CITY OF ANN ARBOR

INVITATION TO BID

FULLER POOL BOILER REPLACEMENT

ITB # 4315
Due Date: December 19, 2013 On or Before 2:00 P.M.

Public Services Area/Field Operations Unit
Administering Service Area/Unit

Issued By:

City of Ann Arbor
Procurement Unit
301 E. Huron Street
Ann Arbor, MI 48107

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ADVERTISEMENT
FOR THE
FULLER POOL BOILER REPLACEMENT
CITY OF ANN ARBOR

ITB NO. 4315

Sealed Bids will be received by the City of Ann Arbor Procurement Unit, 301 East Huron Street, Fifth Floor, Larcom City Hall, on or before Thursday, December 19, 2013 by 2:00 PM (Local Time) for the construction of Fuller Pool Boiler Replacement. Bids will be publically opened and read aloud at this time.

A pre-bid conference will be held Tuesday, December 10, 2013 at 10:00 AM at the Fuller Pool located at 1519 Fuller Road, Ann Arbor, Michigan 48105, followed by a site visit. Attendance is highly recommended.

Work to be done includes: replacement of an existing boiler including all necessary demolition, piping, ducting, roof penetrations, roof repair, all mechanical, plumbing, gas, electrical, start-up, testing, training and all related work necessary for a complete and full operational system.

Bid documents, plans, specifications, and addenda shall be downloaded by Bidders at either of the following websites: Michigan Inter-governmental Trade Network (MITN) www.mitn.info or City of Ann Arbor Purchasing website: www.A2gov.org. It is the Bidder's responsibility to verify they have obtained all information before submitting a bid.

Each Bid shall be accompanied by a certified check, or Bid Bond by a recognized surety, in the amount of 5% of the total of the bid price. A Bid, once submitted, becomes the property of the City. In the sole discretion of the City, the City reserves the right to allow a bidder to reclaim submitted documents provided the documents are requested and retrieved no later than 48 hours prior to the scheduled bid opening.

The successful Bidder will be required to furnish satisfactory performance and labor and material bonds in the amount of 100% of the bid price and satisfactory insurance coverage.

Precondition for entering into a Contract with the City of Ann Arbor is compliance with Chapter 112 of Title IX of the Code of the City of Ann Arbor. The successful Bidder may also be required to comply with Chapter 23 of Title I of the Code of the City of Ann Arbor. Further information is outlined in the Contract Documents. All bidders are required to complete and submit the City of Ann Arbor Conflict of Interest Disclosure Form with the bid.

After the time of opening, no Bid may be withdrawn for a period of 90 days. The City reserves the right to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

Technical questions regarding this project may be submitted in writing to the Consulting Engineer, Stantec Consulting, Attn: Glen Wiczorek, PE via email at glen.wiczorek@stantec.com. Questions by telephone call are prohibited. Technical questions directed to the Owner are prohibited. The deadline for questions shall be seven (7) calendar days before bids; questions are due on or before Thursday, December 12, 2013 at 5:00 PM. Questions will not be received after this date.

Any further information on bid documents may be obtained from the Procurement Office, (734) 794-6500.

CITY OF ANN ARBOR PROCUREMENT UNIT

NOTICE OF PRE-BID CONFERENCE

A pre-bid conference for this project will be held on Tuesday, December 10, 2013 at 10:00 AM at the Fuller Pool located at 1519 Fuller Road, Ann Arbor, Michigan 48105. A site visit will follow the pre-bid conference to allow potential bidders the opportunity to view the project site. This will be the only opportunity for bidders to view the project site.

Attendance at this conference is highly recommended. Administrative and technical questions regarding this project will be answered at this time. The pre-bid conference is for information only. Any answers furnished will not be official until verified in writing by the Financial Service Area, Procurement Unit. Answers that change or substantially clarify the bid will be affirmed in an addendum.

INSTRUCTIONS TO BIDDERS

General

Work to be done under this Contract is generally described through the detailed specifications and must be completed fully in accordance with the contract documents. All work to be done under this Contract is located in or near the City of Ann Arbor.

The City shall make available to all prospective Bidders, prior to receipt of the Bids, access to the area in which the work is to be performed. Advance notice should be given to the Administering Service Area/Unit in cases where access to the site must be arranged by the City.

Any Bid which does not conform fully to these instructions may be rejected.

