _____

ATTEST: (Corporation)

By: _____ (CORPORATE SEAL)

Title: _____
(Corporate Secretary or Asst. Secretary Only)

BID BOND FORM **Section 00 43 13**

KNOW ALL MEN BY THESE PRESENTS, That we,

_____

(Bidder's Name)

_____, of _____

(Street Address) (City, State, Zip)

Hereinafter called the Principal, and

_____

(Surety's Name)

A corporation organized and existing under the Laws of the State of _____, and authorized to transact business in the State of _____, as Surety, hereinafter called Surety, are held and firmly bound unto the _____ (Owner).

Hereinafter called Obligee, in the Penal sum of five percent (5%) of the amount bid, good and lawful money of the United States of America, for the payment of which the Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

The Condition of this Obligation is such, that, WHEREAS the Principal has submitted a proposal to the Obligee on a contract for the construction

of _____

(Contract Name and Number)

NOW THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee is accordance with the terms of such bid, and give such bond or bonds as may be specified in the Bidding or Contract Documents with good and sufficient surety for the faithful performance of such construction for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith

contract with another party to perform the Work covered by said bid, then this obligation shall be null and void; otherwise to remain in full force and effect.

In witness whereof, we have hereunto set our signatures and seal this _____ day of _____, 20_____, all pursuant to due authorization.

_____ (Seal)

Principal

_____

By
Surety

_____

By

Attorney-in-Fact in accordance with the attached Power of Attorney

STATE OF _____)

ss:

COUNTY OF _____)

I, _____, a Notary Public in and for the State and County aforesaid, do hereby certify that _____, and _____, whose names are signed to the foregoing bond, this day personally appeared before me in my State and County aforesaid and acknowledged the same.

Given under my hand seal this _____ day of _____, 19_____.

_____ (Seal)

Notary Public

My Commission expires:

Guilford County Board of Education
Administrative Procedure

Descriptor Term:	Descriptor Code:
PARTICIPATION BY MINORITY AND WOMEN OWNED BUSINESSES (MWBE)	DK-P

Draft Date:	Date Issued by the Superintendent:	Latest Revision Date:
March 29, 2007		November 28, 2011

The Guilford County Schools' MWBE Office, Facilities and Purchasing Departments are committed to:

• Getting maximum benefits for the students from the school system's state, local and federal funds carrying out the purchasing process in the best interest of the Guilford County Schools, its students and employees and the taxpayers of Guilford County.

• Acting in accordance with NC General Statutes, local Board of Education policies and procedures, and recognized professional purchasing practices.

• Providing a climate of fair and open competition for all qualified vendors.

A. For the purposes of this procedure, the following definitions shall apply:

1. "Bidder/Participant" – Any person, firm, partnership, corporation, association, or joint venture seeking to be awarded a public contract or subcontract.

2. "Contract" – A mutually binding legal document which defines a business relationship or any modification at the level of performance which obligates the seller to furnish supplies, equipment, materials or services, knowledge in performing construction and procurements, and obligating the buyer to pay for services.

3. "Contractors" – Any person, firm, partnership, corporation, association, or joint venture awarded a contract purchase or service agreement at any level with GCS or has contracted with the GCS to perform construction work or repair.

4. "Discrimination" – To distinguish, differentiate, separate, or segregate solely on the basis of age, race, religion, sex, national origin, handicap or veteran's status.

5. "Disabled" – A person with a disability as that term is defined in N.C. Gen. Stat. § 168A-3(7a).

6. "Equipment" – Includes materials, supplies, commodities, apparatus.

7. "Goal" – An objective, expressed numerically to evaluate the type and amount of public contract awards and performance of MWBE firms.

8. "Good Faith Effort" – An activity performed by bidders to assure the participation of MWBE firms in contracts covered under this plan.

9. "Joint Venture" – A legal merger of two or more separately owned businesses/firms for the purpose of submitting a single bid, to carry out a single business enterprise for profit, for which purpose they combine their property, capital, efforts, skills or knowledge.

10. "LEA" – Local Education Administration unit, thusly Guilford County Schools (GCS).

11. "Minority" - a person who is a citizen or lawful permanent resident of the United States and who is:

    a. African-American, that is, a person having origins in any of the original racial groups in Africa;

    b. Hispanic, that is, a person of Spanish or Portuguese culture with origins in Mexico, South or Central America, or the Caribbean Island, regardless of race;

    c. Native-American, that is, a person having origins in any of the original peoples of North America;

    d. Asian-American, that is, persons having origin in any of the countries of the Far East, Southeast Asia, or the Indian areas.

12. "Minority or Women or Disabled or Disadvantaged Business Enterprises (MWBE)" – A business enterprise owned and controlled at a minimum of 51% by one or more members of a group defined as a minority or women. A business certified as an MWBE will show evidence of ownership and management interests and the daily business operations are real and continuing not created solely to meet the MWBE requirements.

13. "Owned and controlled" means a business, which is a: 1) sole proprietorship legitimately owned by a person who is a minority or white female; 2) a partnership or joint venture controlled by minorities and/or women, and in which at least 51% of the beneficial ownership interests legitimately are held by minorities and/or females, and in which at least 51% of the voting stock or interested 51% of the beneficial ownership interests are legitimately held by minorities and/or females. In addition, these persons must control the management and operations of the business on a day-to-day basis.

14. "Owner" – The Guilford County Board of Education (BOE).

15. "Subcontractor" – A firm under contract with the prime contractor for supplying materials or labor and materials and/or installation. The subcontractor may or may not provide materials in his subcontract. Work subcontracted in an emergency and which could not have been anticipated is excluded as a part of this program.

16. "Socially and Economically Disadvantaged Individual" – A person who is socially and economically disadvantaged as that term is defined in 15 U.S.C. § 637. Socially

disadvantaged individuals are those who have been subjected to racial or ethnic prejudice or cultural bias because of their identity as a member of a group without regard to their individual qualities. Economically disadvantaged individuals are those socially disadvantaged individuals whose ability to compete in the free enterprise system has been impaired due to diminished capital and credit opportunities as compared to others in the same business area that are not socially disadvantaged.

17. "Verifiable Goal" –

a. For purposes of separate prime contract system, that the awarding authority has adopted written guidelines specifying the actions that will be taken to ensure a good faith effort in the recruitment and selection of MWBE firms for participation in contracts awarded.

b. For purposes of separate prime contract system, that the awarding authority has adopted written guidelines specifying the actions that the prime Contractor must take to ensure a good faith effort in the recruitment and selection of MWBE firms for participation in the contract awarded; and

c. The required actions must be documented in writing by the prime contractors to the GCS.

B. GCS's Duties

1. Identification/Certification of Minority, Women and Socially and Economically Disadvantaged Business Enterprises

a. The school system shall affirmatively seek out and gain knowledge of minority and women-owned business enterprises (hereinafter MWBE) in the construction trades.

b. The school system will maintain a list of products and services provided by MWBE firms.

c. Attend the scheduled prebid conference.

d. At least 10 days prior to the scheduled day of bid opening, notify MWBE firms that have requested notices from the GCS for public construction or repair work and MWBE firms that have indicated to the MWBE coordinator's office an interest in the type of work being bid or the potential contracting opportunities listed in the proposal. The notification shall include the following:

1. A description of the work for which the bid is being solicited.
2. The date, time, and location where bids are to be submitted.
3. The name of the individual within the owner's organization who will be available to answer questions about the project.
4. Where bid documents may be reviewed.
5. Any special requirements that may exist.

e. Utilize other media, as appropriate, likely to inform potential MWBE firms of the bid being sought.

f. Maintain documentation of any contacts, correspondence, or conversation with MWBE firms made in an attempt to meet the goals.

g. Review jointly with the designer all requirements of G.S.143-128.2(c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the MWBE firms that will be utilized with corresponding total dollar value of the bid and affidavit listing good faith efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) prior to recommendation of award to the Guilford County Board of Education.

h. Evaluate and analyze documentation to determine that a good faith effort has been achieved for MWBE utilization prior to recommendation of award to Guilford County Board of Education.

i. Review prime contractor's pay applications for compliance with MWBE utilization commitments prior to payment.

j. Make documentation showing evidence of implementation of GCS's responsibilities available for review by State Construction Office and HUB Office and other interested parties upon request.

C. Minority Business Subcontractor Goals

1. The goals set for participation by MWBE firms as subcontractors have been set at 12.46%. GCS goal for goods and services has been set at 10%.

2. The bidder must identify on its bid all MWBE firms that will be utilized on the project with corresponding total dollar value of the bid and an affidavit listing and documenting good faith efforts (Affidavit A) or an affidavit of self-performance of work (Affidavit B), if the bidder will perform work under contract by its own workforce, as required by G.S.143-128.2(c) and G.S.143-128.2(f).

3. The bidder must complete all Sections of Affidavit A and attach Affidavit A to its bid, with documentation of Good Faith Effort as required, including a description of the portion of work to be executed by MWBE firms expressed as a percentage of the total contract price, OR

4. Provide Affidavit B, which includes sufficient information for GCS to determine that the bidder does not customarily subcontract work on this type project.

The above information must be provided as required. Failure to earn at least 50 points from the Good Faith Efforts list on Affidavit A shall render the bid non-responsive. Achieving the participation goal of 12.46% creates a presumption that the bidder made the required Good Faith Effort. Regardless of the percentage of participation, however, ALL BIDDERS must complete and submit Affidavit A, and must further provide certain documentation as specified by Affidavit A with their bid in order to receive Good Faith Points for certain items. GCS also shall require the apparent lowest, responsible, responsive bidder to

provide additional documentation of Good Faith Efforts within 72 hours of notification of being the apparent lowest responsible, responsive bidder. Failure to submit these documents / information as requested shall be grounds for deduction of Good Faith Points. In the event such a deduction results in a failure to achieve the required number of Good Faith Points, the bid shall be rejected unless the bidder has otherwise demonstrated Good Faith Efforts.

D. Communications with MWBE firms

GCS shall provide information to MWBE firms about the GCS's construction program. This shall be accomplished by:

1. Sending a notice to each MWBE engaged in any aspect of school construction that is identified and certified for each school construction project that is advertised for bids;

2. Insuring that prospective MWBE bidders and subcontractors have access to bidding documents; and

3. Furnishing MWBE subcontractors with the name of prospective bidders on a project upon request, and providing prospective bidders with the schools system's list of known MWBE firms.

E. Designer

Under the single-prime bidding, separate prime bidding, construction manager at risk, or alternative contracting method, the designer will:

Attend the scheduled pre-bid conference to assist in the explanation of MWBE firms requirements to the prospective bidders.

Assist the owner to identify and notify prospective MWBE prime and subcontractors of potential contracting opportunities.

Maintain documentation of any contacts, correspondence, or conversation with MWBE firms made in an attempt to meet the goals.

Review jointly with the owner all requirements of G.S.143-128.2 (c) and G.S.143-128.2(f) – (i.e. bidders' proposals for identification of the MWBE firms that will be utilized with corresponding total dollar value of the bid and affidavit listing Good Faith Efforts, or affidavit of self-performance of work, if the contractor will perform work under contract by its own workforce) – prior to recommendation of award.

During construction phase of the project, review "MWBE Documentation for Contract Payment" – (Appendix E) for compliance with MWBE utilization commitments. Submit Appendix E form with monthly pay applications to the owner.

Assist the Owner in evaluating any Contractor's request to terminate an MWBE, including, but not limited to, evaluation of the merits of termination request, and computation of percentage of completion of the work of the MWBE at issue.

Make documentation showing evidence of implementation of Designer's responsibilities available for review by State Construction Office and HUB Office, upon request.

F. Anticipated Assurances from Contractors

1. Upon adoption of its verifiable goal GCS is expected to require bidders on projects to provide assurances in writing that they will make a good faith effort to solicit MWBE firms as subcontractors should they be awarded a construction contract. Bidders shall provide the following information to GCS and any other information requested in the attached forms:

    a. Provide applicable GCS Affidavit A or B on bid date with backup information for any requested items as specified by Affidavit A or B. Failure to submit this information shall be deemed non-responsive and subject to rejection of bid.

    b. An Identification of MWBE Participation form;

    c. A description of the work, each named MWBE will perform; (AFFIDAVIT A, Section II)

    d. The dollar amount of participation by each MWBE (AFFIDAVIT A, Section II) and

    e. Documentation of Good Faith Efforts (Affidavit A, Section III)

2. A contractor's good faith effort to included but are not limited to involve MWBE firms in the project can be demonstrated by using, among other factors, the following:

    Contacted at least three MWBE firms that reasonably could have been expected to submit a quote and that were known to the contractor, or available on approved lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed. "Contact" means contact by letter, fax, e-mail or other means to a viable and active address. Contractor must attach evidence of this contact to bid document to Affidavit A and submit with its bid.

    Made the construction plans, specifications and requirements available for review by prospective MWBE firms or providing these documents to them at least 10 days before the bids are due.

    Broken down or combined elements of work into economically feasible units to facilitate MWBE participation.

    Worked with MWBE trade, community, or contractor organizations identified by the MWBE Administrator's Office and included in the bid documents that provide assistance in recruitment of MWBE firms.

    Attended pre-bid meetings scheduled by the public owner.

    Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors.

    Negotiated in good faith with interested MWBE firms and did not reject them as unqualified without discussion with entity a sound reasons based on their capabilities. Any

rejection of an MWBE based on lack of qualification should have the reasons documented in writing and submitted with Affidavit A with the bid.

Provided assistance to an otherwise qualified MWBE in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assist MWBE firms in obtaining the same unit pricing with the bidder's suppliers in order to help MWBE firms in establishing credit.

Negotiated joint venture and partnership arrangements with MWBE participation on this construction or repair project when possible.

Provide quick pay agreements and policies to enable MWBEs and suppliers to meet cash-flow demands.

3. Failure to submit backup information for any item required by Affidavit A may result in the bid being declared non responsive and subject to rejection.

G. MWBE Responsibilities

All MWBE firms must seek certification through the Department of Administration Office for Historically Underutilized Business ("HUB Office"). MWBEs who are not certified at the time the firm commits to provide services, should immediately apply for certification with the HUB Office. If the MWBE fails to submit an application or if the MWBE is not granted certification, that MWBE's contract dollars will not be counted as MWBE participation.

1. MWBE firms do not have to be certified to be listed on the bid documents; however, MWBE firms that have been awarded contracts will not be credited towards the Bidder's MWBE Participation Plan unless they are certified with the State of North Carolina.

2. MWBE firms should make every effort to establish contacts and relationships with contractors for potential future business, including attending pre-bid conferences and subscribing to industry and trade journals.

3. MWBE firms should also document all contact and communications made with contractors above so as to be able to assist the Grievance Designee in determining whether a complaint lodged by an MWBE against a bidder for failure to use good faith efforts is valid.

4. In addition, MWBE firms who are contacted by GCS or bidders should respond promptly as to whether or not they wish to submit a bid.

5. MWBE firms are urged to take advantage of appropriate technical assistance and training when it is available.

H. Subcontractor Replacement

1. The Director of Construction and the MWBE Administrator must be notified in writing immediately upon the need to replace any Subcontractor. The notification shall include the following:

    a. The basis for the request to terminate;

    b. The estimated percentage of completion of the work of the affected Subcontractor;

    c. The amount due to the affected Subcontractor, if any, on account of work in place;

    d. A description of any defective work;

    e. The estimated cost of any corrective work; and

    f. Any back charges claimed against the affected Subcontractor.

2. A Contractor shall not replace a mechanical, electrical or plumbing Subcontractor listed on its bid without the prior written consent of the Director of Construction (following prior notification to the Board) for good cause shown. A Contractor shall not replace an MWBE listed on its Affidavit A without the prior written consent of the Director of Construction and the MWBE Administrator (following prior notification to the Board) and for good cause shown.

3. Upon receipt of notification from a Contractor that it seeks to replace a Subcontractor, the Director of Construction shall inform the Superintendent or his designee. The Director of Construction also shall immediately provide the affected Subcontractor written notice of the request, and an opportunity of no less than seven (7) days within which to respond.

    The response of the affected Subcontractor shall include the following:

    a. Subcontractor's response(s) to Contractor's allegation(s) offered in support of termination;

    b. The estimated percentage of completion of the work of the affected Subcontractor;

    c. The amount due to the affected Subcontractor if any, on account of work in place;

    d. Subcontractor's response to any claims of defective work;

    e. Subcontractor's response to any claims for back charges; and

    f. A list of all second tier subcontractors, vendors and suppliers, including for each the amount paid to date, amount currently due, and total contract value.

4. After receiving the response of the affected Subcontractor, if any, the Director of Construction may require the Contractor, the affected Subcontractor or both to submit further documentation in support of their position.

5. Prior to, or as a condition of, giving approval to replace a Subcontractor, the Director of Construction may require the Contractor and the affected Subcontractor to mediate any dispute.

6. If approval for termination is granted, the Contractor shall immediately pay any undisputed amounts owed to the affected Subcontractor.

7. The Contractor shall make and document Good Faith Efforts in the selection of a substitute Subcontractor to the same extent required of Bidders submitting an initial bid under N.C. Gen. Stat. § 143-128.2 and Guilford County Board of Education's MWBE Procedure. If the Subcontractor to be replaced is an MWBE, Contractor shall use its best efforts to select another MWBE to serve as a substitute Subcontractor.

   The Director of Construction and the MWBE Administrator must approve any substitute Subcontractor in writing.

Emergency Circumstances Exception as defined in the Financial Services Procedure Manual Section 7.3 page 51: GCS may waive the utilization requirements if it is determined that an emergency exists that requires goods or services to be provided with such immediacy that the contractor is unable to comply with the replacement procedure.

I. Penalties for Contractor Noncompliance

1. The low bidder or bidders on a school construction project must provide assurance in writing to the BOE prior to the acceptance of their bid that they have made a good faith effort to meet the verifiable goal for MWBE participation adopted by the BOE.

2. When deciding whether or not a bidder has made a good faith effort, the BOE shall consider whether the bidder has met the verifiable goal for MWBE participation, as well as the criteria set forth above, including the number of certified MWBE firms available and capable of performing the work and the amount of other work being awarded or performed in the market area of the GCS.

3. Failure of a low bidder to make and demonstrate a good faith effort to meet the goal shall result in the bid being considered as non-responsive and being rejected.

4. Failure to comply with the requirements of this GCS Good Faith Effort policy may lead to the contractor's disqualification from bidding on and receiving other GCS contracts.

5. In the event that any contractor or subcontractor fails to provide requested records for inspection, such failure shall constitute a material breach of the contract and will permit the imposition of remedies noted in this section.

K. Competitive Bids

Nothing contained herein is to be construed as to require the GCS or contractors to purchase supplies and equipment or award contracts to MWBE firms whom do not submit the lowest responsible bid.

L. Grievance Procedures

It is the policy of this BOE that disputes, which involve a person's rights, duties or privileges, should be settled through informal procedures. Any participant feeling himself/herself aggrieved by implementation of the MWBE Program may present such grievance to the Superintendent or his designee. The grievance (internal complaint resolution) procedure is a resource available to all contractors, subcontractors, and vendors doing business with the Guilford County Schools under the MWBE Program. Grievances related to the administration of the MWBE Program will be processed as follows:

1. The grievance shall first be discussed with the responsible operating department. If the grievance is not resolved, exercise item #2.

2. The grievance (complaint) must be reported in writing, including a brief description and supporting documentation and evidence to the Superintendent's designee at 712 N. Eugene Street, Greensboro, North Carolina, 27401.

3. The Superintendent's designee will review the basis and the issue(s) of the complaint and may request additional supporting evidence. A response to the grievance will be completed within fifteen (15) working days unless circumstances mandate otherwise. Parties involved will be notified of any and all delays in processing the grievance.

4. Any participant not satisfied with the decision of the Superintendent's designee may avail himself/herself or any remedies available under applicable Federal, State and Local law.

To that end, MWBE disputes arising under these guidelines should be resolved.

Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid Attach to Bid

The total value of minority business contracting will be ($)_____.

AFFIDAVIT A

This Affidavit and **ALL THREE (3) SECTIONS** Herein Must Be Completed By **ALL BIDDERS** and Submitted with Bid.

Section I - Listing of the Good Faith Effort

Bidder must earn at least 50 points from the Good Faith Efforts list for their Bid to be considered responsive and must submit documentation supporting all items checked within the timeframes set forth in Section III below.

I have made Good Faith Effort to comply under the following areas checked:

- ☐ **1** - Contacted minority businesses that reasonably could have been expected to submit a quote and that were known to the contractor, or available on State or local government maintained lists, at least 10 days before the bid date and notified them of the nature and scope of the work to be performed. "Contact" means contact by letter, fax, e-mail or other means to a viable and active address. **CONTRACTOR MUST ATTACH EVIDENCE OF CONTACT TO THIS AFFIDAVIT AND SUBMIT WITH BID.** Value = 10 points.
- ☐ **2**.-Made the construction plans, specifications and requirements available for review by prospective MWBE businesses, or providing these documents to them at least 10 days before the bids are due. Value = 10 points.
- ☐ **3** - Broken down or combined elements of work into economically feasible units to facilitate minority participation. Value = 15 points.
- ☐ **4** - Worked with MWBE trade, community, or contractor organizations identified by the Office of Historically Underutilized Businesses and included in the bid documents that provide assistance in recruitment of MWBE'S. Value = 10 points.
- ☐ **5** - Attended prebid meetings scheduled by the public owner. Value = 10 points.
- ☐ **6** - Provided assistance in getting required bonding or insurance or provided alternatives to bonding or insurance for subcontractors. Value = 20 points.
- ☐ **7** - Negotiated in good faith with interested MWBE'S and did not reject them as unqualified without discussing with MWBE'S sound reasons based on their capabilities. **CONTRACTOR MUST ATTACH TO THIS AFFIDAVIT AND SUBMIT WITH BID COPIES OF QUOTES OR RESPONSES FROM ALL FIRMS SUBMITTING QUOTES OR RESOPNSES, AND, IF APPLICABLE, WRITTEN JUSTIFICATION FOR ANY REJECTION OF A MWBE BASED ON LACK OF QUALIFICATION.** Value = 15 points.
- ☐ **8** - Provided assistance to an otherwise qualified MWBE in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letters of credit, including waiving credit that is ordinarily required. Assisted minority businesses in obtaining the same unit pricing with the bidder's suppliers in order to help MWBE businesses in establishing credit. Value = 25 points.
- ☐ **9** - Negotiated joint venture and partnership arrangements with MWBE businesses in order to increase opportunities for MWBE business participation on the construction or repair project when possible. Value = 20 points.
- ☐ **10** - Provided quick pay agreements and policies to enable MWBE contractors and suppliers to meet cash-flow demands. Value = 20 points.

The undersigned hereby certifies that he or she has read the terms of the MWBE business commitment, that the bidder has made the Good Faith Efforts in the areas checked above, and that he or she is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Section II - Portion of the Work to be Performed by Minority Firms

I will expend a minimum of _____% of the total dollar amount of the contract with MWBE. MWBE will be employed as construction subcontractors, vendors, suppliers or providers of professional services. Such work will be subcontracted to the following firms listed below.

(Attach additional sheets if necessary)

Name and Phone Number	*MWBE Category	Work description	Dollar Value

*MWBE categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

Pursuant to GS143-128.2(d), the undersigned will enter into a formal agreement with MWBE for work listed in this schedule conditional upon execution of a contract with the Owner. Failure to fulfill this commitment may constitute a breach of the contract.

The undersigned hereby certifies that he or she has read the terms of this commitment and is authorized to bind the bidder to the commitment herein set forth.

Date:_____Name of Authorized Officer:_____

Signature:_____

Section III – Documentation of Good Faith Efforts

ALL BIDDERS, regardless of percentage of MWBE participation, **MUST** provide documentation of all Good Faith Efforts checked in Section I within the timeframes set forth in Parts A and B below.

Failure to submit these documents / information shall be grounds for deduction of Good Faith Points. In the event such a deduction results in a failure to achieve the required number of Good Faith Points, the Bid shall be rejected unless the bidder has otherwise demonstrated Good Faith Efforts.

PART A (Documentation Required to be Submitted With Bid)

Documentation **MUST** be provided **WITH THE BID** in order for the bidder to receive credit for certain items checked. If the bidder checked Items 1 or 7 in Section I, the bidder **MUST** provide documentation supporting those Good Faith Efforts **WITH THE BID**.

Examples of such documentation include, but are not limited to, the following:

ITEM 1

- Copies of solicitations for quotes to at least three (3) MWBE's from the source list provided by the State for each subcontract to be let under this contract (if 3 or more firms are shown on the source list). Each solicitation shall contain a specific description of the work to be subcontracted, location where bid documents can be reviewed, representative of the Prime Bidder to contact, and location, date and time when quotes must be received.
- Copies of quotes and responses received from each firm responding to the solicitation.
- A telephone log of follow-up calls to each firm sent a solicitation.

ITEM 7

- Copies of quotes or responses received from all firms submitting quotes or responses for each subcontract, and, if applicable a letter detailing the reason(s) for any rejection of minority business(es) due to lack of qualification.

I do certify the attached documentation as true and accurate representation of my good faith efforts.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____day of _____20____

Notary Public_____

My commission expires _____

PART B (Documentation Required to be Submitted Within 72 Hours of Notification)

Certain documentation **MUST** be provided within 72 hours of notification of being the apparent lowest responsible, responsive bidder in order to receive credit for certain additional Items checked. If the bidder checked Items 2, 3, 4, 5, 6, 8, 9 or 10, the bidder **MUST** provide documentation supporting those Good Faith Efforts within 72 hours of notification of being the apparent lowest responsible, responsive bidder.

Examples of such documentation include, but are not limited to the following:

ITEM 2

- Invitation to view construction plans, specifications and requirements.
- Cover letter enclosing construction plans, specifications and requirements.

ITEM 3

- Copies of all bid solicitations or request for proposals broken down by scope of work.
- Letter detailing contractor's efforts to break down or combine elements of work into economically feasible units to facilitate minority participation.

ITEM 4

- Documentation of any contacts or correspondence to MWBE, community, or contractor organizations in an attempt to meet the goal.

ITEM 5

- Copy of pre-bid roster.

ITEM 6

- Letter documenting efforts to provide assistance in obtaining required bonding or insurance for MWBE.

ITEM 8

- Letter documenting proposed assistance offered to minority business in need of equipment, loan capital, lines of credit, or joint pay agreements to secure loans, supplies, or letter of credit, including waiving credit that is ordinarily required.

ITEM 9

- Letter documenting negotiations with MWBE businesses to create joint venture or partnership arrangement for the construction or repair project.

ITEM 10

- Copy of quick pay agreements.
- Copy of quick pay policies.

I do certify the attached documentation as true and accurate representation of my good faith efforts.

Date:_____ Name of Authorized Officer:_____

Signature:_____

Title:_____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20____

Notary Public_____

My commission expires _____

AFFIDAVIT B
Intent to Perform Contract with Own Workforce.

County of _____

Affidavit of _____
(Name of Bidder)

I hereby certify that it is our intent to perform 100% of the work required for the _____

_____ contract.
(Name of Project)

In making this certification, the Bidder states that the Bidder does not customarily subcontract elements of this type project, and normally performs and has the capability to perform and will perform all elements of the work on this project with his/her own current work forces; and

The Bidder agrees to provide any additional information or documentation requested by the owner in support of the above statement.

The undersigned hereby certifies that he or she has read this certification and is authorized to bind the Bidder to the commitments herein contained.

Date: _____ Name of Authorized Officer: _____

Signature: _____

Title: _____

SEAL

State of North Carolina, County of _____

Subscribed and sworn to before me this _____ day of _____ 20___

Notary Public _____

My commission expires _____

APPENDIX E

MWBE DOCUMENTATION FOR CONTRACT PAYMENTS

Prime Contractor/Architect: _____

Address & Phone: _____

Project Name: _____

Pay Application #: _____ Period: _____

The following is a list of payments made to Minority and Women Business Enterprises on this project for the above-mentioned period.

A	B	C	D	E	F	G	H
MWBE FIRM NAME	* TYPE OF MWBE	ORIGINAL CONTRACT AMOUNT	PREVIOUS PAYMENTS	PAYMENT THIS PERIOD	TOTAL CHANGE ORDERS TO DATE	TOTAL AMOUNT COMMITTED (C + F)	TOTAL RETAINED TO DATE

*Minority categories: Black (B), Hispanic (H), Asian American (AA), American Indian (AI), White Female (WF), Socially and Economically Disadvantaged (SED)

Approved/Certified By:

_____ _____

Name Title

_____ _____

Date Signature

SUBMIT WITH EACH PAY REQUEST - FINAL PAYMENT - FINAL REPORT

Identification of MWBE Participation

Submission of Affidavits which include statements of "To Be Determined" or failure to submit the required information as outlined in the Specifications shall cause the Bid be deemed non-responsive and subject to rejection.

I,____,
(Name of Bidder)
do hereby certify that on this project, we will use the following minority business enterprises as construction subcontractors, vendors, suppliers or providers of professional services.

Firm Name, Address and Phone #	Work type	*MWBE Category

*Minority categories: Black, African American (**B**), Hispanic (**H**), Asian American (**A**) American Indian (**I**), Female (**F**) Socially and Economically Disadvantaged (**D**)

DRAFT

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor

where the basis of payment is a Stipulated Sum

AGREEMENT made as of the « » day of « » in the year « »
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

«Guilford County Schools»
«Building Services 3920 Naco Road»
«Greensboro, NC 27401»

and the Contractor:
(Name, legal status, address and other information)

« »« »
« »
« »
« »

for the following Project:
(Name, location and detailed description)

«Chiller Replacement»
«Western Guilford High School, Guilford County Schools»
«409 Friendway Road»
«Greensboro, NC 27410»

The Architect:
(Name, legal status, address and other information)

«Sud Associates, P.A.»
«90 Southside Avenue Suite 350»
«Asheville, NC 28801»

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

ELECTRONIC COPYING of any portion of this AIA® Document to another electronic file is prohibited and constitutes a violation of copyright laws as set forth in the footer of this document.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] A date set forth in a notice to proceed issued by the Owner.

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[« »] Not later than «one hundred and eighty » («180 ») calendar days from the date of commencement of the Work.

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date
Chiller to be operational providing reliable cooling	April 16th, 2022

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be « » ($ « »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item M-1	Price
NA	

§ 4.5 Liquidated damages:

§ 4.5.1 Should the Contractor fail to achieve substantial completion within the Contract Time, as adjusted, Contractor shall pay to the Owner _three hundred_ and No/100 Dollars ($300) for each day beyond the Contract Time, as may be adjusted for which Substantial Completion has not been achieved, and _three hundred_ and No/100 Dollars ($_300_) for each day beyond the Contract Time, as may be adjusted for which Final Completion has not been achieved, not as a penalty, but as liquidated damages.

§4.5.2 Contractor and Owner agree to the daily sum of three hundred and No/100 Dollars ($_300_) as liquidated damages because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would sustain in the event the Contractor fails to achieve Substantial Completion within the Contract Time, as may be adjusted, and that the daily sum of _three hundred_ and No/100 Dollars ($_300_) as liquidated damages because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would sustain in the event the Contractor fails to achieve Final Completion within the Contract Time, as may be adjusted.« »

§ 4.6 Other:

(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the « 5th » day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «5th » day of the «following» month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than «forty» (« 40 ») days after the Architect receives the Application for Payment.

(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported

by such data to substantiate its accuracy, as the Architect may require. This schedule of values, unless objected to by the Owner or Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work; and

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld or nullified a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect or Owner may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« Five percent (5%) »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« Once fifty percent (50%) of the Work has been completed, provided the Owner finds that satisfactory progress is being made and subject to the consent of the Surety, the Owner may authorize payment to the Contractor in full of any progress payment for work performed beyond the fifty percent (50%) stage of completion. If a reduction in retainage has been made, the Owner may increase the retainage back to five percent (5%) at any time if the Owner concludes that the Contractor is not progressing the work in a timely or satisfactory manner. The Owner may also if agreed by the Contractor release retainage to the Contractor and direct the Contractor to reduce the retainage of a particular subcontractor.

If a reduction in retainage has been made, the Owner may increase the retainage back to five percent (5%) at any time if the Owner concludes that the Contractor is not progressing the work in a timely or satisfactory manner. The Owner may also if agreed by the Contractor release retainage to the Contractor and direct the Contractor to reduce the retainage of a particular subcontractor.
»

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Final Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

«Eight percent (8» %) «per annum »

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

« »
« »
« »
« »

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

«Litigation, unless the Owner elects Arbitration pursuant to Section 15.4 of AIA Document A201-2017, as modified. »

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »
« »
« »
« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 NA
.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

This Agreement entered into as of the day and year first written above

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
« »« »	« »« »
(Printed name and title)	*(Printed name and title)*

DRAFT

AIA® Document A101™ – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

«Chiller Replacement Western Guilford High School, Guilford County Schools»
«409 Friendway Road, Greensboro, NC 27410»

THE OWNER:
(Name, legal status and address)

«Guilford County Schools»
«Building Services 3920 Naco Road»
«Greensboro, NC 27401»

THE CONTRACTOR:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

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

This document is intended to be used in conjunction with AIA Document A201™–2017, General Conditions of the Contract for Construction. Article 11 of A201™–2017 contains additional insurance provisions.

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§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any insurance required by this Section A.2, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the

Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than «five million dollars » ($ «5,000,000 ») each occurrence, «ten million dollars » ($ «10,000,000 ») general aggregate, and «five million dollars » ($ «5,000,000 ») aggregate for products-completed operations hazard, providing coverage for claims including

.1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
.2 personal injury and advertising injury;
.3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
.4 bodily injury or property damage arising out of completed operations; and
.5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.
.3 Claims for bodily injury other than to employees of the insured.
.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
.8 Claims related to roofing, if the Work involves roofing.
.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
.10 Claims related to earth subsidence or movement, where the Work involves such hazards.
.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than «one million dollars» ($ «1,000,000») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than «one million dollars» ($ «1,000,000») each accident, «one million dollars» ($ «1,000,000») each employee, and «five million dollars» ($ «5,000,000») policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than «two million dollars » ($ «2,000,000») per claim and «two million dollars» ($ «2,000,000») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than «one million dollars» ($ «1,000,000») per claim and «two million dollars» ($ «2,000,000») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than «two million dollars» ($ «2,000,000») per claim and «two million dollars » ($ «2,000,000 ») in the aggregate.

§ A.3.2.11 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than «two million dollars» ($ «2,000,000») per claim and «four million dollars» ($ «4,000,000») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:
(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.
(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[« »] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property

insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:
(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

[« »] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for Work within fifty (50) feet of railroad property.

[« »] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[« »] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[« »] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[« »] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	
Performance Bond	

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

« »

BOND No._____

PERFORMANCE BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor): _____ **("Principal")**

Name of Surety: _____ **("Surety")**

Name of Contracting Body: **Guilford County Board of Education** **("Owner")**

Amount of Bond: _____

Project: _____

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the Owner, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind, ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Owner, identified as shown above, (the "Contract"), the terms of which are hereby incorporated by reference and made a part hereof, for work on the above referenced Project.

NOW, THEREFORE, Principal and Surety agree as follows:

1) Principal and Surety jointly and severally hereby bind themselves to Owner for the full and complete performance of all undertakings, covenants, terms, conditions and agreements of such Contract. If the Principal shall well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term of said Contract and any extensions thereof that may be granted by the Owner, with or without notice to the Surety, and during the life of any guaranty or warranty required under the Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue.

2) The responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the balance of the Contract Sum, the Surety is obligated without duplication for all of Contractor's obligations and responsibilities under the Contract, including, but not limited to:

   (a) The responsibilities of the Contractor for correction of defective work and completion of the Contract within the time required;

   (b) Other costs and expenses resulting from the Contractor's default as allowed by the Contract; and

   (c) Liquidated damages, or if no liquidated damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor

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

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

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Witness:

_____
(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

_____
(Surety Company)

Witness:

_____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

(Surety Corporate Seal)

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

BOND No. _____

PAYMENT BOND

Date of Contract: _____

Date of Execution: _____

Name of Principal (Contractor) _____ **("Principal")**

Name of Surety: _____ **("Surety")**

Name of Contracting Body: **Guilford County Board of Education** **("Owner")**

Amount of Bond: _____

Project: _____

KNOW ALL MEN BY THESE PRESENTS, that we, the Principal and Surety above named, are held and firmly bound unto the above named contracting body, hereinafter called the Owner, in the penal sum of the amount stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal entered into a certain contract with the Owner, identified as shown above, (the "Contract"), the terms of which are hereby incorporated by reference and made a part hereof, for work on the above referenced Project.

NOW, THEREFORE, if the Principal shall promptly make payment to all persons supplying labor/material in the prosecution of the work provided for in said Contract, and any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, then this obligation to be void; otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above-bounden parties have executed this instrument under their several seals on the date indicated above, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

Witness:

_____
(Proprietorship or Partnership)

Attest: (Corporation)

By: _____

Title: _____
(Corp. Sec. or Asst. Sec.. only)

(Corporate Seal)

_____
Contractor: (Trade or Corporate Name)

By: _____

Title: _____
(Owner, Partner, or Corp. Pres. or Vice Pres. only)

_____
(Surety Company)

Witness:

_____

By: _____

Title: _____
(Attorney in Fact)

Countersigned:

_____

_____
(N.C. Licensed Resident Agent)

_____

_____
Name and Address-Surety Agency

_____

_____
Surety Company Name and N.C.
Regional or Branch Office Address

(Surety Corporate Seal)

Name of Contractor or Contruction Manager

HUB Participation Report

Project Name

Report shall include ALL known subcontractor and supplier commitments regardless of MWBE/HUB status or tier level.

Input this value:

GMP or Prime Contract Award TOTAL:

Calculated fields

Total Value of HUB Trade/Supply Contracts: $ - #DIV/0! HUB Percentage of Total GMP or Prime Contract

Total Value of ALL trade/supply contracts: $ - #DIV/0! HUB Percentage of subcontracted effort

HUB Participation

Input the full Contract value in the appropriate column (only one column); (% is calculated as portion of PRIME contract value.)

	Trade Contractor/Supplier	Scope of Work	Non- HUB Participation (Input full contract value (less any lower tier HUB participation))		African American (B)		Hispanic (H)		Asian (A)		Native American (AI)		Socially & Economically Disadvantaged (SE)		White Female (WF)		HUB Contract Amount	HUB %	Affidavit A or B	Affidavit C, D, or NA
			$	%	$	%	$	%	$	%	$	%	$	%	$	%				
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SECTION 230510 - BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCES & INTENT

A. All work of this Division shall comply with the requirements of the Drawings, General Conditions, Supplementary General Conditions and Division 01 Specifications section.

B. Study all drawings and specifications before submitting bids.

C. Work under this Division includes all essential labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items for proper installation and operation of all systems even though not specifically mentioned or indicated.

D. Drawings are diagrammatic. Drawings are not intended to be absolutely precise and do not specify or show every offset, fitting, and component. The purpose of the drawings is to indicate a system concept, the main components of the systems, and the approximate geometrical relationships. Based on the systems concept, the main components, and the approximate geometrical relationships, the contractor shall provide all other components and materials necessary to make the systems fully complete and operational. Contractor shall route piping or provide offsets to avoid interference with structural elements, equipment, electrical panels and junction boxes, etc. Verify locations, dimensions, flow directions, etc. before construction.

E. It is the intent of these specifications and drawings to provide for finished systems of the quality specified, properly tested, balanced and ready for operation. This includes all devices and accessories required to make the work complete even though such items may not be expressly shown or specified. Drawings and specifications are complementary and must be so construed to determine the full scope of work.

F. Jobsite Conditions: The Contractor shall visit the site and familiarize himself with the existing conditions before submitting his bid. Failure to do so does not relieve the Contractor from completing the work as specified herein and after. Requests for additional payments due to the Contractor's failure to allow for work conditions will be rejected.