Preparation of Bids

Bids should be prepared providing a straight-forward, concise description of the Bidder's ability to meet the requirements of the ITB. Bids shall be written in ink or typewritten. No erasures are permitted. Mistakes may be crossed out and corrected and must be initialed and dated in ink by the person signing the Bid.

Bids must be submitted on Page Numbers ITB 1-3 and on the "Bid Forms" provided with each blank properly filled in. If forms are not fully completed it may disqualify the bid.

Each person signing the Bid certifies that he/she is the person in the Bidder's firm/organization responsible for the decision as to the fees being offered in the Bid and has not and will not participated in any action contrary to the terms of this provision.

Questions or Clarification on ITB Specifications

All questions regarding this ITB shall be submitted via email. Emailed questions and inquires will be accepted from any and all prospective Bidders in accordance with the terms and conditions of the ITB.

All questions shall be submitted by Thursday, December 12, 2013 at 5:00 PM and should be addressed as follows:

Specification/Scope of Work questions emailed to glen.wiczorek@stantec.com
Bid Process and HR Compliance questions emailed to KLancaster@a2gov.org.

Addenda

If it becomes necessary to revise any part of the ITB, notice of the Addendum will be posted to Michigan Inter-governmental Trade Network (MITN) www.mitn.info and/or City of Ann Arbor web site www.A2gov.org for all parties to download.

Each Bidder must in its Bid, to avoid any miscommunications, acknowledge all addenda which it has received, but the failure of a Bidder to receive, or acknowledge receipt of; any addenda shall not relieve the Bidder of the responsibility for complying with the terms thereof.

The City will not be bound by oral responses to inquiries or written responses other than written addenda.

Bid Submission

All Bids are due and must be delivered to the City of Ann Arbor Procurement Unit on or before Thursday, December 19, 2013 by 2:00 PM. Bids submitted late or via oral, telephonic, telegraphic, electronic mail or facsimile **will not** be considered or accepted.

Each Bidder must submit one (1) original Bid and two (2) additional Bid copies in a sealed envelope clearly marked: **ITB No. 4315 – Fuller Pool Boiler Replacement.**

Bids must be addressed and delivered to:

City of Ann Arbor
Procurement Unit, 5th Floor
301 East Huron Street
P.O. Box 8647
Ann Arbor, MI 48107

All Bids received on or before the Due Date will be publicly opened and recorded immediately. No immediate decisions are rendered.

Hand delivered Bids will be date/time stamped/signed by the Procurement Unit at the address above in order to be considered. Normal business hours are 9:00 a.m. to 3:00 p.m. Monday through Friday, excluding Holidays. The City will not be liable to any Bidder for any unforeseen circumstances, delivery or postal delays. Postmarking to the Due Date will not substitute for receipt of the Bid. Each Bidder is responsible for submission of their Bid.

Additional time for submission of bids past the stated due date and time will not be granted to a single Bidder; however, additional time may be granted to all Bidders when the City determines in its sole discretion that circumstances warrant it.

Award

The City intends to award a Contract(s) to the lowest responsible Bidder(s). On multi-divisional contracts, separate divisions may be awarded to separate Bidders. The City may also utilize alternatives offered in the Bid Forms, if any, to determine the lowest responsible Bidder on each division, and award multiple divisions to a single Bidder, so that the lowest total cost is achieved for the City. For unit price bids, the contract will be awarded based upon the unit prices and the lump sum prices stated by the bidder for the work items specified in the bid documents, with consideration given to any alternates selected by the City. If the City determines that the unit price for any item is materially different for the work item bid than either other bidders or the general market, the City, in its sole discretion, in addition to any other right it may have, may reject the bid as not responsible or non-conforming.

The acceptability of major subcontractors will be considered in determining if a Bidder is responsible. In comparing Bids, the City will give consideration to alternate Bids for items listed in the bid forms.

Qualifications

The City will evaluate Proposals based on cost as well as experience. Contractors that have not included the required list of similar work experience and associated references in Section 5 of the Bid Form may have their bid rejected.

As part of the proposal, Bidders shall provide documentation that the Bidder's company has at least 10 years of experience performing construction on similar projects. Bidders shall also submit the attached form, "Section 5 – References," which identifies a minimum of three projects completed in the past five years on similar projects, including construction cost, contractor and subcontractor information, that demonstrate similar work experience and complexity to that included within these contract documents.

All key staff and subcontractors are subject to the approval by the City.

Official Documents

The City of Ann Arbor shall accept no alternates to the bid documents made by the Bidder unless those alternatives are set forth in the "Alternate" section of Bid form.