1.2 WORK INCLUDED

A. The following work is specifically included without limiting the generality implied by these specifications and drawings.
   1. All mechanical scope of work specified herein and as shown on the plans. Contractor should review all drawings and include all items that are a part of his scope.
   2. All associated wiring, cutting and patching.

B. Bidders shall examine equipment plans and specifications and include in their bids all labor and material required for complete installation and connection of equipment which is properly a part of their trade even if it is not provided in the equipment specifications.

1.3 STANDARDS AND CODES

A. All equipment with electrical components shall bear the UL label.

B. The following minimum standards apply wherever applicable:

1. ANSI American National Standards
2. ASTM American Society for Testing Materials
3. NBFU National Board of Fire Underwriters
4. NEC National Electric Code
5. NEMA National Electrical Manufacturers Association
6. NFPA National Fire Protection Association
7. OSHA Occupational Safety and Health Act
8. SMACNA Sheet Metal/Air-Conditioning Contractors National Ass., Inc.
9. North Carolina Building Code
10. Any Other Applicable local and State Codes

C. In the event there are conflicts between specifications and standards or codes, standards or codes shall govern unless specifications are in excess of standards.

1.4 PERMITS AND FEE

A. Make application for all necessary permits and pay applicable fees.

1.5 STRUCTURAL STEEL AND CONCRETE

A. Structural members may not be pierced without prior written approval of the Engineer.

1.6 WATERPROOFING

A. Waterproofed floors and walls may not be cut.

1.7 WORK SCHEDULE

A. Work schedule shall be in accordance with Division 01.

B. Any demolition or installation work producing excessive dust or noise deemed to be disruptive or possibly unsafe to building operations must be, at the Owner's discretion, performed after normal working hours.

1.8 PROTECTION OF EQUIPMENT

A. Provide all necessary protection and be fully responsible for material and equipment stored or installed on the site. Material or equipment stolen or damaged shall be replaced at no additional cost to the Owner.

B. Provide protection against theft, physical damage and the entry of dirt, water or corrosive fumes into the material and equipment. Maintain protective covers for the duration of construction. Store equipment, such as controls, subject to damage by moisture and temperature extremes in a dry, heated space.

1.9 FIRE SAFETY

A. Fire Watch: Provide a fire watch wherever welding, brazing, cutting or other processes involving an open flame or potential for generating sparks is used. Fire watch shall consist of a person with a 10 pound carbon dioxide fire extinguisher. While on fire watch, the person so assigned shall have no other duties or assignments.

B. Fire Blanket: In addition to providing a fire watch, use an approved fire blanket to cover any combustible materials in the immediate area.

1.10 GUARANTEES

A. Furnish written guarantee in accordance with requirements of General Conditions. Partial approval of a portion of work does not affect the validity of guarantee.

1.11 SHOP DRAWINGS

A. It shall be noted that shop drawing submittals processed by the Engineer are not change orders; that the purpose of shop drawing submittals is to demonstrate to the Engineer that the Contractor understands the design concept, that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install, and by detailing the fabrication and installation methods he intends to use. If deviations, discrepancies or conflicts between shop drawing submittals and the contract documents in the form of design drawing and specifications are discovered either prior to or after shop drawing submittals are processed by the Engineer, the design drawings and specifications shall control and shall be followed. The Engineer may also require the contractor to submit samples of proposed or specified equipment for approval with the samples to be returned to the contractor upon request.

B. Prior to procurement or manufacturing, submit for approval appropriate shop drawings and/or descriptive literature giving performance data, physical size, wiring diagrams, configuration, capacity, material, etc., for all items under this Division including the following:
1. Hydronic Piping & Piping Specialties
2. General Duty Valves for HVAC
3. Variable Speed Drives
4. Mechanical Painting & ID
5. Testing & Balancing
6. HVAC Insulation
7. DDC Controls, Valves and Actuators
8. Ductwork, Dampers, & Louvers
9. Air Inlets and Outlets
10. AHU
11. Packaged RTU
12. Variable Air Volume Boxes

C. The contractor shall visit the site and familiarize himself with the project requirements and the field conditions before preparing shop drawings and ordering equipment. Field verify the characteristics of all specified or existing equipment before preparing shop drawings. This shall include available space, available voltages, suitability of substrate for receiving the specified equipment, etc. Where existing equipment is re-used, he shall verify dimensions, capacities, horse-power, etc. and bring any discrepancies to the attention of the Engineer.

D. Where different products have to work together, it is the Contractor's responsibility to select manufacturers whose products are visually and/or technically compatible.

E. Prepare listing of all equipment and materials for the project. A sample schedule is included at the end of this section to complete this requirement. Provide all information represented.

1.12 RECORD DRAWINGS

A. During construction, keep an accurate record of all changes and deviations from contract documents. Upon completion of this installation, the contractor shall submit to the Engineer marked up prints indicating any installed work that is different from what is shown on the drawings. Complete and accurate drawings shall be submitted to the Owner at the conclusion of this project. All changes will be reflected in CAD format. Marked-up as-built drawings will not be permitted.

PART 2 - PRODUCTS

2.1 QUALITY OF MATERIAL

A. Equipment of the same general type shall be of the same make. Reference is made to relays, motors, valves, motor starters, contactors, etc.

B. Brand names and catalog numbers included with equipment or material specifications are used to indicate quality, rating or operating characteristics of the equipment or material.

C. All materials provided shall be new and shall be approved and labeled by the Underwriter's Laboratories, Inc., or other accredited third-party agency, wherever such agency has applicable standards. All work shall be accomplished in a neat, workmanlike manner by experienced journeymen. All work shall be performed at such times as are required by the progress of the job.

D. All components, equipment and systems shall comply with ASHRAE 90.1 and any other applicable ASHRAE standard.

PART 3 - EXECUTION

3.1 CLEARANCE AND RESTORATION OF SITE

A. It may be required to temporarily remove existing ceiling tiles, piping, duct, conduits, etc. to introduce new work as specified in this Division. Contractor, after installation of new work, shall reinstall, reconnect removed items to match the existing. Installation of any new equipment shall not compromise existing fire ratings of rated assemblies. All penetrations shall be sealed to existing conditions per UL guidelines for penetration protections. Provide offsets if required in existing piping, ducts etc. to introduce new work.

3.2 COORDINATION

A. Install all work to permit removal of equipment without damage to the equipment or the building. Verify equipment space requirements, condition of substrate, voltages,

etc. at the time of shop drawing submission and advise the Engineer of any conflict.

B. Coordinate equipment locations as well as piping and conduit routing with Owner's representative to optimize all present and foreseen future space usage and clearance requirements.

C. Do not rough prior to receipt of approved shop drawings.

3.3 EQUIPMENT INSTALLATION AND SUPPORT

A. Install all equipment where indicated, in accordance with manufacturer's published installation instructions, and with recognized industry practices to ensure that equipment complies with requirements and serves intended purposes. Consult with Engineer if said instructions or practices conflict with the drawings/specifications.

B. Support plumb, rigid and true to line all work and equipment furnished under this Division. Study thoroughly architectural, mechanical drawings and all related drawings to determine how equipment, piping, ductwork, etc., are to be supported, mounted or suspended. Provide extra steel bolts, inserts, pipe stands, brackets and accessories for proper support as required whether or not shown on drawings. When directed, furnish for approval a drawing showing supports.

C. Any system component which may require maintenance, such as control valves, manual valves, strainers, etc. shall not be installed over electrical equipment, machinery, control panels or floor openings.

3.4 FINAL ADJUSTMENT AND TESTING

A. General: Provide all testing, preliminary and final adjustment of instrumentation for this purpose. Conduct all tests in full compliance with applicable codes prior to covering or concealing work by insulation, enclosures, etc. Material found to be defective shall not be repaired. It shall be replaced with new material which tests satisfactorily. Defective workmanship shall be corrected.

B. Working Tests: Subject all equipment and controls to simultaneous and continuous working tests for a period of one day prior to final inspection. Make adjustments, repairs and equipment replacements as required.

3.5 LABELS, IDENTIFICATION AND TAGS

A. All components or equipment shall be identified using 3/4 inch high permanent engraved bakelite nameplates or 3/4 inch high anodized aluminum nameplates, white letter, black background, with minimum 1/4 inch high letters. Nameplates shall be permanently attached with pin-head screws to device or to wall or mounting panel above device. Stick-on type labels will not be acceptable.

3.6 OWNER'S RIGHT TO TEST SYSTEMS

A. Should, in the opinion of the Engineer, and during the guarantee period, reasonable doubt exist as to the proper functioning of any equipment installed under this Contract, the right is reserved for the Owner and Engineer to perform any test deemed practical to determine whether such equipment is functioning properly and performing at required capacity. If such tests show proper functioning, the cost of the test will be paid by the Owner. If the tests indicate a deficiency in equipment

capacity or performance, the Contractor shall pay the cost of the test and also make good any deficiencies shown by the test to the full satisfaction of the Owner and the Engineer.

3.7 CLEANING UP

A. The contractors performing work under this section shall at all times keep the premises and the building in a neat and orderly condition and any instructions of the Engineer in regard to the storing of material, protective measures, cleaning up of debris, etc. shall be explicitly followed. At the completion of the job, all equipment shall be cleaned to the satisfaction of the Owner.

B. The building will be occupied during installation of the new addition and/or alterations as described hereinafter. Thus, special care shall be taken during installation to protect equipment and other furniture in the buildings from dust and debris generated during installation of work specified in this Division.

3.8 INSPECTION CERTIFICATES

A. Obtain all inspections required by law, ordinances, rules, and regulations of the Authorities having jurisdiction and obtain and furnish to the Engineer certificates of such inspections, pay all fees, charges, and other expenses in connection therewith.

3.9 FINAL REVIEW

A. Final review and tests of the completed construction shall be performed in the presence of the Engineer or his representative and shall be at such times as are convenient to the Engineer. Final tests shall show conclusively that all equipment performs its intended and specified function and that all work complies with the provisions of these specifications. All material, equipment, and instruments required for the tests shall be furnished by the Contractor at his own expense.

3.10 EQUIPMENT DELIVERY AND PROTECTION

A. All material shall be delivered and unloaded by the Contractor within the project site as directed by the Owner. The Contractor shall protect all material and equipment from breakage, theft or weather damage.

3.11 OPERATING INSTRUCTIONS

A. The Contractor shall provide a minimum of six (6) hours of personal instruction to Owner's personnel in the proper operation of all equipment specified and provided. The instruction shall be provided by factory trained and certified competent personnel.

B. Maintenance Manuals shall be submitted in three (3) copies in vinyl 3-ring binders. Each binder shall have the following:
   1. Service telephone number of the installing company, including an emergency number.
   2. Contact person, phone number, and address of manufacturer or distributor where equipment was purchased.
   3. The manufacturing company's operating and maintenance manuals for each piece of equipment.
   4. Copies of all approved shop drawings.

C. Furnish for each building permanent type charts, framed under glass, mounted where directed as follows:
   1. Service organizations with day and night telephone numbers.

PRODUCTS LISTING FORM

INSTRUCTIONS

Do not use the terminology "as specified", rather indicate specifically the product proposed.

Prepared by: _____

_____

Date: _____ Project:

SPEC. SECTION	ITEM	MANUFACTURER

END OF SECTION

SECTION 230520 - PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-1 Specification section, and other Division 23 sections apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of piping specialties required is indicated on drawings and/or specified in other Division 23 sections, and by requirements of this section.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions, and dimensioned drawings for each type of manufactured piping specialty. Include pressure drop curve or chart for each type and size of piping specialty. Submit schedule showing manufacturer's figure number, size, location, and features for each required piping specialty.

PART 2 - PRODUCTS

2.1 PIPE ESCUTCHEONS

A. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe outside diameter, or outside of pipe insulation where pipe is insulated. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.

B. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.

C. Pipe Escutcheons for Dry Areas: Provide stamped steel escutcheons, solid or split hinged, 22 gauge minimum.

2.2 DIELECTRIC UNIONS

A. General: Provide brass ball valves where piping material changes from ferrous to non-ferrous material in order to prevent galvanic action and stop corrosion. Non-metalic dielectric unions shall not be used.

2.3 FIRE BARRIER PENETRATION SEALS

A. Provide seals for any opening through fire-rated walls, floors, or ceilings used as passage for mechanical components such as piping or ductwork in accordance with UL penetration protection guidelines with UL approved components. Refer to fire barrier penetration detail(s) in construction drawings.

2.4 THERMOMETERS

A. Provide solar digital thermometers for all water temperature display applications as shown on plans and/or as otherwise required by field conditions.

2.5 THERMOMETER WELLS

A. Provide thermometer wells constructed of stainless steel, pressure rated to match piping system design pressure. Provide 2" extension for insulated piping. Provide cap nut with chain fastened permanently to thermometer well.

2.6 FABRICATED PIPING SPECIALTIES

A. Drip Pans: Provide drip pans fabricated from corrosion-resistant sheet metal with watertight joints, and with edges turned up 2-1/2". Reinforce top, either by structural angles or by rolling top over 1/4" steel rod. Provide hole, gasket, and flange at low point for watertight joint and 1" drain line connection.

B. Pipe Sleeves: Provide pipe sleeves of one of the following: (except where allowed otherwise in non-load bearing and non-fire barrier partitions).
   1. Steel-Pipe: Fabricate from Schedule 40 galvanized or black steel pipe; remove burrs
   2. Iron-Pipe: Fabricate from cast-iron or ductile iron pipe; remove burrs.

PART 3 - EXECUTION

3.1 INSTALLATION OF PIPING SPECIALTIES

A. Pipe Escutcheons: Install pipe escutcheons on each pipe penetration through floors, walls, partitions, and ceilings where penetration is exposed to view and on exterior of building. Secure escutcheon to pipe or insulation so escutcheon covers penetration hole, and is flush with adjoining surfaces.

B. Dielectric Unions: Install at each piping joint between ferrous and non-ferrous piping. Comply with manufacturer's installation instructions.

C. Fire Barrier Penetration Seals: Comply with UL guidelines and refer to details in drawings.

3.2 INSTALLATION OF TEMPERATURE GAGE

A. General: Install temperature gages in vertical upright post, and tilted so as to be easily read by observer standing on floor.

B. Thermometer Wells: Install in piping tee where indicated, in vertical upright post. Fill well with oil or graphite, secure cap. Install a spare well within twelve inches of each temperature sensor installed under the temperature control section.

3.3 INSTALLATION OF FABRICATED PIPING SPECIALTIES

A. Drip Pans: Locate drip pans under piping passing over or within 3' horizontally of electrical equipment, and elsewhere as indicated. Hang from structure with rods and building attachments, weld rods to sides of drip pan. Brace to prevent sagging or swaying. Connect 1" drain line to drain connection, and run to nearest plumbing floor

drain or elsewhere as indicated

B. Pipe Sleeves: Install pipe sleeves where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of work, except as detailed on drawings, or as reviewed by Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement in sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than pipe run. Where insulation includes vapor-barrier jacket, provide sleeve with sufficient clearance for installation. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except floor sleeves. Extend floor sleeves 1/4" above level floor finish and 3/4" above floor finish sloped to drain. Provide temporary support of sleeves during placement of concrete and other work around sleeves, and provide temporary closure to prevent concrete and other materials from entering sleeves.

C. All interior pipe sleeves shall be schedule 40 steel, unless otherwise noted.

D. Install iron-pipe sleeves at exterior penetrations, both above and below grade.

3.4 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.

B. Cleaning: Clean windows of meters, gages and factory-finished surfaces. Replace cracked or broken windows and repair any scratched or marred surfaces with manufacturers' touch-up paint.

END OF SECTION

SECTION 230523 - GENERAL DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-1 Specification sections and other Division 23 specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of valves required is indicated on drawings and/or specified in other Division - 23 sections, and by requirements of this section.

1.3 QUALITY ASSURANCE

A. Valve Types: Provide valves of same type by same manufacturer.

B. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

1.4 CODES AND STANDARDS

A. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions."

B. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves."

1.5 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve orchart for each type and size of valve. Submit valve schedule showing Manufacturer's figure number, size, location, and valve features for each required valve.

PART 2 - PRODUCTS

2.1 VALVES

A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide end connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.

B. Sizes: Unless otherwise indicated, provide valves of same size as upstream pipe size.

C. Operators: Provide handwheels, fastened to valve stem, for valves other than

quarter-turn. Provide lever handle for quarter-turn valves, 6" and smaller, other than plug valves. Provide gear operators for quarter-turn valves 8" and larger. Provide chain-operated sheaves and chains for overhead valves 8" and larger or as indicated.

2.2 GATE VALVES

A. Comply with the following standards:
1. Cast-Iron Valves: MSS SP-7
2. Bronze Valves: MSS SP-80
3. Steel Valves: ANSI B16.34

2.3 GLOBE VALVES

A. Comply with the following standards:
1. Cast-Iron Valves: MSS SP-85
2. Bronze Valves: MSS SP-80
3. Steel Valves: ANSI B16.34

2.4 BALL VALVES

A. Comply with the following standards:
1. Cast-Iron Valves: MSS SP-72
2. Steel Valves: ANSI B16.34

2.5 BUTTERFLY VALVES

A. Comply with MSS SP-67, "lug" type.

2.6 SWING CHECK VALVES

A. Comply with the following standards:
1. Cast-Iron Valves: MSS SP-71
2. Bronze Valves: MSS SP-80
3. Steel Valves: ANSI B16.34

2.7 WAFER CHECK VALVES

A. General: Provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between 2 standard class125 flanges.

2.8 LIFT CHECK VALVES

A. Conform to FCI 74-1 for design, rating and testing.

2.9 VALVE FEATURES

A. General: Provide valves with features indicated and, where not otherwise indicated, provide proper valve features as determined by Installer for installation requirements. Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

B. Bypass: Comply with MSS SP-45, and except as otherwise indicated, provide manufacturer's standard bypass piping and valving.

C. Drain: Comply with MSS SP-45, and provide threaded pipe plugs.

D. Flanged: Valve flanges complying with ANSI B16.5, (steel), or ANSI B16.24 (bronze).

E. Threaded: Valve ends complying with ANSI B2.1.

F. Butt-Welding: Valve ends complying with ANSI B16.25.

G. Socket-Welding: Valve ends complying with ANSI B16.11.

H. Solder-Joint: Valve ends complying with ANSI B16.18.

I. Flangeless: Valve bodies manufactured to fit between flanges complying with ANSI B16.5 (steel), or ANSI B16.24 (bronze).

J. Pressure Ratings: Unless indicated otherwise, valve pressure ratings shall be as follows:

K. Water System: Class 150 for bronze valves, Class 125 for iron valves.

L. Steam Systems: Bronze gate, check, and globe valves in lines with operating pressures to 150 psi SWP shall be 150-pound class and 200-pound class for higher pressures. Cast iron gate valves in lines with operating pressures to 125 psi SWP shall be 125-pound class and 250-pound class for higher pressures.

NOTE: All piping valves, fittings, and steam specialties furnished under this contract shall be as required for the installation of 150 psi boilers operating between 125 psi and150 psi SWP. (Refer to Section 15570 and 15571 for additional requirements)

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements:
   1. Install valves where required for proper operation of piping and equipment, including valves in branch lines to isolate sections of piping.
   2. Locate valves so as to be accessible and so that separate support can be provided when necessary.
   3. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable.
   4. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.

B. Insulation: Where insulation is indicated, install extended- stem valves, arranged in proper manner to receive insulation.

C. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to about 5' above floor and hook to clips to clear aisle passage.

D. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections:
   1. Tube Size 2" and Smaller: Soldered-joint valves.
   2. Pipe Size 2" and Smaller: Threaded valves.
   3. Pipe Size 2-1/2" and Larger: Flanged valves.

E. Valve Stems: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

F. Non Metallic Disc: Shall not be used, except where indicated.

G. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

H. Fluid Control: Except as otherwise indicated, install gate and butterfly valves to comply with ANSI B31.9. Where throttling is indicated or recognized as principal reason for valve, install butterfly valves.

3.2 INSTALLATION OF CHECK VALVES

A. Swing Check Valves: Install in horizontal position with hinge pin horizontally perpendicular to center line of pipe. Install for proper direction of low.

B. Wafer Check Valves: Install between two flanges in horizontal or vertical position, position for proper direction of flow.

C. Lift Check Valves: Install in piping line with stem vertically upward, position for proper direction of flow.

3.3 VALVE SCHEDULE

A. Subject to compliance with "Pressure Ratings" required by Page 15100-3 of these specifications.

3.4 GATE VALVES

A. Refer to Supplementary Valve Schedule for Equivalents.

B. 2" and Smaller: Class 150, Bronze, screw-in bonnet, rising stem, solid wedge, equivalent to Stockham B-100 for threaded ends or Stockham B-108 for solder ends. Milwaukee 148, Milwaukee 1149 or Grinnel 3010, Grinnel 3010-SJ, respectively.

C. 2-1/2" and Larger: Class 125, flanged ends, iron body, bolted bonnet, solid wedge, bronze mounted, OS&Y rising stem, equivalent to Stockham G-623.

D. Hose End, 2-1/2" and smaller: FM, UL-listed, 175 psi, bronze body, solid wedge, inside screw, non-rising stem, equivalent to Jenkins 707.

E. Threaded End, 2" and smaller: FM, UL-listed, 175 psi, bronze body, solid wedge, outside screw and yoke, rising stem, equivalent to Stockham B-133, Nibco T-1040, or Crane 459.

F. Flanged End, 2-1/2" and larger: FM, UL-listed, 175 psi, iron body, bronze mounted, solid wedge, outside screw and yoke, rising stem, equivalent to Stockham G-634.

3.5 GLOBE VALVES

A. 2" and Smaller: Class 150, Bronze body, screw-in bonnet, integral seat, renewable disc, equivalent to Jenkins 746 for threaded ends or Jenkins 1200 for solder ends.

B. 2-1/2" and Larger: Class 125, flanged ends, iron body, bolted bonnet, renewable seat and disc, bronze mounted, equivalent to Jenkins 613.

3.6 DRAIN VALVES

A. Bronze body, screw-in bonnet, rising stem, composition disc, 3/4" hose outlet, equivalent to NIBCO 73 for threaded ends or NIBCO 72 for solder ends.

3.7 PLUG VALVES

A. 2" and Smaller: 150 psi, bronze body, straightaway pattern, square head, threaded ends, equivalent to Lunkenheimer 454.

B. 2-1/2" and Larger: 175 psi, lubricated plug type, semi-steel body, single gland, wrench operated, flanged ends, equivalent to Powell 2201.

3.8 BALL VALVES

A. 1" and Larger: 400 psi WWP, bronze body, full port, bronze trim, TFE seats and seals. Valves shall be CONBRACO "Appollo" series, or equivalent.

3.9 BUTTERFLY VALVES

A. Butterfly Valves shall be full-tapped lug design suitable for dead-end service. Valves through 6" shall have infinite position handles equipped with adjustable memory stops.

B. Valves for working pressure up to 150 psi and 275 F shall have cast iron body, ductile iron or aluminum bronze discs, stainless steel shaft, and elastomeric seats and o-rings.

C. Valves for working pressure above 150 psi shall have carbon steel body and disc, stainless steel stem, reinforced TFE pressure actuated seat with backing ring, and stuffing box with elastomeric packing, follower, and gland.

D. Valves shall be Jamesbury or equivalent.

3.10 CHECK VALVES

A. 2" and Smaller: Class 150, bronze body, horizontal swing, regrind type, Y-pattern, renewable disc, equivalent to Stockham B-319 for threaded ends or Stockham B-309 for solder ends.

B. 2-1/2" and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends, equivalent to Stockham G-931.

C. 2-1/2" and Larger: Class 175, iron body, bronze mounted, renewable composition disc and bronze seat ring, bolted cover, flanged ends, equivalent to Stockham G-940.

3.11 WAFER CHECK VALVES

A. All Sizes: Cast-iron body, aluminum bronze or plated iron plates, stainless steel stem, Buna-N seat, stainless steel springs, equivalent to Stockham WG-970.

3.12 LIFT CHECK VALVES

A. 2" and Smaller: Class 150, Bronze body, lift type, spring loaded, renewable disc, threaded ends, equivalent to Jenkins 655A.

3.13 SUPPLEMENTARY VALVE SCHEDULE

A. General: Provide selections from the following valves for various valve type listed in Division-23 piping sections.

3.14 GATE VALVES

A. 2" and Smaller: Class 150, bronze, screw-in bonnet, rising stem, solid wedge.

	Threaded Ends	Solder Ends
Fairbanks:	0252	0282
Grinnel:	3010	3010-SJ
Hammond:	IB640	IB635
Jenkins:	47	1242
Lunkenheimer:	2127	2132
Milwaukee:	148	1149
Nibco:	T-111	S111
Powell:	500-S	1821-S
Stockham:	B-100	B-108
Walworth:	55	55-SJ

B. 2" and Smaller: Class 150, bronze, screw-in bonnet, non-rising stem, solid wedge.

	Threaded Ends	Solder Ends
Fairbanks:	0250	0280
Grinnel:	3000	3000-SJ
Hammond:	IB645	IB647
Jenkins:	370	1240
Lunkenheimer:	2129	2133
Milwaukee:	105	1145
Nibco:	T-113	S113
Powell:	507	1822
Stockham:	B-103	B-104
Walworth:	55	4-SJ

C. 2-1/2" and Larger: Flanged ends, Class 125, iron body, bolted bonnet, solid wedge, bronze-mounted.

	OS&Y Rising Stem	Non-Rising Stem
Fairbanks:	0405	0403
Grinnel	6020	6060
Hammond:	IR1140	IR1138
Jenkins:	651C	326

Lunkenheimer:	1430	1428
Milwaukee:	F-2885	F-2882
Nibco:	617	619
Powell:	1793	1787
Stockham:	G-623	G-612
Walworth:	8726-F	8719-F

D. Hose-End, 2-1/2": FM, UL-listed, 175 WWP, bronze body, solid wedge, inside screw, non-rising stem. Provide cap and chain.

Fairbanks:	0210
Jenkins:	707
Lunkenheimer:	366
Nibco:	T-113-HC
Walworth:	115

E. Threaded End, 2" and Smaller: FM, UL-listed, 175 WWP, bronze body, solid wedge, outside screw and yoke, rising stem.

Crane:	459
Fairbanks:	0222
Hammond:	IB681
Jenkins:	275U
Nibco:	T-104-0
Stockham:	B-133
Walworth:	904

F. Flanged End, 2-1/2" and Larger: FM, UL-listed, 175 WWP, iron body bronze mounted, solid wedge, outside screw and yoke, rising stem.

Crane:	467
Fairbanks:	0412
Hammond:	IR1154
Jenkins:	825-A
Nibco:	F-607-0
Stockham:	G-634
Walworth:	8713-F

3.15 BUTTERFLY VALVES

A. 6" and Smaller: 150 psi, cast-iron body, extended neck, aluminum bronze disc, reinforced resilient EDPM seat, manual lever and lock.

	Wafer	Lug
Fairbanks:	302	502
Grinnell:	WC-8211	LC-8211
Hammond:	3804	3824
Jamesbury:	815W	815L
Nibco:	WL-082-3	NL-082-3
Powell:	Series 1000	Series 5000
Stockham:	LG-511-BS3E	LG-711-BS3E
Grooved Ends:	Vitaulic Series 700	

B. 8" and Larger: 150 psi, cast-iron body, extended neck, aluminum bronze disc, reinforced resilient EDPM seat, gear operator.

	Wafer	Lug
Fairbanks:	402	602
Grinnell:	WC-8212	LC-8212

Nibco:	WL-082-5	NL-082-5
Powell:	Series 1000	Series 5000
Stockham:	LG-521-B@3E	LD-721-BS3E
Grooved Ends:	Vitaulic Series 701	

3.16 CHECK VALVES

A. 2" and Smaller: Class 150, bronze body, horizontal swing, regrinding type, Y-pattern, renewable disc.

	Threaded Ends	Solder Ends
Fairbanks:	0640	0680
Grinnel:	3300	3300-SJ
Hammond:	IB940	IB941
Jenkins:	92-A	1222
Lunkenheimer:	2144	2145
Milwaukee:	509	1509
Nibco:	T-413	S413
Powell:	578	1825
Stockham:	B-319	B-309
Walworth:	3406	3406-SJ

B. 2-1/2" and Larger: Class 125, iron body, bolted bonnet, horizontal swing, renewable seat and disc, flanged ends.

Fairbanks:	0702
Grinnell:	6300
Hammond:	IR1124
Jenkins:	629
Lunkenheimer:	1790
Milwaukee:	F2971
Nibco:	F-918
Powell:	559
Stockham:	G931
Walworth:	8928-F

C. 2-1/2" and Larger: FM, UL-listed, 175 WWP iron body bronze mounted, renewable composition disc and bronze seat ring, bolted cover, flanged ends.

Fairbanks:	071
Jenkins:	729
Nibco:	F-908-W
Stockham:	G-940
Walworth:	8883-LT

END OF SECTION

SECTION 230529 - SUPPORTS, ANCHORS AND VIBRATION ISOLATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-01 Specification sections, and other Division 23 specification sections apply to work of this section.

1.2 QUALITY ASSURANCE

A. Codes and Standards:
   1. Code Compliance: Comply with applicable codes pertaining to product materials and installation of supports and anchors.
   2. UL and FM Compliance: Provide products which are UL-listed and FM approved where required.
   3. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS) Standard Compliance: Provide pipe hangers and supports of which materials, design, and manufacture comply with MSS SP-58.

B. Select and apply pipe hangers and supports, complying with MSS SP-69.

C. Fabricate and install pipe hangers and supports, complying with MSS SP-89.

D. Terminology used in this section is defined in MSS SP-90.

E. Acceptable Manufacturers: Vibration Mountings and Controls, Inc., Grinnell, Modern, or approved equal.

1.3 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.1 HORIZONTAL-PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory- fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
   1. Adjustable Steel Clevis Hangers: MSS Type 1.
   2. Yoke Type Pipe Clamps: MSS Type 2.
   3. Steel Double Bolt Pipe Clamps: MSS Type 3.
   4. Steel Pipe Clamps: MSS Type 4.

5. Adjustable Swivel Pipe Rings: MSS Type 6.
6. Adjustable Steel Band Hangers: MSS Type 7.
7. Adjustable Band Hangers: MSS Type 9.
8. Adjustable Swivel Rings, Band Type: MSS Type 10.
9. Split Pipe Rings: MSS Type 11.
10. Extension Split Pipe Clamps: MSS Type 12.
11. U-Bolts: MSS Type 24.
12. Clips: MSS Type 26.
13. Pipe Slides and Slide Plates: MSS Type 35, including one of the following plate types:
    a. Plate: Unguided type.
    b. Plate: Guided type.
    c. Plate: Hold-down clamp type.
14. Pipe Saddle Supports: MSS Type 36, including steel pipe base- support and cast-iron floor flange.
15. Pipe Stanchion Saddles: MSS Type 37, including steel pipe base support and cast-iron floor flange.
16. Adjustable Pipe Saddle Supports: MSS Type 38, including steel pipe base support and cast-iron floor flange.
17. Single Pipe Rolls: MSS Type 41.
18. Adjustable Roller Hangers: MSS Type 43.
19. Pipe Roll Stands: MSS Type 44.
20. Adjustable Pipe Roll Stands: MSS Type 46.

2.2 VERTICAL-PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory- fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.
   1. Two-Bolt Riser Clamps: MSS Type 8.
   2. Four-Bolt Riser Clamps: MSS Type 42.

2.3 HANGER-RODS AND ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachments to suit hanger rods. Provide galvanized steel hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.
   1. Steel Turnbuckles: MSS Type 13.
   2. Swivel Turnbuckles: MSS Type 15.
   3. Malleable Iron Sockets: MSS Type 16.

2.4 BUILDING ATTACHMENTS

A. General: Except as otherwise indicated, provide factory-fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS

SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.

1. Concrete Inserts: MSS Type 18.
2. Channel Clamps: MSS Type 20.
3. Welded Beam Attachments: MSS Type 22.
4. C-Clamps: MSS Type 23.

2.5 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles and shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40; of length recommended by manufacturer to prevent crushing of insulation.

2.6 ROOF CURBS AND PENETRATIONS

A. Prefabricated roof curbs for penetrations shall be provided by this Division. The curbs shall be installed by the general contractor.

2.7 MISCELLANEOUS MATERIALS

A. Metal Framing: Provide products complying with NEMA STD ML 1.

B. Steel Plates, Shapes and Bars: Provide products complying with ASTM A 36.

C. Heavy-Duty Steel Trapezes: Fabricate from steel shapes selected for loads required; weld steel in accordance with AWS standards.

2.8 VIBRATION ISOLATION

A. General: Equipment shall be isolated from the structure by means of resilient vibration and noise isolating supports. Supports shall be such that vibration is isolated and expansion and contraction is accommodated without creating excessive stresses in piping or equipment connections.

B. All isolators shall be designed or treated for resistance to corrosion. Steel components shall be PVC coated or phosphated and painted with industrial grade enamel. All nuts, bolts and washers shall be zinc-electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc chromate or metal etching primer. A finish coat of industrial enamel shall be applied over the primer. All isolators exposed to the weather shall have steel parts PVC coated, hot-dipped galvanized or zinc-electroplated plus coating of neoprene or bitumastic paint. Aluminum components for outdoor installation shall be etched and painted with industrial grade enamel. Nuts, bolts and washers may be zinc-electroplated.

C. Isolators shall be installed in such a manner that loaded deflections are compensated for initially.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure with maximum loading as shown below. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Provide all facia boards, cleats, brackets, backing in partitions, toggle bolts, expansion shields, screws, clamps and rods, etc., for hanging of all piping and equipment included under this Division.

C. Hangers and braces shall adequately support the piping system horizontally and vertically and shall allow for expansion and contraction without binding in sleeves or misalignment. Provide for expansion of piping with swing joints and ample sleeves.

D. Vertical Piping: Supports for vertical piping 1-1/2 inches and smaller from wall with malleable split ring hanger. Nipples cut to fit each case. Two hangers per floor, minimum. Use clamps on every floor for pipes 2 inches and larger. In crawl spaces, support stacks on base fitting placed securely on concrete piers or masonry blocks and with pipe clamps.

E. Horizontal piping shall be supported with hangers as follows:

STEEL PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1 inch	3/8 inch	7 feet
1-1/4” inches	3/8 inch	8 feet
1-1/2 inches	3/8 inch	9 feet
2 inches	3/8 inch	10 feet

F. Load carrying capacities of threaded steel rod based on allowable stress of 12,000 psi.

ROD SIZE-INCHES:	3/8	1/2	5/8	3/4	7/8	1	1-1/8	1-1/4
ALLOW LOAD-LBS:	610	1130	1810	2710	3770	4960	6230	8000

G. Generally, pipes shall be individually supported. Trapeze hangers may be used where approved. Piping shall be individually bolted to trapeze with U bolts.

H. Piping along wall: From approved wall brackets fastened to wall with Phillips anchors or inserts.

I. Installation: Provide pipe bars, angles, etc. as required. Anchor piping to localize expansion and prevent undue strain on piping and branches. Provide spring type hangers for vibration isolation where shown on plans and as specified in vibration isolation section. Locate hanger not more than 4 feet from elbow or tee on screwed piping. Space hangers on 3 foot center on horizontal piping 1-1/2 inch and smaller exposed at corridor ceilings and less than 8 feet from floor in finished rooms.

J. Support from Concrete Construction: All main piping runs shall be supported from hangers secured to cast-in-place concrete inserts. Branch piping hanger supports may be field drilled using self drilling type expansion shields equal to Phillips concrete fasteners or approved equal. Expansion shields shall not cut or unduly

displace reinforcement.

K. Support from Precast Concrete: Use toggle bolts mounted in core sections of precast concrete. Absolutely no ramset or any other power driven fasteners will be allowed in precast planks.

L. Support from Existing Concrete: Piping may be attached to the structure using power driven fasteners. All fasteners into concrete shall penetrate the slab for a distance equal to 6 to 8 times the diameter of the shank. Power driven fasteners will not be used in concrete encased steel beams.

M. Support from Structural Steel: Make use of existing steel members for pipe support. Provide additional structural steel members where required to accommodate hangers.

N. Anchors: Anchor piping as shown or required to isolate expansion and prevent pipe strain due to expansion. Anchors shall be separate from other supports.

O. Expansion Joints and Pipe Guides: Install in accordance with manufacturers recommendation. Locate additional guide within recommended distance of the first guide integral to the expansion joint. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated, for exposed continuous pipe runs, install hangers and supports of same type and style, as installed for adjacent similar piping.

P. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

3.2 PROVISIONS FOR MOVEMENT

A. Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends and similar units.

B. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

3.3 PIPE EXPANSION

A. Provide pipe expansion products to make allowance for expansion and contraction of pipe. Provide bellows type or flexible expansion loop as required.

B. Insulated Piping: Comply with the following installation requirements.

C. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.

D. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields.

3.4 EQUIPMENT SUPPORTS

A. Modify structural steel Stands to support equipment mounted on the roof. Construct

of structural steel members to match existing. Provide factory fabricated tank saddles for tanks mounted on steel stands. Provide shop drawings for structural steel stands for Engineer's approval.

END OF SECTION

SECTION 230685 - SINGLE OR DUAL CIRCUIT SCREW CHILLER

PART 1 - GENERAL

Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

1.1 N/A

1.2 SUBMITTALS

A. Manufacturer's Data: Submit manufacturer's product data, including rated capacities, weights (shipping, installed, and operating), furnished specialties and accessories; and installation and start-up instructions.

1.3 QUALITY ASSURANCE

A. Machine Experience: At time of submission of bid or proposal, chiller model proposed must have acquired minimum of two years experience on each of ten field installations, each machine having acquired minimum of 2,400 operating hours.

1.4 REGULATORY REQUIREMENTS

A. ARI Compliance: Test and rate chillers in accordance with ARI Std 550.

B. ASHRAE Compliance: Construct and install chillers in accordance with ASHRAE STD 15, "Safety Code for Mechanical Refrigeration". Provide Energy Efficiency Ratio (EER) for centrifugal chillers not less than prescribed by ASHRAE Std 90A, "Energy Conservation in New Building Design".

C. NEC Compliance: Comply with applicable NEC requirements pertaining to electrical power and control wiring for construction and installation of centrifugal chiller.

D. ANSI Compliance: Comply with ANSI B9.1 safety code requirements pertaining to unit construction of centrifugal chillers.

E. ASME Compliance: Construct and test centrifugal chiller in accordance with ASME Boiler and Pressure Vessel Code, Section 8.

F. NEMA Compliance: Provide high-efficiency motors for centrifugal chillers which comply with NEMA Stds Pub/No.'s MG 1, 2, 3, 10, and 11.

G. UL Compliance: Comply with applicable requirements of UL 465, "Central Cooling Air Conditioners", pertaining to construction and installation of centrifugal chillers.

H. OSHA: Occupational Safety and Health Act.

1.5 WARRANTY

A. Provide whole unit parts and labor warranty for the duration of two (2) years.

B. Provide refrigerant warranty for the duration of two (2) years.

C. Provide motor/transmission/compressor parts warranty for duration of years 2-5.

D. Next-day service by a factory authorized service technician on warranty issues on the chiller shall be guaranteed if a service call, from the Owner to the Contractor, is placed before 3:00 pm. If the call is placed after 3:00 pm, service shall be guaranteed the following day.

PART 2 - PRODUCTS

2.1 SCREW COMPRESSOR CHILLER

A. Make: Carrier, Trane, Daikin or Pre-approved Equal.

B. General: The Screw Compressor Liquid Cooled Chiller shall be completely factory packaged including evaporator, condenser, sub-cooler, oil separator, compressor, motor, lubrication system, Microcomputer Control Center, and all interconnecting unit piping and wiring. The unit shall contain the full charge of Refrigerant-134A and oil.