The City of Ann Arbor officially distributes bid documents from the Procurement Unit or through the Michigan Intergovernmental Trade Network (MITN). Copies of the bid documents obtained from any other source are not Official copies. Addenda and other bid information will only be posted to these official distribution sites. If you obtained City of Ann Arbor Bid documents from other sources, it is recommended that you register on www.MITN.info and obtain an official Bid.

Bid Security

Each bid must be accompanied by a certified check, or Bid Bond by a surety licensed and authorized to do business within the State of Michigan, in the amount of 5% of the total of the bid price.

Withdrawal of Bids

After the time of opening, no Bid may be withdrawn for the period of 90 days specified in the Advertisement.

Contract Time

Time is of the essence in the performance of the work under this Contract. The available time for work under this Contract is indicated on page C-1, Article III of the Contract. If these time requirements can not be met, the Bidder must stipulate on Bid Form Section 3 - Time Alternate its schedule for performance of the work. Consideration will be given to time in evaluating bids.

Liquidated Damages

A liquidated damages clause, as given on page C-2, Article III of the Contract, provides that the Contractor shall pay the City as liquidated damages, and not as a penalty, a sum certain per day for each and every day that the Contractor may be in default of completion of the specified work, within the time(s) stated in the Contract, or written extensions.

Liquidated damages clauses, as given in the General Conditions, provide further that the City shall be entitled to impose and recover liquidated damages for breach of the obligations under Chapter 112 of the City Code.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

Human Rights Information

Section 5, beginning at page GC-3, outlines the requirements for fair employment practices under City of Ann Arbor Contracts. To establish compliance with this Ordinance, the Bidder should complete and return with its bid completed copies of the Human Rights Division Contract Compliance Forms or an acceptable equivalent. In the event Human Rights forms are not submitted with bid, the Bidder will have 24 hours to provide once requested by the City.

Wage Requirements

Section 4, beginning at page GC-2, outlines the requirements for payment of prevailing wages or of a “living wage” to employees providing service to the City under this contract. The successful bidder must comply with all applicable requirements and provide documentary proof of compliance when requested.

Conflict of Interest Disclosure

The City of Ann Arbor Purchasing Policy requires that prospective Vendors complete a Conflict of Interest Disclosure form (a copy of which is attached to this ITB). A contract may not be awarded to the selected Vendor unless and until the Procurement Unit and the City Administrator have reviewed the Disclosure form and determined that no conflict exists under applicable federal, state, or local law or administrative regulation. Not every relationship or situation disclosed on the Disclosure Form may be a disqualifying conflict. Depending on applicable law and regulations, some contracts may awarded on the recommendation of the City Administrator after full disclosure, where such action is allowed by law, if demonstrated competitive pricing exists and/or it is determined the award is in the best interest of the City.

Major Subcontractors

The Bidder shall identify each major subcontractor it expects to engage for this Contract if the work to be subcontracted is 15% or more of the bid sum or over $50,000, whichever is less. The Bidder also shall identify the work to be subcontracted to each major subcontractor.

Debarment

Submission of a Bid in response to this ITB is certification that the Bidder is not currently debarred, suspended, proposed for debarment, and declared ineligible or voluntarily excluded from participation in this transaction by any State or Federal departments or agency. Submission is also agreement that the City will be notified of any changes in this status.

Disclosures

After bids are opened, all information in a submitter's bid is subjected to disclosure under the provisions of Michigan Public Act No. 442 of 1976, as amended (MCL 15.231 et seq.) known as the "Freedom of Information Act". The Freedom of Information Act also provides for the complete disclosure of contracts and attachments thereto except where specifically exempted.

Bid Protest

All Bid protests must be in writing and filed with the Purchasing Agent within five (5) business days of the award action. The Bidder must clearly state the reasons for the protest. If a Bidder contacts a City Service Area/Unit and indicates a desire to protest an award, the Service Area/Unit shall refer the Bidder to the Purchasing Agent. The Purchasing Agent will provide the Bidder with the appropriate instructions for filing the protest. The protest shall be reviewed by the City Administrator or designee whose decision shall be final.

Reservation of Rights

The City of Ann Arbor reserves the right to accept any bid or alternative bid proposed in whole or in part, to reject any or all bids or alternatives bids in whole or in part and to waive irregularity and/or informalities in any bid and to make the award in any manner deemed in the best interest of the City.