C. The chiller manufacturer shall provide the services of a factory trained field service representative to supervise the initial startup and concurrent operator instruction.

2.2 CAPACITY

A. As scheduled on the drawings.

2.3 COMPRESSOR

A. Compressor shall be semi hermetic helical rotary with twin circuits.

B. Impellers shall be high strength aluminum alloy, fully shrouded, and balanced both statically and dynamically, impellers shall be provided with Teflon impregnated coating in order to increase surface hardness.

C. The entire unit shall be run tested at the factory at full load conditioning. Vibration shall not exceed 0.14 IPS at the compressor bearings.

D. Capacity control shall be accomplished by the use of slide valve. This assembly shall allow capacity modulating from 100% to 25% of schedule conditions.

E. A positive displacement submerged oil pump shall provide lubrication to all parts requiring oil. Provisions shall be included for controlled heating of the oil. Heater shall be selected to maintain oil temperature at a sufficient level to minimize affinity for the refrigerant. The oil pump shall be suitable for operation on 120-volt single phase power. This power shall be supplied through the unit control transformer.

F. Oil cooling shall be provided by a refrigerant cooled or water-cooled heat exchanger.

G. Method of sensing motor winding temperature of each phase shall be provided. This

device shall independently stop the compressor motor if excessive temperature is sensed in any of the three windings.

H. Compressor bearings shall be aluminum insert, hydrodynamic, sleeve bearings with infinite life rating.

2.4 EVAPORATOR AND CONDENSER

A. Evaporator and condenser shall be of the shell-and-tube type, designed, constructed, tested and stamped in accordance with the requirements of the ASME Code, Section VIII, for unfired pressure vessels. Regardless of the operating pressure, the refrigerant side of each vessel will bear the ASME stamp indicating compliance with the code and indicating a tested pressure equal to 1.3 times the maximum operating pressure but not less than 100 psig. Reseating type spring loaded relief valves in accordance with ASHRAE-15 safety code, latest revision, shall be installed on both the evaporator and condenser. The evaporator shall be provided with single or multiple relief valves and the condenser shall be provided with dual valves equipped with a transfer valve between the dual valves to facilitate valves to facilitate valve replacement without loss of charge. Since total loss of charge is possible without the use of a reseating type valve, rupture discs are not acceptable. ASME U-1 documents shall be furnished by the manufacturer as part of the final acceptance by the engineer and as a part of the renewal parts data.

B. Each tube shall be integral externally finned seamless copper. Tubes shall be individually replaceable with tube ends rolled into the tube sheets and sealed with Loctite or approved equal. All tubes shall be securely fastened to the intermediate tube support sheets by means other than rolling the tubes into the intermediate tube support sheets.

C. The water side of each heat exchanger shall be designed, constructed, tested and stamped in accordance with ASME Section VIII. For working pressure above 150 psig, water side of the heat exchanger shall bear an ASME stamp. Taps for vents and drains shall be provided.

D. Evaporator shall have eliminators installed along its complete length above the tubes to prevent liquid refrigerant from entering the compressor.

E. Liquid refrigerant entering evaporator shall be distributed uniformly the entire length of shell and without direct impingement of high velocity refrigerant on tubes.

F. Liquid refrigerant flow shall be controlled by the self-metering thermal expansion valves. Minimum 3/4" bulls-eye sightglass to be located in the liquid line upstream of expansion device for the purpose of monitoring refrigerant flow and moisture indications.

G. Evaporator and condenser shall be enclosed in separate shells.

2.5 MICROPROCESSOR CONTROLLER

A. The unit shall be equipped with a complete microprocessor control system. This system shall consist of temperature and pressure (thermistor and transducer) sensors, Input/Output (I/O) boards, power supply board, main processor board with

display and keypad. Boards shall be individually replaceable for ease of service. All devices and sensors shall be factory mounted and wired.

B. The display shall be a liquid crystal display (LCD) providing all messages in plain English. The display shall be light emitting diode (LED) backlit for easy viewing in all light conditions.

C. The interface device shall be equipped with touch-sensitive membrane key switches

D. End user interaction with the display section of the interface shall provide the following information on the L:

1. Entering chilled water temp
2. Leaving chilled water temp
3. Entering condenser water temp
4. Leaving condenser water temp
5. Evaporator temp
6. Suction temp
7. Suction superheat temp
8. Discharge temp
9. Discharge superheat temp
10. Outside air temp
11. Motor amps (1 amp resolution)
12. Oil feed temp
13. Oil sump temp
14. Oil pressure
15. Condensing temp
16. Liquid line temp
17. Liquid subcooling
18. Condenser approach
19. Evaporator approach
20. Evaporator pressure
21. Condensing pressure
22. Lift pressure
23. Motor amps at % of RLA
24. Oil differential pressure
25. Total hours of operation
26. Number of starts
27. Hours since last start
28. Time of last start
29. Time of last stop
30. High discharge temp
31. Low evaporator temp
32. Soft load
33. Maximum pulldown
34. Remote amp limit
35. Manual amp limit
36. Network amp limit
37. Manual load
38. Maximum amp load
39. Minimum amp load
40. Leaving evaporator setpoint
41. Reset leaving setpoint
42. Remote reset signal
43. Fault history (last 8) with time/date stamp
44. Critical sensor valves at time of faults
45. Unit status
    a. Start-up sequence status
    b. Shutdown status
    c. Operational status

E. The microprocessor shall sense any abnormal condition and take the necessary anticipatory action to either unload or shut down the compressor. As a minimum the following safeties shall be incorporated in the control system and shall be indicated on the display:

1. Low discharge setpoint
2. High discharge setpoint
3. Low evaporator pressure - no load
4. Low evaporator pressure - unload
5. High discharge T - load
6. Condenser pressure low - freeze
7. Evaporator pressure load - freeze
8. Evaporator pump failure
9. Condenser pump failure
10. Low evaporator pressure – SD
11. Low oil delta pressure
12. Low oil feed temp
13. High oil feed temp
14. Low motor current
15. Failed stop - high amps
16. High discharge line temp
17. High condenser pressure
18. Mechanical high-pressure switch
19. High motor temp
20. Surge - high suction superheat
21. No starter transition
22. No evaporator water flow
23. No condenser water flow
24. Starter fault

25. Vanes open
26. Sensor failure
    a. Liquid line temp
    b. Discharge temp
    c. Condenser pressure
    d. Oil feed temp
    e. Oil sump temp
    f. Oil pressure

F. Leaving chilled water temperature shall be controlled to within ±0.2°F of setpoint. The microprocessor shall employ PI (proportional plus integral) control algorithms to ensure precise control without hunting, droop, or overshooting of the setpoint. End user shall input leaving chiller water temperature setpoint by interaction with the keypad and display.

G. The microprocessor shall limit the amp draw of the compressor to the rated load amps (RLA) or at a user selected value from 30 to 100% of RLA.

H. The microprocessor shall be capable of resetting the chilled water temperature either based on return chilled water temperature or a remote 4-20mA DC signal from an energy management system. The microprocessor shall also be capable of being demand limited locally from 30% to 100% RLA (1% increments) or from a remote 4-20mA DC signal from an energy management system.

I. The microprocessor shall incorporate a soft load function to prevent the compressor from operating at full load during the chilled water temperature pulldown period.

J. The microprocessor shall be equipped with a time clock to allow the end user to program a yearly schedule during the week, weekend, and holidays.

K. The control system shall have auto-restart after power failure and not require battery back-up or auxiliary power supply for maintaining program memory. The microprocessor shall have a battery backed-up time clock to ensure correct time of day input after power failure. The time clock function shall allow for time changes.

L. The microprocessor shall be capable of storing the current and previous eight safety shutdowns with a time/date stamp and recording a sensor data at the time of alarm.

M. The microprocessor shall be capable of starting the unit from a local or remote station.

N. Unit microprocessor shall be capable of controlling the chilled water and condenser water pumps through the use of factory supplied optically isolated output contacts.

O. Input/Output boards shall be optically isolated to prevent transients or wrong voltages from entering the board circuits. All field wiring shall be terminated at a separate, raised, clearly marked terminal strip.

P. The microprocessor shall be nonvolatile requiring no battery backup while maintaining all data even during an extended shutdown or power failure.

Q. The microprocessor shall have an auto-logging feature that will automatically log chiller
functions at time of daily peak load or a preset time and store up to six weeks of accumulated data.

R. The unit shall have a Service Test mode for troubleshooting hardware.

2.6 START-UP SERVICE

A. Manufacturer shall furnish a factory trained service technician without additional charge. The service technician shall perform the leak testing, evacuation, and dehydration using a high-quality vacuum pump furnished by the manufacturer. The standard triple evacuation procedure shall be used to insure complete removal of all water and non-condensables. Unit shall be evacuated to at least 500 microns and shall hold vacuum for a period of 12 hours with a maximum increase of 100 microns. Service technician shall submit a certified report to the consulting engineer on the above evacuation procedure. Units that are factory charged or shipped with a refrigerant holding charge will not require field evacuation and dehydration. Charging and start-up of the system shall proceed once the consulting engineer has approved the certified field evacuation and dehydration report.

2.7 MOTOR STARTER

A. The wye delta starters covered by this specification must comply with the requirements of all applicable National Electrical Manufacturers Association (NEMA) standards, and Underwriter Laboratory (U.L.) requirements. Accuracy standards for relay service shall be in accordance with the American Standards Institute (ANSI) Standard C57.13. Starter shall meet all federal, state and local codes.

B. Unless stated otherwise, all controllers are to be continuous duty AC magnetic type constructed in accordance with NEMA standards for Industrial Controls and Systems (ICS). Contactor shall be capable of carrying the specified current on a continuous basis without damage. The starter manufacturer shall have the overall responsibility to provide starters suitable for the motor load. Starters must be capable storage temperatures between -40□ C to 60□ C, operating temperatures between 0□ C to 40□ C and a maximum relative humidity of 95%.

C. The motor electrical characteristics are as follows:
   1. Type: Semi-Hermetic, squirrel cage induction, 3 phase, 50/60 Hertz, 2 pole.
   2. Speed: 3500 rpm at nominal rated shaft horsepower at 60 Hertz.
   3. Duty: Continuous for minimum of 15 years with a maximum number of starts expected at 15,000 and a minimum delay between starts of 20 minutes.
   4. Leads: Motor rated 600 volts and below will have six terminal and are suitable for use with wye-delta, full voltage across-the-line, and autotransformer of primary reactor/resistor starters with not less than 58% of incoming line voltage.

D. Starter shall be NEMA-1 enclosure designed for top and bottom cable entry and shall have front access with adequate working clearance for line and load wiring below 650 amperes and, where possible, sized to be compact. (Compact meaning 60" high X 36" wide X 22" deep.) Adequate separation of high and low voltage sections and proper mechanical and electrical interlocks will be provided to meet all applicable safety and operating codes.

E. Starter shall have a permanent nameplate mounted inside the cabinet showing manufacturer's identifying numbers, order number, voltage, phase, rated load amps and locked rotor amps, and overload trip settings. Starter shall have affixed to the inside of the door a complete, as built, wiring schematic showing all accessory items provided.

F. Starter shall include the following protective and metering devices:
   1. Motor overload trip.
   2. Under voltage/over voltage.
   3. Phase failure/reversal/unbalance protection.
   4. Line site voltage.
   5. Line side current.
   6. Line side power factor.
   7. Frequency.
   8. Kilowatts.
   9. Kilowatt hours.

G. Overload relays shall be IQ-1000-II microprocessor motor controller. There shall be an overload in each phase set a 107% of the rated load amps of the connected motor. Overloads shall be manual reset and shall be de-energize the main contactor when overcurrent occurs. Overload shall be adjustable and selected for mid-range. Overload shall be adjusted for locked rotor trip time of 8 seconds at full voltage (100% delta LRA) and must trip in 60 seconds or less at reduced voltage (33% of delta LRA).

2.8 CONTROL SYSTEM INTERFACE

A. The Microcomputer Control Center shall be provided with all equipment necessary for external communications utilizing BACNet interface or gateway. The interface shall provide full monitoring and control of all parameters and functions available through the chiller's control panel. All hardware, software, documentation, and operational parameters needed for this interface shall be provided.

2.9 REFRIGERANT ISOLATION

A. The condenser shell shall serve as a refrigerant receiver to store the system charge during servicing. Manually operated isolation valves shall be located at the inlet and outlet of the condenser. Valves shall be provided to facilitate removal of the refrigerant from the system should that be necessary. If the refrigerant cannot be isolated in the condenser, a separate refrigerant recovery and storage system shall be provided.

2.10 PAINTING

A. The exterior surfaces shall be protected with one coat of durable alkyd-modified, vinyl enamel, machinery paint.

2.11 SHIPPING PROTECTION

A. The manufacturer shall provide protective covering on compressor motor, control center, and
unit controls. The water nozzles shall be capped with fitted plastic closures.

2.12 OTHER FEATURES

A. The unit shall be completely assembled, with all main, auxiliary, and control piping piped, controls wired, leak tested, air run tested, and charged with oil and refrigerant. The relief device, and miscellaneous material may be packaged separately.

2.13 FACTORY INSULATION

A. Antisweat, 3/4" thick, flexible closed cell plastic insulation shall be factory applied with vapor-proof cement to cooler shell and tube sheets, oil cooler, refrigerant liquid distribution piping, suction connection, and as necessary to auxiliary tubing. This insulation shall prevent sweating in environments with relative humidities up to 75% and dry bulb temperatures ranging from 50□F to 90□F. The insulation shall be given one factory applied coat of solution vinyl paint.

2.14 ISOLATION

A. Neoprene isolation pads shall be supplied. The isolators shall be shipped loose for field installation at the four corners of the unit.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install chiller in accordance with manufacturer’s installation instructions.

B. Install chiller plumb and level, firmly anchored, and maintain manufacturer's recommend clearances for servicing and maintenance.

C. Pipe refrigerant relief valves to discharge outside the building per ASHRAE 15 (where applicable).

3.2 INSULATION

A. Field insulate cold surfaces not provided with factory insulation to prevent condensation. Use manufacturer's standard insulation material. Paint to match adjoining surfaces.

3.3 DEMONSTRATION

A. Provide the service of a factory authorized service representative to provide start-up service and to demonstrate and train the Owner's maintenance personnel as specified below.
   1. Start-Up Service: Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment. Perform lubrication service, including filling of reservoirs, and confirming that lubricant is of quantity and type recommended by manufacturer. Do not place chiller in sustained operation prior to initial balancing of mechanical system.
   2. Training: Provide 4 hours of onsite training for the Owner's maintenance personnel on start-up and shut-down procedures, troubleshooting procedures, and servicing and preventative maintenance schedules and procedures. Review with the Owner's personnel the data contained in the Operating and Maintenance Manuals.

END OF SECTION

SECTION 230700 - MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions, Division-1 Specification sections and other Division 23 specification sections, apply to work of this section.

1.2 RATING

A. All insulation systems, including jackets and adhesives shall be U.L. rated and FM approved. All insulation for indoor use shall have a maximum permanent flame spread rating of 25 or less and a smoke developed rating of 50 or less, as tested by ASTM E 84 (NFPA 255) method. Outdoor mechanical insulation may have flame spread index of 75 and smoke developed index of 150. Submit smoke and flame ratings for every material proposed for use.

B. Make: Certain Teed, Owens Corning, Johns Manville, Knauf and PPG.

1.3 SCOPE

A. Furnish and install insulation for the following: Note scope varies depending on alternates selected.
   1. Exterior condenser piping
   2. Interior chilled water and pumps if Alt M-1 taken
   3. Exterior make-up water piping

1.4 QUALITY ASSURANCE

A. Insulation contractor shall be member of either the National Insulation Association (NIA) or the Southeastern Insulation Contractors Association (SEICA).

1.5 SUBMITTALS

A. Submit evidence of membership in NIA or SEICA.

B. Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, and furnished accessories for each mechanical system requiring insulation.

C. Submit, if requested by Designer, manufacturer's sample of each piping insulation type required, and of each duct and equipment insulation type required. Affix label to sample completely describing product.

PART 2 - PRODUCTS

2.1 Type 1: Thermal Pipe Insulation with Jacket. Preformed Fiberglass Pipe insulation complying with ASTM C547, Class 3, rigid, molded pipe insulation, noncombustible.

Maximum K-factor of .24 at mean temperature of 75° F. All insulation shall have a jacket of white kraft paper reinforced with a glass fiber yarn and bonded to an aluminum foil, with self sealing longitudinal laps and butt strips. Jacket shall comply with ASTM C1136 (Type 1). Insulation and jacket shall be equal to Johns Manville Micro-Lok with AP-T Plus.

2.2 Insulate all fittings, valves and strainers with molded fittings, mitered segments of pipe insulation or over- sized pipe insulation held in place with wire. Finish in accordance with manufacturer's recommendations to comply with the UL Systems listing. Preformed jackets of PVC material as manufactured by Zeston, Inc., may be used at fittings.

A. Type 2: Flexible Pipe Insulation:
1. Material – Flexible, closed cell, elastomeric thermal insulation, minimum k value .27 at 75 degrees F. conforming to ASTM C 534.
2. Fittings - Sleeve type fitting covers and miter cut tubular form.
3. Insulation Adhesive – As recommended by manufacturer.
4. Make: Armstrong AP Armaflex, Rubatex No. R-180-J, or approved equal.

2.3 FIELD APPLIED JACKETS

A. PVC Plastic: Zeston 2000 or equal. One piece molded type fitting covers and jacketing material, gloss white.

B. Canvas Jacket: UL listed fabric, 6 oz/sq yd, plain weave cotton treated with dilute fire retardent lagging adhesive.

C. Aluminum Jacket: 0.016 inch thick sheet, corrugated finish, with longitudinal slip joints and 2 inch laps, die shaped fitting covers with factory attached protective liner.

D. Stainless Steel Jacket: Type 304 Stainless steel, 0.10 inch, corrugated finish.

2.4 TYPE 1 PIPE INSULATION THICKNESS

A. Insulate hot and chilled water pipe and condensate drain pipe sizes with wall thicknesses as indicated in the following table.

	1” and smaller	1 1/4” to 2”	2 1/2” to 4”	5” and larger	Runouts up to 2” diameter and 12’ long
Hot Water	1”	1 1/2”	1 1/2”	2” or larger	1-1/2”
Chilled or Condenser Water	1”	1 1/2”	1 1/2”	1 1/2”	1-1/2”
Condensate	1/2”	1/2”	1”	-	1/2”

2.5 TYPE 2 PIPE INSULATION THICKNESS

A. Insulate hot and chilled water pipe and condensate drain above corridor ceiling pipe sizes with wall thicknesses as indicated in the following table.

	1” and smaller	1 1/4” to 2”	Runouts up to 2” diameter and 12’ long

Hot Water	1/2”	1 ”	1”
Chilled Water	1/2”	1”	1”
Condensate	1/2”	1/2”	

2.6 DUCT INSULATION

A. Type A - Vapor Seal Duct Insulation
1. Material: Fiberglass duct wrap 1 lb. density with FSK facing complying with ASTM C1290. Maximum K-factor of .31 at 75ºF. Jacket shall be FSK aluminum foil reinforced with fiber glass yarn and laminated to fire resistant kraft paper, secured with UL listed pressure sensitive tape and outward clinch expanding staples and vapor barrier mastic. Johns Manville Microlite or equal by Owens Corning or Knauf.
2. Thickness shall be 2 inches.

B. Type B - Vapor Seal Duct Insulation - Rigid
1. Fiberglass ductboard complying with ASTM C612, Type I. 3 lb. density with maximum K-factor of 0.23 at 75ºF mean temperature. Jacket shall be FSK aluminum foil reinforced with fiber glass yarn and laminated to fire resistant kraft paper, secured with UL listed pressure sensitive tape and outward clinch expanding staples and vapor barrier mastic. Johns Manville 800 or equal by Owens Corning or Knauf.

C. Type E - Acoustic Insulation
1. Ductliner complying with ASTM C1071. Made from inorganic glass fiber, min. NRC 0.85, 1- inch thick, minimum R-value of 4.0. Johns Manville Permacote Linacoustic or equal by Owens Corning or Knauf.
2. The air stream surface shall have a 100% coverage coating of acrylic polymer formulated with an immobilized EPA registered anti-microbial agent proven resistant to microbial growth as determined by ASTM G21 and G22.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All insulation shall be applied by experienced pipe coverers and journeymen in accordance with best trade practice. Work shall be as recommended by manufacturer's latest printed installation directions. Test, inspect, and clean all surfaces to be insulated before applying insulation. Take all possible precautions to protect work of other trades. Provide protective covering as required to accomplish this and be responsible for returning all equipment and material to its original new condition and appearance where damage occurs due to neglect.

B. For refrigerant suction piping saddle shall be integral with pre-compressed, 12 to 20 percent density fiberglass segment as manufactured by Insulcoustic.

C. Where subjected to freezing, insulate piping with double the thickness specified in this section.

D. Apply adhesive to exposed risers to prevent slipping and turning.

E. Butt covering neatly to walls, floors, ceiling. Apply bands at end and position so

band covers gap between surface and insulation where exposed.

F. At butt ends of insulation the jacket material shall be pulled over exposed ends and secured with bands to give a neat and finished appearance. Exposed fiberglass material will not be permitted. In location where it will be exposed to view do not apply insulating cement until there is heat on lines.

G. Do not cover nameplates on equipment.

H. Do not insulate vibration eliminators.

I. Insulation on all cold surfaces must be applied with a continuous, unbroken vapor seal. Any hangers, supports, anchors, etc. that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation. Seal pipe terminations every four sections using Foster 30-35 or equal by Miracle or Mon-Eco Industries, Inc.

J. Provide PVC jacket on all exposed piping mounted below 10' in finished areas. Owner will select color from chart offered by manufacturer.

K. Provide aluminum jacket on all exterior piping.

L. Provide canvas jacket in mechanical rooms and on all exposed piping above 10’.

M. Insulation on piping below ground shall receive 15# felt paper wired every 12” O/C with 18 ga. Stainless steel wire. Felt paper shall be coated with an asphalt-based vapor and weather barrier equal to Chil-Pruf (CP-22/23/24) insulation coating manufactured by Childers Products Company, Inc. Felt and insulation coating shall continue for two feet where pipe comes up above ground.

N. Overlap aluminum jacket over the above-ground vapor barrier.

3.2 PIPE INSULATION SHALL BE APPLIED AS FOLLOWS

A. Type 1 - Thermal Pipe Insulation with Jacket.
1. Condensate drain piping from cooling coils.
2. Chilled water, hot water, piping installed above ground and inside building.

B. Type 2 - Flexible Pipe Insulation
1. Condensate piping and runout piping at contractor’s option

3.3 DUCT INSULATION SHALL BE APPLIED AS FOLLOWS

A. Type A - Vaporseal Duct Insulation.
1. All concealed supply air ducts or outdoor air ducts inside the building.
2. All concealed return air or outside air ducting in unconditioned spaces.

B. Type B - Vapor Seal Duct Insulation - Rigid.
1. Air conditioning return and supply air ducts and outdoor air located in the mechanical room or otherwise indicated on the drawings. Provide canvas jacket.

C. Type E- acoustical liner

1. NA

3.4 SPECIFIC REQUIREMENTS

A. Type A Insulation: Fiberglass duct wrap insulation shall be applied over clean, dry sheet metal duct. Before applying the insulation all joints and seams shall be sealed air tight. Duct wrap shall be installed to allow maximum fullness at corners. Minimum thickness at corners is one inch.

B. Insulation shall be butted tightly at joints and vapor barrier facing shall be overlapped at minimum of 2 inches. Insulation should be removed from lap prior to stapling.

C. All seams shall be stapled approximately 6 inches on center with outward clinching staples then sealed with a foil vapor barrier tape, or vapor barrier mastic.

D. Where ducts are over 24 inches in width, the duct wrap shall be additionally secured to the bottom of rectangular ducts with mechanical fasteners spaced on 18 inch centers (maximum), to prevent sagging of insulation. Seal penetrations so as to provide a vapor-tight system.

E. Insulation shall be installed according to manufacturer recommendations.

F. Insulation over the expansion joint and the flexible section shall be loose and of adequate length to permit the movement of pipe.

G. Provide insulation shield equivalent to Fee and Mason Fig. 81 at each support.

3.5 DO NOT INSULATE

A. Vibration eliminators.

END OF SECTION

SECTION 232123 - HVAC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

1.2 QUALITY ASSURANCE

A. HI Compliance: Design, manufacture, and install HVAC pumps in accordance with HI "Hydraulic Institute Standard".

B. UL Compliance: Design, manufacture, and install HVAC pumps in accordance with UL 778 "Motor Operated Water Pumps".

1.3 SUBMITTAL

A. Submit manufacturer's pump specifications, installation and start-up instructions, and current accurate pump characteristic performance curves with selection points clearly indicated.

PART 2 - PRODUCTS

2.1 FLEXIBLE COUPLED END SUCTION PUMPS

A. Pumps shall be base-mounted, single-stage, and end suction design with true back pull-out, capable of being serviced without disturbing piping connections, pump volute or motor.

B. Pump and motor shall be coupled with a drop-out spacer coupling capable of absorbing torsional vibration. The spacer shall be removable without disturbing the pump volute or the motor. An ANSI/OSHA compliant coupling guard shall completely enclose the coupling and rotating shaft.

C. Pump volute shall be cast iron with integrally-cast pedestal support. The impeller shall be cast bronze, enclosed-type, dynamically balanced, keyed to the shaft and secured by a locking cap-screw.

D. The liquid cavity shall be sealed off at the pump shaft by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 250 deg. F. A replaceable bronze shaft sleeve shall completely cover the wetted area under the seal. A stuffing box or externally flushed mechanical seal design with longer span between impeller centerline and first bearing centerline will not be allowed.

E. Pumps shall be rated for a minimum of 175 psi working pressure. Casings shall have gauge ports at nozzles and vent and drain ports at top and bottom of casing.

F. Pump bearing housing assembly shall have heavy-duty regreasable ball bearings, replaceable without disturbing piping connections, pump volute or motor, and, have

foot support at coupling end.

G. Base plate shall be of structural steel or fabricated steel channel configuration fully enclosed at sides and ends, with securely welded cross members and fully open grouting area. Contractor is to level and grout each unit according to manufacturer's instructions.

H. The motor shall meet NEMA specifications and shall be the size, voltage, enclosure, and efficiency called for on the plans and in section 15030.

I. Pump and motor shall be factory aligned, and shall be realigned by contractor after installation.

J. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.

K. Each unit shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner's reference.

L. End suction pumps shall be Series "1510" as manufactured by ITT Bell and Gossett or approved equal by Taco or Armstrong.

2.2 IN-LINE CIRCULATING PUMPS

A. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump shall be capable of being serviced without disturbing piping connections.

B. Pump body shall be of Class 30 cost iron, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports. Pumps shall have suction and discharge sizes as scheduled.

C. Impeller shall be non-ferrous material, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.

D. The liquid cavity shall be sealed from the pump bearing by an internally-flushed mechanical seal with ceramic seal seat and carbon seal ring, suitable for continuous operation at 250 deg. F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.

E. Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to damper staring torque and torsional vibrations shall be employed.

F. The motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans.

G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high grade machinery enamel prior to shipment.

H. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to pump for owner’s reference.

I. Pumps shall be Series 60" as manufactured by ITT Bell and Gossett or approved

equal by Taco or Grundfos.

J. Provide brass flanges of correct pipe thread size.

PART 3 - EXECUTION

3.1 INSTALLATION OF FLEXIBLE COUPLED END SUCTION PUMPS

A. The pump and motor shall be mounted on a common base plate of heavy structural steel design and securely welded cross members and open grouting area.

B. Install base mounted pumps on concrete housekeeping base.

C. Each unit shall be leveled and grouted according to the manufacturer's instructions before alignment and start-up.

D. Pull and trim the pump impeller after a proportional balance has been done by the balance contractor. Hydronic systems shall be balanced in a manner to first minimize throttling losses; then the pump impeller shall be trimmed. A balance report from the installer shall be furnished to the Code Enforcement Official and a copy included in the operating and maintenance manual.

E. Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by the manufacturer.

F. Alignment: Lubricate pumps before start-up. Start-up in accordance with the manufacturer’s instructions.

3.2 INSTALLATION OF IN-LINE CIRCULATING PUMPS

A. Install and support pump per manufacturer’s recommendation.

B. Provide access space around HVAC pumps for service as indicated, but in no case less than that recommended by the manufacturer.

END OF SECTION

SECTION 232160 - PIPES AND PIPE FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, Standard General Conditions of the Construction Contract, including Supplementary General Conditions and Division-1 Specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

A. Extent of pipes and pipe fittings required is indicated on drawings and/or specified in other Division-23 sections.

1.3 QUALITY ASSURANCE

A. Welding: Qualify welding procedures, welders and operators in accordance with ASME Boiler and Pressure Vessel Code, Section IX, for shop and project site welding of piping work. Owner reserves the right to perform nondestructive testing of welded pipe joints by radiographic inspection whether or not explicitly required by code.

B. All welding of piping up to the second stop shall be done by the holder of an ASME "PP" Stamp.

C. Owner reserves the right to utilize any testing procedure listed in Chapter VI ANSI/ASME B31.1 to verify structural integrity of any weld(s) not meeting Engineer's approval. If integrity of weld(s) is found to be in compliance with ANSI B31.1, Owner will pay for the additional testing cost. If weld(s) is found to be deficient, contractor shall be responsible for all costs associated with the testing and repair of the weld(s).

PART 2 - PRODUCTS

2.1 GENERAL

A. Where called for in the scope or where shown in drawings, use applicable products from those specified below. All pipes shall be American made.

B. Piping Materials: Provide pipe and tube of type, joint type, grade, size and weight (wall thickness or class) indicated for each service. Where type, grade or class is not indicated, provide proper selection as determined by Installer for installation requirements, and comply with governing regulations and industry standards.

C. Pipe/Tube Fittings: Provide factory fabricated fittings of type, materials, grade, class and pressure rating indicated for each service and pipe size. Provide sizes and types matching pipe, tube, valve or equipment connection in each case. Where not otherwise indicated, comply with governing regulations and industry standards for selections, and with pipe manufacturer's recommendations where applicable.

2.2 STEEL PIPES AND PIPE FITTINGS

A. Applications (Chilled and Hot Water – 2 1/2 inches and larger)
   1. Carbon Steel Pipe: Schedule 40 (minimum) ASTM A 53 for piping 4" and larger, A 106 or A 120 for piping 3" and smaller; except comply with ASTM A 53 or A 106 where close coiling or bending is required.
   2. Malleable-Iron Threaded Fittings: ANSI B16.3; plain or galvanized as indicated.
   3. Malleable-Iron Threaded Unions: ANSI B16.39; selected by Installer for proper piping fabrication and service requirements, including style, end connections, and metal-to-metal seats (iron, bronze or brass); plain or galvanized as indicated.
   4. Threaded Pipe Plugs: ANSI B16.14.
   5. Steel Flanges/Fittings: ANSI B16.5, including bolting and gasketing of the following material group, end connection and facing, except as otherwise indicated.
      a. Material Group: Group 1.1
      b. End Connections: Buttwelding
      c. Facings: Raised-face
   6. Forged-Steel Socket-Welding and Threaded Fittings: ANSI B16.11, except MSS SP-79 for threaded reducer inserts; rated to match schedule of connected pipe
   7. Pipe Nipples: Fabricated from same pipe as used for connected pipe; except do not use less than Schedule 80 pipe where length remaining unthreaded is less than 1-1/2", and where pipe size is less than 1-1/2", and do not thread nipples full length (e.g., no close-nipples)

2.3 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88; Type (wall thickness) as indicated for each service; hard-drawn temper, except as otherwise indicated.
   1. DWV Copper Tube: ASTM B 306.
   2. ACR Copper Tube: ASTM B 280.
   3. Cast-Copper Solder-Joint Fittings: ANSI B16.18.
   4. Wrought-Copper Solder-Joint Fittings: ANSI B16.22.
   5. Cast-Copper Solder-Joint Drainage Fittings: ANSI B16.23.
   6. Wrought-Copper Solder-Joint Draingage Fittings: ANSI 16.29.
   7. Cast-Copper Flared Tube Fittings: ANSI B16.26.
   8. Bronze Pipe Flanges/Fittings: ANSI 16.24.
   9. Copper-Tube Unions: Provide standard products recommended by manufacturer for use in service indicated.

2.4 MISCELLANEOUS PIPING MATERIALS/PRODUCTS

A. Provide welding materials to comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.

B. Provide Blue, Black or equal pipe joint compound.

C. Soldering Materials: Provide soldering materials as follows:
   1. Tin-Antimony Solder: ASTM B 32, Grade 95TA. (for pipe size 1-1/2" & under)
   2. Brazing Alloy: Silver 15%, copper 80%, phosphorous 5%. (for pipe size 2" and larger)
   3. Gaskets for Flanged Joints: ANSI B16.21; raised-face for steel flanges, unless otherwise indicated

2.5 DISSIMILAR PIPE UNIONS

A. Piping Connectors for Dissimilar Non-Pressure Pipe: Elastomeric annular ring insert, or elastomeric flexible coupling secured at each end with stainless steel clamps, sized for exact fit to pipe ends and subject to approval by plumbing code.

B. Piping Connectors for Dissimilar Pressure Pipe (Dielectric Union to be full-port, teflon seat ball brass valves): Provide brass ball valves to effectively isolate ferrous from non-ferrous piping (electric conductance), prevent galvanic action, and stop corrosion. Do not use rubber gasket type Dielectric Unions

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pipes and pipe fittings in accordance with recognized industry practices which will achieve permanently leak-proof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. All 90-degree elbows shall have long radius. Two 45-degree elbows in lieu of one 90-degree elbow are not permitted where short elbows are used. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance. Comply with ANSI B31 Code for Pressure Piping.

B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs unless such routing is clearly indicated on the drawings. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building. Provide manual air vents at all high points in the piping. Provide a system drain and drains at all low points in the piping to allow complete system drainage. All vent and drain piping within the mechanical room shall run down the wall to the floor drain with shut-off ball valves located four feet above the ground. All other vents shall be piped to a nearby location facing downwards.

3.2 PIPING SYSTEM JOINTS

A. Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) where recommended by pipe/fitting manufacturer, on male threads at each joint and tighten joint to leave not more than 3 threads exposed.

B. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.

C. Weld pipe joints in accordance with ASME B31.1 or ASME B31.9, as applicable.
   1. Welding: Pipe welding in sizes 2 inches and smaller may be either by the Manual Metallic Arc Process or the Oxyacetylene Welding Process and in sizes larger than 2 inches shall be by the Manual Metallic Arc Process with coated electrodes.
   2. All welding of steam piping shall be done in conformance with Chapter V of the latest edition of the ANSI/ASME Code for Power Piping B31.1.

D. Operators who are to do the welding must be properly qualified to do satisfactory work. Proof of an operator's qualifications shall be either the Contractor's record of suitable tests passed within the preceding 90 days while in the employ of the Contractor, or maintaining his qualifications by welding at least every 90 days since last test. Any workman considered by the Engineer as not having the skill necessary for the work shall be required to pass an appropriate qualification test or shall be at once barred from further welding on the job.

E. Joints shall be properly beveled, thoroughly cleaned of rust or other foreign matter, and degreased before welding. Metallic arc-welding electrodes shall conform to ASTM A233. Oxyacetylene welding rods shall be commercial steel gas welding rods and shall conform to ASTM A251, GA60.

F. All piping connections shall be with pre-manufactured fittings (T, elbow, etc.) or with "weldolets," "threadolets" or "sockolets." This includes instrumentation such as thermometer wells, etc.

G. "Weldolets" with outlet size 2-1/2" and larger and "Threadolets" or "Sockolets" with outlet size 2" and smaller may be used for branch takeoff up to one half (1/2) diameter of main. Use "Threadolets" where threaded fittings are specified and use "Sockolets" where socket weld fittings are specified. Materials of "Weldolets" and "Threadolets" shall match material of piping.

H. Mitered ells, welded branch connections, notched tees and "orange peel" reducers are not allowed. Unless specifically indicated, reducing flanges and reducing bushings are not allowed.

I. Flanged Joints: Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.

3.3 CLEANING, FLUSHING, INSPECTING

A. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coatings (if any). Flush out piping systems with clean water before proceeding with required tests. Flush system with water until it runs clean. If Owner desires, introduce chemicals provided by Owner unless specific section of this Division dictates otherwise. Fill, vent, and circulate system while increasing temperature. Drain and refill system. Clean all strainers and check valves, etc. before refilling. Inspect each run of each system for completion of joints, supports and accessory items. Remove start up strainers and leave for owner’s inspection.

B. Inspect pressure piping in accordance with procedures of ASME B31.1 or ASME B31.9, as applicable. Owner reserves the right to perform radiographic inspections

of welded joints in pressure piping.

3.4 PIPING TESTS

A. Test pressure piping in accordance with ASME B31.1 or ASME B31.9, as applicable. Minimum test pressure shall be 1-1/2 times the normal operating pressure or 100 psi, whichever is greater, unless otherwise indicated.

B. Notify Owner at least 24 hours in advance of pressure test to allow for Owner observation. If Owner is not properly notified, contractor shall repeat pressure test in Owner's presence.

END OF SECTION

SECTION 260000 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 This section is intended to supplement or modify the conditions and requirements defined in the General or Project Requirements given in the General Requirements.

A. All work, materials, etc., shall be furnished and installed, whether or not specifically shown on the drawings and/or called for in the specifications, which may be necessary to comply with all of the requirements, due to the exigencies of the work, to complete the work and the contract in a satisfactory and approved manner.

B. The work to be done under this contract shall consist of furnishing all equipment, labor, materials required for the items listed in the proposal, and/or as shown on the contract drawings, together with all devices, connectors, splices and appurtenances, required for a safe, clean, complete and ready for service, reliable, substantial and rugged working installation, to the satisfaction of the Engineer and to execute the intent of this contract and these specifications.

C. The Contractor shall be responsible for determining the proper connection points for all power, control, and signal wiring installed under this contract, regardless of whether the connection points are in equipment furnished under this contract, existing equipment, or equipment furnished by others. The Contractor shall include in his bid prices any field surveys, wire tracing or other work required to ascertain the proper connection points for all wiring.

D. It is the intent of these specifications that the Contractor shall furnish equipment and material which is suitable for the purpose and for installation in the location as is.

E. It is also the intent of the specification that the equipment, materials and accessories, as furnished, shall be complete in all respect and ready to operate.

F. The specifications cover the general design, construction arrangement, and certain particular features, but do not purport to cover all details entering into the design of the equipment and accessories.

G. Minor revisions in construction details will be made to accommodate equipment proposed and approved on the drawings thereof, submitted by the Contractor. Major revisions shall not be made nor shall equipment be submitted for approval which cannot be installed in structures of the approximate dimensions and character specified herein.

H. Further, it is also the intent of these specifications to provide a complete contract including items which may be omitted or not shown but which are considered normal and accepted engineering practice for this type of contract at no additional cost to the Owner.

I. All work shall be done in a thorough and workmanlike manner and shall conform to the best modern practice in the manufacture and installation of high-grade

equipment and materials. Wherever possible, all parts shall be made according to standard gauge to facilitate replacement and repair.

J. All materials furnished under these items shall be the best of their respective kinds and shall be free from defects in design and workmanship.

K. All materials or equipment not meeting the specified requirements shall be rejected, and shall be replaced at once by the Contractor with materials or equipment of the specified type and quality, at no cost to the Owner.

L. All materials for which no detailed specifications are given herein shall be of the quality and character best adapted and suitable for the purpose for which they are to be used and shall be subject to the approval of the Engineer.

M. Where any material or article or the maker or distributor thereof is specified by name, this is done for the purpose of more clearly describing the type or quality desired. Any material or article of equal quality, merit and performance, in the opinion of the Engineer, will be acceptable, if approval is given in writing.