City of Ann Arbor Procurement Office
INSTRUCTIONS FOR CONTRACTORS

For Completing CONTRACT COMPLIANCE FORM

City Policy

The "non discrimination in contracts" provision of the City Code, (Chapter 112, Section 9:161) requires contractors/Bidders/grantees doing business with the City not to discriminate on the basis of actual or perceived race, color, religion, national origin, sex, age, condition of pregnancy, marital status, physical or mental limitations, source of income, family responsibilities, educational association, sexual orientation, gender identity or HIV status against any of their employees, any City employee working with them, or any applicant for employment. It also requires that the contractors/Bidders/grantees include a similar provision in all subcontracts that they execute for City work or programs.

This Ordinance further requires that each prospective contractor/Bidder submit employment data to the City showing current total employee breakdown by occupation, race and gender. This allows the Human Rights Office to determine whether or not the contractor/Bidder has a workforce that is reflective of the availability of women and under-represented minorities within the contractor's labor recruitment area (the area where they can reasonably be expected to recruit employees). ***This data is provided to the City on the Human Rights Contract Compliance Forms (attached).***

To complete the form:

1) **If a company has more than one location, then that company must complete 2 versions of the form.**

- **Form #1** should contain the employment data for the **entire corporation**.
- **Form #2** should contain the employment data for those employees:
  - who will be working on-site;
  - in the office responsible for completing the contract; or,
  - in the case of non-profit grantees, those employees working on the project funded by the City grant(s).

2) If the company has only one location, fill out Form #1 only.

3) Complete all data in the upper section of the form including the name of the person who completes the form and the name of the company/organization's president.

4) Complete the Employment Data in the remainder of the form. Please be sure to complete all columns including the Total Columns on the far right side of the form, and the Total row and Previous Year Total row at the bottom of the form.

5) Return the completed form(s) to *your contact* in the City Department for whom you will be conducting the work.

For assistance in completing the form, contact:
Procurement Office of the City of Ann Arbor
(734) 794-6500

If a contractor is determined to be out of compliance, the Procurement Office will work with them to assist them in coming into compliance.

CITY OF ANN ARBOR HUMAN RIGHTS OFFICE

Form #1

CONTRACT COMPLIANCE FORM

Entire Organization (Totals for All Locations where applicable)

Name of Company/Organization_____ Date Form Completed_____

Name and Title of Person Completing this Form_____ Name of President _____

Address_____ County_____ Phone #_____
(Street address) (City) (State) (Zip) (Area Code)

Fax#_____ Email Address_____
(Area Code)

EMPLOYMENT DATA

Job Categories	**Number of Employees (Report employees in only one category)**												
	Male						**Female**						
	White	Black or African American	Asian	Hispanic or Latino	Native Hawaiian or Other Pacific Islander	American Indian or Alaska Native	White	Black or African American	Asian	Hispanic or Latino	Native Hawaiian or Other Pacific Islander	American Indian or Alaskan Native	**TOTAL COLUMNS A-L**
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	
Exec/Sr. Level Officials													
Supervisors													
Professionals													
Technicians													
Sales													
Admin. Support													
Craftspeople													
Operatives													
Service Workers													
Laborers/Helper													
Apprentices													
Other													
TOTAL													
PREVIOUS YEAR TOTAL													

CITY OF ANN ARBOR HUMAN RIGHTS OFFICE

Form #2

CONTRACT COMPLIANCE FORM

Local Office (Only those employees that will do local or on-site work, if applicable)

Name of Company/Organization_____ Date Form Completed_____

Name and Title of Person Completing this Form_____ Name of President _____

Address_____ County_____ Phone #_____
(Street address) (City) (State) (Zip) (Area Code)

Fax#_____ Email Address_____
(Area Code)

EMPLOYMENT DATA

Job Categories	**Number of Employees (Report employees in only one category)**												
	Male						**Female**						
	White	Black or African American	Asian	Hispanic or Latino	Native Hawaiian or Other Pacific Islander	American Indian or Alaska Native	White	Black or African American	Asian	Hispanic or LatinO	Native Hawaiian or Other Pacific Islander	American Indian or Alaskan Native	**TOTAL COLUMNS A-L**
	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	
Exec/Sr. Level Officials													
Supervisors													
Professionals													
Technicians													
Sales													
Admin. Support													
Craftspeople													
Operatives													
Service Workers													
Laborers/Helper													
Apprentices													
Other													
TOTAL													
PREVIOUS YEAR TOTAL													

2/12

Questions about this form? Call 734-794-6500

ATTACHMENT C
CITY OF ANN ARBOR
LIVING WAGE ORDINANCE
DECLARATION OF COMPLIANCE

The Ann Arbor Living Wage Ordinance (Section 1:811-1:821 of Chapter 23 of Title I of the Code) requires that employers providing services to the City or recipients of grants for financial assistance (in amounts greater than $10,000 in a twelve-month period of time) pay their employees who are working on the City project or grant, a minimum level of compensation known as the **Living Wage**. This wage must be paid to the employees for the length of the contract/project.