N. All materials furnished and work done by the Contractor shall be subject to the inspection of the Engineer. Defective materials shall be removed from the site of the work and defective work repaired or replaced as directed. Facilities for handling and inspection of materials and equipment and for access to the work in progress, shall at all times be furnished by the Contractor.

O. Where any delay is encountered in carrying out work due to unfavorable operating conditions, the Contractor shall not be entitled to additional compensation therefore, but the time allowed equivalent to the period of actual delay.

1.2 DESCRIPTION OF WORK

A. Work includes all labor and electrical equipment to install the Cooling Tower.

B. Unless specifically dimensioned, the work shown on the drawings is diagrammatic, and is intended only to show general arrangement.

C. Include in the work, all accessories and devices necessary for the intended operation or perfection of any system, whether or not specifically shown or specified.

D. The term ″Furnish″ shall mean to obtain and supply to the job site. The term ″Install″ shall generally mean to fix in position and connect for use. Where language indicates that one party or trade is to ″install″ and another is to ″connect″, the term ″install″ shall mean only to fix in position, and ″connect″ shall mean to make electrical connections to. The term ″Provide″ shall mean to furnish and install.

E. Furnish all documentation, such as shop drawings, as-built drawings, operation and maintenance manuals, certification and perform all required testing as herein specified.

1. Testing & Start-Up: Asssit MC in startup of all equipment. Provide As-Built Documentation, start-up and test protocol.
2. As Built Documentation: Provide a minimum of (4) sets of Ring Binders per each system with the following minimal content:
    a. Floorplans, Partial Floorplans
    b. Elevations of Control Cabinets
    c. General schematic and detailed loops wiring diagrams and associate termination lists for the basement and 1st Floor wiring.
    d. CD with all programming and conclusive documentation. Every line of code shall be properly commented to facilitate future debugging and modifications.

1.3 STANDARD OF QUALITY

A. The specifications establish the standards of quality required, either by description or by references, to brand name, name of manufacturers or manufacturer's model number. All materials shall be new unless noted otherwise.

B. Where one product only is specifically identified by name or manufacturer's model number, the Contractor shall base his bid on the use of the named product. Where multiple names are used, the Contractor shall base his bid on the use of any of those products named.

C. The Contractor may submit, with his bid, the names of products which are proposed as substitutions for products named in the specifications. Each proposed substitution shall be accompanied by a written sum of money to be added or deducted from his bid. The Owner reserves the sole right to accept or reject said substitutions with or without cause.

D. When equipment and/or materials are proposed to be purchased from a manufacturer other than those specified, the Contractor shall provide complete data adequate for the Engineer's evaluation of the proposed substitution.

E. When the equipment other than that specified is used, the Contractor shall be responsible for any extra cost of required revisions such as structural steel, concrete, electrical, piping, etc. Such additional costs shall be identified at the time such substitutions are proposed.

1.4 SUBMITTALS

A. Engineer’s review of shop drawings is solely for the benefit of the Owner and in no way relieves the contractor from his obligations to furnish materials which satisfy the requirements of his contract and the design intent.

B. Shop drawings, product data and samples shall be submitted as required by the General Conditions or Project Requirements and as supplemented by this section.

C. When a specific specification section identifies that no submittal is required, the contractor shall provide the specified materials without submittals.

D. Provide to the Engineer, a schedule of shop drawing submissions identifying

submittal target dates.

E. The Contractor shall review, approve and submit shop drawings, with promptness so as to cause no delay in his work or in that of others. No submissions will be accepted by the Engineer without the signed review and approval of the Contractor.

F. The Contractor shall check and verify pertinent field measurements, and quantities of equipment and materials required.

G. Submittals shall be identified by reference to the drawing(s), section(s) of specifications, or equipment symbols to which they relate.

H. Shop drawings, when required, shall include:
1. Verification of information given in Contract Documents such as performance, dimensions, weight, materials, construction, types, models, manufacturer, etc.
2. Equipment layouts drawn to scale as may be required.
3. Wiring diagrams and schematics for equipment.
4. Any special construction conditions.
5. Other information/data as may be requested.

I. All submittals shall identify the specific details of the product or assembly. All optional features being provided or proposed shall be so noted or the submittal will be rejected.

J. The Engineer will return submittals with one of the following notations stamped thereon; REVIEWED, REVIEWED AS NOTED, REJECTED RESUBMIT.

K. Review is only for general conformance with the design concept of the project and general compliance with the information given in the contract documents. Any action shown is subject to the requirements of the plans and specifications. Contractor is responsible for:
1. dimensions which shall be confirmed and correlated at the job site.
2. fabrication processes and techniques of construction.
3. coordination of his work with that of all other trades.
4. the satisfactory performance of his work.

L. The work involved may proceed when submittals are marked REVIEWED or NO EXCEPTIONS TAKEN with no further submission required.

M. The work involved may proceed when submittals are marked REVIEWED AS NOTED providing corrections are made and submittals are resubmitted for record. Review does not authorize changes to Contract Sum unless stated in a separate letter or Change Order. In the event that any notes placed on the submittals by the Engineer are believed to result in a change in the Contract Sum, the Engineer shall be notified immediately and fabrication may not be undertaken until written authorization to proceed is issued by the Owner.

N. The work involved may not proceed when submittals are marked REVISE AND RESUBMIT. Submittals must be corrected and resubmitted for review.

O. Submittals marked REJECTED are not in accordance with the Contract

Documents and require a new submittal for review.

P. For items being resubmitted, clearly identify changes made from the initial submittal requested by the Engineer. The Engineer will review only those changes requested and identified by the Contractor.

1.5 PROTECTION OF WORK

A. Each Contractor is responsible for the protection of his materials, equipment, and completed work as defined in the General or Project Requirements and as supplemented herein.

B. All openings into any part of the conduit systems, all fixtures and equipment must be securely covered or otherwise protected to prevent damage due to dropped tools or materials, work by others or intrusion of grit, dirt, water, snow, ice or other foreign matter. Remove burrs, dirt, paint spots and debris. The Contractor shall be held responsible for all damage done to unprotected work or materials.

1.6 STEEL AND CONCRETE WORK FOR ELECTRICAL EQUIPMENT

A. Steel: Provide all miscellaneous steel supports and anchors required for equipment and materials installed under this Specification. Manual of Construction by American Institute of Steel Construction latest edition shall be followed in design and construction except that the second sentence of paragraph 4.2.1., Section 4 of Division 5, page 5-177 will not apply. Structural steel members shall conform to ASTM A36, and shall have a shop applied coat of rust inhibiting paint. Welding of steel shall conform to American Welding Society, Standard Code for Arc and Gas Welding in Building Construction. Bolts, nuts and washers for structural steel framing and concrete embedment shall be high tensile type minimum 3/4" diameter conforming to ASTM A325. Slotted-steel channel supports shall have flange edges turned toward web, and 9/16 inch diameter slotted holes at a maximum 2 inches o.c., in webs.

B. Channel depth: 2-1/2 inches minimum.

C. Channel thickness: Selected to suit structural loading.

D. Fittings and Accessories: Products of the same channel manufacturer. Channel supports and fittings shall be hot dip galvanized steel.

E. Concrete work and anchors: Refer to Section 16050 and Section 03300 for concrete work and anchors.

1.7 COUNTERFLASHING

A. Where conduits or other items pass through any roof, wall or other exterior component, provide counter flashing as required.

1.8 EQUIPMENT BY OTHERS

A. Summary of Work, together with other technical sections in the Project Manual, describe equipment that will be furnished by the Owner or from other sources.

B. The responsibility for setting, installation and protection of such equipment will be defined in other sections of the Project Manual.

C. Provide services rough-in for and make final connections to this equipment as shown and specified.

D. Provide coordination to assure clearances required for moving equipment to final location.

1.9 MOVING OF EQUIPMENT

A. Verify that electrical equipment will pass through all restricting openings, and when equipment or sections of equipment are larger than these openings, install this equipment prior to construction of enclosing walls, floors or roofs.

B. Use planking or cribbing as required to protect adjoining construction from damage.

C. Provide rigging and expert rigging personnel as required for equipment installation in difficult locations. Rigging shall include any necessary structural investigation and temporary structural support.

1.10 CUTTING AND PATCHING

A. Provide all openings through walls, floors and ceilings, etc. required for the installation of work defined on the drawings and specifications.

B. Following installation and testing, restore floors, walls and ceilings with materials equal to the original construction and finish to match existing surfaces.

C. Cutting and patching shall be performed only by tradesmen familiar with the construction involved.

1.11 IDENTIFICATION

A. Nameplates:
   1. Provide each new normal power load break switch, automatic transfer switch, starter, circuit breaker, panel, remote start-stop station, pilot light or safety switch with an engraved laminated black and white phenolic nameplate, white letters on black background. Provide similar emergency and normal/emergency equipment with an engraved laminated red and white phenolic nameplate, white letters on red background.
   2. Compose the legend so as to clearly indicate the function of the equipment. Letters and numbers to be at least 3/16 inch high.
   3. Locate the nameplate in a position so as to be clearly visible and secure with screws. Rivets and adhesives are not acceptable.
   4. Submit proposed nameplate legend for review.
   5. Provide a nameplate on the main switchgear indicating names of the electrical contractor and the engineer and project year.

B. Stenciling:
   1. Paint bright red, all exposed pull/splice boxes, conduits, duct banks and

raceways containing high voltage conductors over 600 volts.

2. Provide 1 inch high stenciling, white letters on red background as follows:
   a. ″HIGH VOLTAGE **** VOLTS″
3. The stenciling shall occur 10 feet on center on each side of the raceway and on the front face of pull/splice box.

1.12 FINAL ACCEPTANCE

A. The Contractor shall perform and complete work in accordance with the Contract Documents without fault or defect of any kind. In the absence of more specific directives, the work shall:
   1. be completed in a first class manner.
   2. be placed in a thoroughly clean and unmarred condition.
   3. be checked out in a step-by-step manner to ascertain that fastenings, controls, parts, safety devices, operating devices and other required appurtenances have been provided in accordance with the Contract Documents.
   4. be free of previously condemned or rejected parts and be properly restored to an acceptable condition.
   5. be adjusted for proper operation wherever adjustments or calibrations exist in the work.

B. All systems shall be operated to demonstrate that the requirements of the Contract have been met and that the systems have been adjusted and will operate in accordance therewith.

1.13 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish for review, three hard bound copies of complete written instructions for the operation, care and maintenance of each piece of equipment and/or system. Include recommended frequency of inspection, cleaning, oiling, greasing, and adjustment and other action as may be required in accordance with manufacturer's recommendations. Material shall include manufacturer's brochures, catalog cuts, parts lists, wiring diagrams, service organizations, etc.

1.14 PERMITS, FEES AND CERTIFICATES OF APPROVAL

A. Contractor shall acquire all permits and certificates. Submit a final inspection certificate from Middle-Atlantic Inspections or other NFPA affiliated agency with request for final payment.

B. Contractor shall provide all power, labor and instruments required for tests and cleaning of systems.

C. Whenever tests are required, three (3) copies of the test reports shall be submitted to the Engineer.

D. Tests may be observed by the Engineer or his representative. Notify the Engineer a minimum of three weeks in advance of test dates.

1.15 COMPLIANCE WITH CODES, STANDARDS AND REGULATIONS

A. In the absence of specific instruction in the technical specifications, equipment and installation shall conform to the following applicable codes, standards and regulations, latest editions:

1. American Society for Testing and Materials (ASTM)
2. American National Standard Institute (ANSI)
3. Underwriter's Laboratories, Inc. (UL)
4. American Welding Society Code (AWSC)
5. NFPA 70, ″National Electrical Code″, latest edition
6. National Electrical Manufacturer's Association (NEMA).
7. Occupational Safety and Health Act (OSHA).
8. National Fire Protection Association (NFPA).
9. National Electrical Safety Code (NESC)
10. National Building Code (BOCA) – 1996
11. Institute of Electrical and Electronics Engineers (IEEE)
12. Illuminating Engineering Society of North American (IESNA)
13. State and Local Building, Electric, and Fire Codes and Regulations.

1.16 PAINTING

A. Cabinet trims and similar prefabricated equipment shall be factory primed and finish painted with baked enamel in color selected. This equipment shall not be painted in the field unless the factory finishes have been marred or as otherwise directed. Do not paint over UL or similar labels or mechanical/electrical nameplates.

1.17 COORDINATION OF WORK

A. Coordinate installation of conduit runs and equipment with other trades and conditions in the building and participate in all coordinated shop drawings. Variance from work shown on drawings will be subject to approval. Where interference occurs and electrical work is directed to be relocated, provide such relocation without additional cost.

B. It is the System Integrator’s responsibility to coordinate with the manufacturers of all new and existing pieces of equipment the different aspects of their interfaces. All additional costs for equipment manufacturer’s redesign of interfaces caused by the System Integrator’s failure to properly coordinate all aspects of the interfaces shall be borne by the System Integrator.

1.19 ACCESS PANELS

A. Furnish access panels where required, to concealed pull boxes, junction boxes, or similar equipment located above dry wall board ceiling or behind walls. Installation of access panels shall be by mechanics of the pertinent trade under General Construction.

B. Access panels shall be 18" x 18" minimum, 16 gage wall or ceiling frame and a 14 gage panel door with not less than 1/8" fire proofing secured to the inside of the door. The door shall be provided with concealed hinges and cylinder lock, and prime-coated steel prepared for painting. Each door shall be capable of opening 180 degrees. Doors for wall panels shall be secured with suitable clips and counter sunk tamperproof screws.

C. Access panels shall have "label" fire rating equal to the ceiling or wall surface.

1.20 WARRANTY

A. The contractor and equipment manufacturers shall jointly guarantee all wiring and equipment to be free of defects in workmanship and material for a period of one year from the date of final acceptance, unless otherwise noted.

1.21 PROJECT RECORD DOCUMENTS

A. Maintain at job site, one copy of record documents and samples as required under the General Conditions of the Contract, including Drawings, Specifications, Addenda and Bulletins, Change Orders, Shop Drawings, Product Data and Samples, Field Orders, Field Test Records and Maintenance and Operating Manuals.

B. Provide files and racks for storage of documents. Maintain documents in a clean, dry legible condition and in good order. Do not use record documents for construction purposes. Make record documents and samples available during normal working hours for inspection.

C. Recording:
1. Label each document ″Project Record″ in neat large letters and provide final completion date.
2. Record information concurrently with construction progress.
3. Do not conceal any work until required information is recorded.

D. Record Drawings - legibly mark to record actual construction as follows:
1. A print set (blue-line or black-line) of contract drawing or shop drawing mark-ups of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawing are used for mark-up, record a cross reference at corresponding location on working drawings. Mark with red erasable pencil and, where feasible, use other colors to distinguish between variation in separate categories or work. Mark-up new information which is recognized to be of importance to 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. Note related change order numbers where applicable.
2. Record Specifications and Addenda, Bulletins, Requests for Information (RFI's) and Construction Clarification Sketches (CSK's) - legibly mark each Section to record:
    a. Any variations in actual work in comparison with text of specifications and modifications as issued. Give particular attention to substitutions, selection of options, and similar information work where it is concealed or cannot otherwise be readily discerned at a later date by direct observations. Note related record drawing information and product data, where applicable.
    b. Changes made by Field Order or by Change Order.

E. Product Data: Maintain one copy of each product data submittal, and mark-up significant variation in actual work in comparison with submitted information. Include both variations in product as delivered to site, and variations from manufacturer's instruction and recommendations for installation. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observations. Note related change orders and mark-up of record drawings and specifications.

F. Record Drawings Submittal at Project Completion: Organize record drawing sheets into manageable sets, bind with durable paper cover sheets and print suitable titles, dates and other identification on cover of each set. Transfer marking required by previous paragraphs to set of reproducible transparencies. Submit complete set of transparencies to the Design Professional and two sets of blue-line prints.

G. Product Data Submittal at Project Completion: Submit three sets of marked-up product data submittals for record purposes that include resolution of all review notes and field revisions.

H. Record Sample Submittals: Immediately prior to date of substantial completion Design Professional (and including Owner's personnel where desired) will meet with Contractor at site, and will determine which if any of submitted samples maintained by Contractor during progress of work are to be transmitted to Owner for record purposes. Comply with Design Professionals instruction for packaging, identification marking, and delivery to Owner's sample storage space.

I. Miscellaneous Record Submittals: Refer to other sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to date(s) of substantial completion, complete miscellaneous records and place in good order properly identified and bound or filed, ready for continued use and reference. Submit to Architect/Engineer for Owner's records.

J. Maintenance Manuals: Organize maintenance-and-operating manual information into three suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include:
1. emergency instructions
2. spare parts listing
3. warranties
4. wiring diagrams
5. recommended "turn-around" cycles
6. inspection and cleaning procedures
7. recommended frequency of testing
8. adjustment and any other maintenance requirements
9. shop drawings
10. product data
11. similarly applicable information.

K. Bind each manual of each set in heavy duty 2-inch, vinyl-covered ring binder, and include pocket folders for folded sheet information. Mark identification on both front and spine for each binder

END OF SECTION

SECTION 260075 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes electrical identification materials and devices required to comply with ANSI C2, NFPA 70, OSHA standards, and authorities having jurisdiction.

1.3 SUBMITTALS

A. No submittals

1.4 QUALITY ASSURANCE

A. Codes and Standards:
   1. Comply with ANSI C2.
   2. Comply with NFPA 70.
   3. Comply with ANSI A13.1 and NFPA 70 for color-coding.

1.5 PRODUCTS

A. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for m\mum size of letters for legend and for minimum length of color field for each raceway and cable size.
   1. Color: Black letters on orange field.
   2. Legend: Indicates voltage and service.

B. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl with legend overlaminated with a clear, weather- and chemical-resistant coating.

C. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).

E. Underground-Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape. Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick). Compounded for permanent direct-burial service. Embedded continuous metallic strip or core. Printed legend indicating type of underground line.

F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

G. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

1.6 NAMEPLATES AND SIGNS

A. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

B. Engraved Plastic Nameplates and Signs: Engraving stock, melamine plastic laminate, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes. Engraved legend with black letters on white face. Punched or drilled for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

D. Exterior Metal-Backed Butyrate Signs: Weather-resistant, non-fading, pre-printed, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

E. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32, stainless-steel machine screws with nuts and flat and lock washers.

1.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking, Type 6/6 nylon cable ties.
1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: According to color-coding.

B. Paint: Formulated for the type of surface and intended use.
1. Primer for Galvanized Metal: Single-component acrylic vehicle formulated for galvanized surfaces.
2. Primer for Concrete Masonry Units: Heavy-duty-resin block filler.
3. Primer for Concrete: Clear, alkali-resistant, binder-type sealer.
4. Enamel: Silicone-alkyd or alkyd urethane as recommended by primer manufacturer.

PART 2 - PRODUCT NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Identification Materials and Devices: Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations with corresponding designations in the Contract Documents or with those required by codes and standards. Use consistent designations throughout Project.

C. Sequence of Work: If identification is applied to surfaces that require finish, install identification after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before applying.

E. Install painted identification according to manufacturer's written instructions and as follows:
   1. Clean surfaces of dust, loose material, and oily films before painting.
   2. Prime surfaces using type of primer specified for surface.
   3. Apply one intermediate and one finish coat of enamel.

F. Color Banding Raceways and Exposed Cables: Band exposed and accessible raceways of the systems listed below:
   1. Bands: Pretensioned, wraparound plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
   2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
   3. Apply the following colors to the systems listed below:
      a. Fire Alarm System: Red.
      b. Fire-Suppression Supervisory and Control System: Red and Yellow.
      c. Combined Fire Alarm and Security System: Red and Blue.
      d. Security System: Blue and yellow.
      e. Mechanical and Electrical Supervisory System: Green and Blue.
      f. Telecommunication System: Green and Yellow.

G. Caution Labels for Indoor Boxes and Enclosures for Power and Lighting: Install pressure-sensitive, self-adhesive labels identifying system voltage with black letters on orange background. Install on exterior of door or cover.