Companies employing fewer than 5 persons and non-profits employing fewer than 10 persons are exempt from the Ordinance. If this exemption applies to your firm, please check below:

_____ This **company** is exempt due to the fact that we employ or contract with fewer than 5 individuals.
_____ This **non-profit agency** is exempt due to the fact that we employ or contract with fewer than 10 employees.

The Ordinance requires that all contractors/bidders and/or grantees agree to the following terms:

a) To pay each of its employees performing work on any covered contract or grant with the City, no less than the living wage, which is defined as $12.52/hour when health care is provided, or no less than $13.96/hour for those employers that do *not* provide health care. It is understood that the Living Wage will be adjusted each year on April 30, and covered employers will be required to pay the adjusted amount thereafter. The rates stated above include any adjustment for 2013.

b) Please check the boxes below which apply to your workforce:

☐ Employees who are assigned to *any covered* City project or grant will be paid at or above the applicable living wage without health benefits Yes_____ No_____

OR

☐ Employees who are assigned to *any covered* City project or grant will be paid at or above the applicable living wage with health benefits Yes_____ No_____

c) To post a notice approved by the City regarding the Living Wage Ordinance in every work place or other location in which employees or other persons contracting for employment are working.

d) To provide the City payroll records or other documentation as requested; and,

e) To permit access to work sites to City representatives for the purposes of monitoring compliance, investigating complaints or non-compliance.

The undersigned authorized representative hereby obligates the contractor/bidder or grantee to the above stated conditions under penalty of perjury and violation of the Ordinance.

Company Name	Address, City, State, Zip
Signature of Authorized Representative	Phone (area code)
Type or Print Name and Title	Email address
Date signed	

Questions about this form? Please contact:
Procurement Office City of Ann Arbor
Phone: 734/794-6500

Revised 3/2013 LW-2

CITY OF ANN ARBOR
LIVING WAGE ORDINANCE

RATE EFFECTIVE APRIL 30, 2013 - ENDING APRIL 29, 2014

$12.52 per hour

If the employer provides health care benefits*****

$13.96 per hour

If the employer does **NOT** provide health care benefits*****

Employers providing services to or for the City of Ann Arbor or recipients of grants or financial assistance from the City of Ann Arbor for a value of more than $10,000 in a twelve-month period of time must pay those employees performing work on a City of Ann Arbor contract or grant, the above living wage.

ENFORCEMENT

The City of Ann Arbor may recover back wages either administratively or through court action for the employees that have been underpaid in violation of the law. Persons denied payment of the living wage have the right to bring a civil action for damages in addition to any action taken by the City.

Violation of this Ordinance is punishable by fines of not more than $500/violation plus costs, with each day being considered a separate violation. Additionally, the City of Ann Arbor has the right to modify, terminate, cancel or suspend a contract in the event of a violation of the Ordinance.

***** Health Care benefits include those paid for by the employer or making an employer contribution toward the purchase of health care. The employee contribution must not exceed $.50 an hour for an average work week; and the employer cost or contribution must equal no less than $1/hr for the average work week.

The Law Requires Employers to Display This Poster Where Employees Can Readily See It.

For Additional Information or to File a Complaint Contact
Karen Lancaster at 734/794-6500 or Klancaster@a2gov.org

Revised 3/2013 LW-1

Vendor Conflict of Interest Disclosure Form

All vendors interested in conducting business with the City of Ann Arbor must complete and return the Vendor Conflict of Interest Disclosure Form in order to be eligible to be awarded a contract. Please note that all vendors are subject to comply with the City of Ann Arbor's conflict interest policies as stated within the certification section below.

If a vendor has a relationship with a City of Ann Arbor official or employee, an immediate family member of a City of Ann Arbor official or employee, the vendor shall disclose the information required below.