H. Circuit Identification Labels on Boxes: Install labels externally.
   1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
   2. Concealed Boxes: Plasticized card-stock tags.
   3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

I. Color-Coding of Secondary Phase Conductors: Use the following colors for service feeder, and branch-circuit phase conductors:
   1. 208/120-V Conductors:
      a. Phase A: Black.
      b. Phase B: Red.
      c. Phase C: Blue.
   2. 480/277-V Conductors:
      a. Phase A: Brown.
      b. Phase B: Orange.
      c. Phase C: Yellow

3. Factory apply color the entire length of conductors, except the following field-applied, color-coding methods may be used instead of factory-coded wire for sizes larger than No. 10 AWG:
    a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors specified. Adjust tape bands to avoid obscuring cable identification markings.
    b. Colored cable ties applied in groups of three ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

J. Power-Circuit Identification: Metal tags or aluminum, wraparound marker bands for cables, feeders, and power circuits in vaults, pull and junction boxes, manholes, and switchboard rooms.
1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
2. Tag Fasteners: Nylon cable ties.
3. Band Fasteners: Integral ears.

K. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future
2. Indicate source and circuit numbers.
3. Multiple Power or Lighting Circuits in the Same Enclosure.
4. Identify each conductor with source, voltage, circuit number, and phase. Use color-coding to identify circuits' voltage and phase.

L. Multiple Control and Communication Circuits in the Same Enclosure:
1. Identify each conductor by its system and circuit designation.
2. Use a consistent system of tags, color-coding, or cable marking tape.

M. Apply warning, caution, and instruction signs as follows:
1. Warnings, Cautions, and Instructions: Install to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

N. Equipment Identification Labels: Engraved plastic laminate. Install on each unit of equipment, including central or master unit of each system. This includes power, lighting, communication, signal, and alarm systems, unless units are specified with their own self explanatory identification. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high. Use white lettering on black field. Apply labels for each unit of the following categories of equipment using mechanical fasteners:
1. Identification of some items listed below is required by NFPA 70.
2. Panelboards, electrical cabinets, and enclosures.
3. Access doors and panels for concealed electrical items.
4. Disconnect switches.

5. Enclosed circuit breakers.
6. Motor starters.
7. Push-button stations.
8. Contactors.
9. Remote-controlled switches.
10. Control devices.

END OF SECTION

SECTION 260080 - ELECTRICAL TESTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes general requirements for electrical field testing and inspecting. Detailed requirements are specified in each Section containing components that require testing. General requirements include the following:
   1. Qualifications of testing agencies and their personnel.
   2. Suitability of test equipment.
   3. Calibration of test instruments.
   4. Coordination requirements for testing and inspecting.
   5. Reporting requirements for testing and inspecting.

B. Allowances: Electrical tests and inspections specified in various Division 23 and 26 Sections are covered by a testing and inspecting allowance specified in Division 1 Section "Allowances." See Division 1 Section "Allowances" for what is included in allowance amount, the amount of the allowance, payment procedures for allowances, changes to allowance amounts, and disposition of unused portions of allowance.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: As specified in each Section containing electrical testing requirements and in subparagraph and associated subparagraph below.
   1. Independent Testing Agencies: Independent of manufacturers, suppliers, and installers of components to be tested or inspected.
   2. Testing Agency's Field Supervisor for Power Component Testing: Person currently certified by the International Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Division 26 power component Sections.

B. Test Equipment Suitability: Comply with NETA ATS, Section 5.2.

C. Test Equipment Calibration: Comply with NETA ATS, Section 5.3.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL TESTS AND INSPECTIONS

A. If a group of tests are specified to be performed by an independent testing agency, prepare systems, equipment, and components for tests and inspections, and perform preliminary tests to ensure that systems, equipment, and

components are ready for independent agency testing. Include the following minimum preparations as appropriate:

1. Perform insulation-resistance tests.
2. Perform continuity tests.
3. Perform rotation test (for motors to be tested).
4. Provide a stable source of single-phase, 208/120-V electrical power for test instrumentation at each test location.

B. Test and Inspection Reports: In addition to requirements specified elsewhere, report the following:

1. Manufacturer's written testing and inspecting instructions.
2. Calibration and adjustment settings of adjustable and interchangeable devices involved in tests.
3. Tabulation of expected measurement results made before measurements.
4. Tabulation of "as-found" and "as-left" measurement and observation results.

END OF SECTION

SECTION 260120 - CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
   1. The Terms ″Listed″ and ″Labeled″ as defined in NDPA 70, Article 100.
   2. Listing and Labeling Agency Qualifications: A ″Nationally Recognized Testing Laboratory″ as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for 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, the manufacturers specified.

2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 CONDUCTORS AND CABLES

A. Manufacturers:
1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Rome Cable Company.

B. Refer to Part 3 "Conductor and Insulation Applications" Article for insulation type, cable construction, and ratings.

C. Conductor Material: Copper complying with NEMA WC 5 or 7; solid conductor for No. 10 AWG and smaller, stranded for No. 8 AWG and larger.

D. Conductor Insulation Types: Type THW, THHN-THWN, XHHW and SO complying with NEMA WC 5 or 7.

2.3 CONNECTORS AND SPLICES

A. Manufacturers:
1. AFC Cable Systems, Inc.
2. AMP Incorporated/Tyco International.
3. Hubbell/Anderson.
4. O-Z/Gedney; EGS Electrical Group LLC.
5. 3M Company; Electrical Products Division.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATIONS

A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.

B. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Feeders Concealed in Concrete, below Slabs-on-Grade, and in Crawlspaces: Type XHHW-2, single conductors in raceway.

D. Exposed Branch Circuits, including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

E. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

F. Branch circuit homeruns exposed or concealed: Type THHN-THWN, single conductors in EMT or RMC.

G. Cord Drops and Portable Appliance Connections: Type SO, hard service cord.

H. Fire Alarm Circuits: Type THHN-THWN, in raceway or Power-limited, fire-protective, signaling circuit cable in steel armor spiral cover.

I. Class 1 Control Circuits: Type THHN-THWN, in raceway.

J. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

3.2 INSTALLATION

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Support cables according to Division 26 Section "Basic Electrical Materials and Methods."

F. Seal around cables penetrating fire-rated elements according to Division 7 Section "Through-Penetration Firestop Systems."

G. Identify and color-code conductors and cables according to Division 26 Section "Electrical Identification."

H. Direct burial cable is not allowed unless otherwise noted in drawings.

I. NMC and MC/AC cable are not allowed.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in
UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

3.4 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:
1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.

2. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Test Reports: Prepare a written report to record the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

END OF SECTION

SECTION 260130 - RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

B. Related Sections include the following:
1. Division 2 Section "Underground Ducts and Utility Structures" for exterior ductbanks, manholes, and underground utility construction.
2. Division 7 Section "Through-Penetration Firestop Systems" for fire-stopping materials and installation at penetrations through walls, ceilings, and other fire-rated elements.
3. Division 26 Section "Basic Electrical Materials and Methods" for supports, anchors, and identification products.
4. Division 26 Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. FMC: Flexible metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquidtight flexible metal conduit.

E. RMC: Rigid Metal Conduit.

F. RNC: Rigid nonmetallic conduit. (Typically PVC)

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways, boxes, enclosures, cabinets, and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 METAL CONDUIT AND TUBING

A. Manufacturer:
1. AFC Cable Systems, Inc.
2. Alflex Inc.
3. Anamet Electrical, Inc.; Anaconda Metal Hose
4. Electri-Flex Co.
5. Grinnell Co. /Tyco International; Allied Tube and Conduit Div.
6. LTV Steel Tubular Products Company
7. Manhattan/CDT/Cole-Flex
8. O-Z Gedney; Unit of General Signal
9. Wheatland Tube Co.

B. Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT and Fittings: ANSI C80.3.
1. Fittings: Compression type.

E. FMC: Zinc-coated steel.

F. LFMC: Flexible steel conduit with PVC jacket.

G. Fittings: NEMA FB 1; compatible with conduit and tubing materials.

2.3 METAL WIREWAYS

A. Manufacturer:
1. Hoffman
2. Square D

B. Material and Construction: Sheet metal sized and shaped as indicated, NEMA 1 or 3R.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.

E. Wireway Covers: Screw cover type, Flanged and gasketed type at exterior.

F. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard grey finish coat.
Manufacturer:
1. Walker Systems, Inc.; Wiremold Company (The).
2. Wiremold Company (The); Electrical Sales Division.

B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.5 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturer:
1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Emerson/General Signal; Appleton Electric Company
3. Erickson Electrical Equipment Co.
4. Hoffman
5. Hubbell, Inc.; Killark Electric Manufacturing Co.
6. O-Z/Gedney; Unit of General Signal
7. RACO; Division of Hubbell, Inc.
8. Robroy Industries, Inc.; Enclosure Division
9. Scott Fetzer Com.; Adalet-PLM Division
10. Spring City Electrical Manufacturing Co.
11. Thomas & Betts Corporation
12. Walker Systems, Inc.; Wiremold Company (The)
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover

D. Nonmetallic Outlet and Device Boxes: NEMA OS 2

E. Floor Boxes: Cast metal, fully adjustable, rectangular

F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1

G. Cast-Metal Pull and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover

H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch

I. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

J. Nonmetallic Enclosures: Plastic finished inside with radio-frequency-resistant paint.

K. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage and include accessory feet where required for freestanding equipment.

2.6 FACTORY FINISHES

A. Finish: For raceway, enclosure or cabinet components provide manufacturer's standard prime-coat finish ready for field painting.

B. Finish: For raceway, enclosure or cabinet components provide manufacturer's standard gray paint applied to factory-assembled surface raceways, enclosures, and cabinets before shipping.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Outdoors:
1. Exposed: Rigid steel or IMC.
2. Concealed: Rigid steel or IMC.
3. Underground, Single Run: RMC or RNC.
4. Underground, Grouped: RMC or RNC.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
6. Boxes and Enclosures: NEMA 250, Type 3R or 4.

B. Indoors:
1. Exposed: EMT.
2. Concealed: EMT.
3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
   a. FMC; except use LFMC in damp or wet locations.
   b. Damp or Wet Locations: Rigid steel conduit.
4. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
   a. Damp or Wet Locations: NEMA 250, Type 4.
5. Minimum Raceway Size: 3/4-inch trade size (DN 21)
6. Raceway Fittings: Compatible with raceways and suitable for use and location.
7. Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated
8. Install nonferrous conduit or tubing for circuits operating above 60 Hz.

3.2 INSTALLATION

A. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping. Complete raceway installation before starting conductor installation. Support raceways as specified in Division 16 Section "Basic Electrical Materials and Methods." Install temporary closures to prevent foreign matter from entering

raceways. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portions of bends are not visible above the finished slab. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and keep straight legs of offsets parallel, unless otherwise indicated. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated. Install concealed raceways with a minimum of bends in the shortest practical distance, considering type of building construction and obstructions, unless otherwise indicated.

B. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

C. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

D. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
   2. Where otherwise required by NFPA 70.

E. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

F. Flexible Connections: Use maximum of 54 inches (1830 mm) of flexible conduit for device connections:
   1. For equipment subject to vibration, noise transmission, or movement.
   2. For all motors.
   3. Use LFMC, with watertight hubs, in damp or wet locations. Install separate ground conductor across flexible connections.

G. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture ground terminals.

H. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.3 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended

by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.4 CLEANING

A. After completing installation of exposed, factory-finished raceways and boxes, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 260410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers, rated 600 V and less, used for disconnecting and protection functions.

B. See Division 262813 Section "Fuses" for fuses for fusible disconnect switches.

1.2 SUBMITTALS

A. Product Data and shop drawings: For each type of switch and circuit breaker.

B. Field quality-control test reports.

C. Operation and maintenance data.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Source Limitations: Obtain switches and circuit breakers through one source from a single manufacturer.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton Corp.; Cutler-Hammer Products.
      b. General Electric Co.; Electrical Distribution & Control Division.
      c. Square D Co.

2.2 ENCLOSED SWITCHES

A. Enclosed, Non-fusible Switch: NEMA KS 1, Type HD and HP, with lockable handle, interlocked with cover.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD and HP, with clips to accommodate specified fuses, and lockable handle, interlocked with cover.

C. Exterior mounted switches: NEMA 3R rated enclosures with watertight hubs.

D. Corrosive environments, Kitchens or Division 2 locations: NEMA 4X-SS, Type HD and HP with watertight hubs

2.3 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger. KAIC ratings as required by system conditions.
   2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
   3. Current-Limiting Circuit Breakers: Frame sizes 600 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
   4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.
   1. Lugs: Suitable for number, size, trip ratings, and material of conductors.
   2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.
   3. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   4. Shunt Trip: 120-V trip coil (unless otherwise noted) energized from separate circuit, set to trip at 75 percent of rated voltage.

2.4 ENCLOSURES

A. Listed for environmental conditions of installed locations, including:
   1. Outdoor Locations: NEMA 250, Type 3R/12.
   2. Food Service Areas: NEMA 250, Type 4X, stainless steel.
   3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Temporary Provisions: Remove temporary lifting provisions and blocking of moving parts.

B. Identify components; provide warning signs as specified in Division 260510 Section "Common Work Results."

3.2 FIELD QUALITY CONTROL

A. Testing: After installing disconnect switches and circuit breakers and after

electrical circuits have been energized, demonstrate product capability and compliance with requirements.

B. Inspections and Tests for Switches and Circuit Breakers: Make internal and external inspections and perform tests, including the following:
   1. Inspect for freedom from physical damage, proper unit rating, mechanical condition, enclosure integrity, cover operation, unit anchorage, clearances, and tightness of electrical connections. If a loose electrical connection is observed on any unit, check each electrical connection for each switch and circuit breaker with a torque wrench for compliance with manufacturer's torquing instructions.
   2. Test insulation resistance of each pole, phase-to-phase, and phase-to-ground, following manufacturer's written instructions. Test insulation resistance of shunt trip circuits. Use 500-V minimum test voltage for units and circuits rated up to 250 V, 1000-V minimum test voltage for units rated more than 250 V. Measured insulation resistance must be 25 megohms, minimum, for switches rated up to 250 V, and 100 megohms, minimum, for switches rated more than 250 V.
   3. Test cover and other interlocks and interlock release devices for proper operation.

C. Additional Inspections and Tests for Switches: Include the following:
   1. Inspect for proper rating and fuse provisions.
   2. Check adequacy and integrity of fuse-holders.
   3. Check integrity of phase barriers.
   4. Inspect blade alignment visually while operating switch to observe adequacy of blade pressure.

D. Additional Inspections and Tests for Circuit Breakers: Include the following:
   1. Inspect for proper frame, trip, and fault current interrupting rating.
   2. Test shunt trip devices, circuits, and actuating components for proper operation.

E. Correct defective and malfunctioning units on-site, where possible, and re-inspect and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION

SECTION 260501 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Supporting devices for electrical components.
   2. Concrete equipment bases.
   3. Cutting and patching for electrical construction.
   4. Touchup painting.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.4 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
   1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

C. Coordinate electrical service connections to existing transformer.
   1. Coordinate installation and connection of exterior underground utilities and services.

D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."

E. Coordinate electrical connections by mechanical contractor. Reference mechanical specification 230530, Section 1.02.

PART 2 - PRODUCT

2.1 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- diameter slotted holes at a maximum of 2 inches o.c., in webs.
   1. Channel Thickness: Selected to suit structural loading.

D. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

E. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

F. Cable Supports for Vertical Conduit: Factory fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.

G. Expansion Anchors: Carbon steel wedge or sleeve type.

H. Toggle Bolts: All steel springhead type.

2.2 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or non-metallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Selection of Supports: Comply with manufacturer's written instructions.

D. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.3 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening
methods are indicated:
1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Light Steel: Sheet-metal screws.
6. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.4 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.5 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:
Supporting devices for electrical components.
2. Cutting and patching for electrical construction.
3. Touchup painting.

3.6 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.7 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect

exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

C. Protect all open device boxes from painter's sprays.

END OF SECTION

SECTION 260510 - GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

1.3 SUBMITTALS

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

B. Field Test Reports: Submit written test reports to include the following:
1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467.

PART 2 - PRODUCTS

2.1 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 260120 Section "Conductors and Cables."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Bare Copper Conductors: Comply with the following:
1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

E. Copper Bonding Conductors As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

F. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2.2 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

PART 3 - EXECUTION

3.1 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install an insulated green copper equipment ground in all branch circuits and feeders.

3.3 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Conductors shall be in EMT conduit, bond conduit at both ends with
approved bonding bushings and #6.

B. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a

disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

C. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following: Single and duplex receptacles, including ground-fault circuit interrupters.
   1. Single and double-pole snap switches.
   2. Device wall plates.
   3. Floor service outlets.

1.3 SUBMITTALS

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

B. Shop Drawings: List of legends and description of materials and process used for pre-marking wall plates.

C. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device through one source from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. Straight-Blade-Type Receptacles: Comply with NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.

B. Straight-Blade and Locking Receptacles: Heavy-duty grade, 20 Amp.

C. GFCI Receptacles: Straight blade, non-feed-through type, heavy-duty grade, with integral NEMA WD 6, Configuration 5-20R duplex receptacle; complying with

UL 498 and UL 943. Design units for installation in a 2-3/4-inch- deep outlet box without an adapter.

D. Receptacles shall have separate hex-head grounding screw terminals.

E. Special purpose receptacles to match NEMA designations of various manufacturers' plugs.

2.2 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
   1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-jacket; with green-insulated grounding conductor and equipment rating ampacity plus a minimum of 30 percent.
   2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.3 SWITCHES

A. Single, Double-Pole, or 3 Way Switches: Comply with DSCC W-C-896F and UL 20.

B. Snap Switches: Heavy-Duty grade, quiet type, 20 Amp.

C. Switches shall have separate hex-head grounding screw terminals.

2.4 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: Brushed Stainless Steel.
   3. Material for Unfinished Spaces: Galvanized steel, with rolled edges to match box size.
   4. Material for Wet Locations: Cast aluminum with spring-loaded lift-cover, and listed and labeled for use in "wet locations" and "rain-tight while in use".

2.5 FINISHES

A. Color:
   1. Wiring Devices Connected to Normal Power System: Grey, unless otherwise indicated or required by NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install devices and assemblies level, plumb, and square with building lines.

B. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

C. Remove wall plates and protect devices and assemblies during painting.

D. Adjust locations of floor service outlets to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Electrical Identification."
   1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 CONNECTIONS

A. Ground equipment according to Division 26 Section "Grounding and Bonding."

B. Connect wiring according to Division 26 Section "Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturers published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:
   1. After installing wiring devices and after electrical circuitry has been energized, test for proper polarity, ground continuity, and compliance with requirements. Test GFCI receptacle operation with both local and remote fault simulations according to manufacturer's written instructions. Operation of the GFCI trip shall not interrupt power to any other receptacle on circuit unless otherwise noted.

B. Remove malfunctioning units, replace with new units, and retest as specified above.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product Data: Catalog sheets, specifications and installation instructions.

1.2 MAINTENANCE

A. Spare Parts:
   1. Six spare fuses of each size and category, including any accessories required for a complete installation.
   2. Special tools if required for installation or removal of fuses.

PART 2 - PRODUCTS

2.1 FUSEHOLDERS

A. Equipment provided shall be furnished with fuseholders to accommodate the fuses specified.

2.2 FUSES RATED 600V OR LESS

A. Fuses for Safety Switches (Lighting and Heating Circuits):
   1. Cartridge Type (250 Volts): Single element, UL Class RK-1, 200,000 amperes R.M.S. symmetrical interrupting capacity:
      a. Cooper Industries Inc./Bussmann Div., Type KTN-R.
      b. Gould Inc./Circuit Protection Div. (Shawmut) Type A2K-R.
      c. Littlefuse Inc. Type KLN-R.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses, in identical sets, in readable orientation.

B. Verify that fuse clips fit tightly on fuse.

C. Provide minimum of 10% spare fuses to owner’s on site rep.

END OF SECTION