Certification: I hereby certify that to my knowledge, there is no conflict of interest involving the vendor named below:

1. No City official or employee or City employee's immediate family member has an ownership interest in vendor's company or is deriving personal financial gain from this contract.
2. No retired or separated City official or employee who has been retired or separated from the City for less than one (1) year has an ownership interest in vendor's Company.
3. No City employee is contemporaneously employed or prospectively to be employed with the vendor.
4. Vendor hereby declares it has not and will not provide gifts or hospitality of any dollar value or any other gratuities to any City employee or elected official to obtain or maintain a contract.
5. Please note any exceptions below:

Vendor Name	**Vendor Phone Number**
Conflict of Interest Disclosure *	
Name of City of Ann Arbor employees, elected officials, or immediate family members with whom there maybe a potential conflict of interest.	( ) Relationship to employee_____ ( ) Interest in vendor's company _____ ( ) Other _____

*Disclosing a potential conflict of interest does not disqualify vendors. In the event vendors do not disclose potential conflicts of interest and they are detected by the City, vendor will be exempt from doing business with the City.

I certify that the information provided is true and correct by my signature below:

_____ _____ _____

Signature of Vendor Authorized Representative | Date | Printed Name of Vendor Authorized Representative

PROCUREMENT USE ONLY

☐ Yes, named employee was involved in Bid / Proposal process.

☐ No, named employee was not involved in procurement process or decision.

INVITATION TO BID

City of Ann Arbor
Guy C. Larcom Municipal Building
Ann Arbor, Michigan 48107

Ladies and Gentlemen:

The undersigned, as Bidder, declares that this Bid is made in good faith, without fraud or collusion with any person or persons bidding on the same Contract; that this Bidder has carefully read and examined the bid documents, including Advertisement, Human Rights Division Contract Compliance Forms, Conflict of Interest Disclosure Form, Notice of Pre-Bid Conference, Instructions to Bidders, Bid, Bid Forms, Contract, Bond Forms, General Conditions, Standard Specifications, Detailed Specifications, all Addenda, and the Plans and understands them. The Bidder declares that it conducted a full investigation at the site and of the work proposed and is fully informed as to the nature of the work and the conditions relating to the work's performance. The Bidder also declares that it has extensive experience in successfully completing projects similar to this one.

The Bidder acknowledges that it has not received or relied upon any representations or warrants of any nature whatsoever from the City of Ann Arbor, its agents or employees, and that this Bid is based solely upon the Bidder's own independent business judgment.

The undersigned proposes to perform all work shown on the plans or described in the bid documents, including any addenda issued, and to furnish all necessary machinery, tools, apparatus, and other means of construction to do all the work, furnish all the materials, and complete the work in strict accordance with all terms of the Contract of which this Bid is one part.

In accordance with these bid documents, and Addenda numbered _____, the undersigned, as Bidder, proposes to perform at the sites in and/or around Ann Arbor, Michigan, all the work included herein for the amounts set forth in the Bid Forms.

The Bidder declares that it has become fully familiar with the liquidated damage clauses for completion times and for compliance with City Code Chapter 112, understands and agrees that the liquidated damages are for the non-quantifiable aspects of non-compliance and do not cover actual damages that may be shown and agrees that if awarded the Contract, all liquidated damage clauses form part of the Contract.

The Bidder declares that it has become fully familiar with the provisions of Chapter 14, Section 1:319 (Prevailing wages) and Chapter 23 (Living Wage) of the Code of the City of Ann Arbor and that it understands and agrees to comply, to the extent applicable to employees providing services to the City under this Contract, with the wage and reporting

requirements stated in the City Code provisions cited. Bidder further agrees that the cited provisions of Chapter 14 and Chapter 23 form a part of this Contract.

The Bidder declares that it has become familiar with the City Conflict of Interest Disclosure Form and certifies that the statement contained therein is true and correct.

The Bidder encloses a certified check or Bid Bond in the amount of 5% of the total of the Bid Price. The Bidder agrees both to contract for the work and to furnish the necessary Bonds and insurance documentation within 10 days after being notified of the acceptance of the Bid.

If this Bid is accepted by the City and the Bidder fails to contract and furnish the required Bonds and insurance documentation within 10 days after being notified of the acceptance of this Bid, then the Bidder shall be considered to have abandoned the Contract and the certified check or Bid Bond accompanying this Bid shall become due and payable to the City.

If the Bidder enters into the Contract in accordance with this Bid, or if this Bid is rejected, then the accompanying check or Bid Bond shall be returned to the Bidder.

In submitting this Bid, it is understood that the right is reserved by the City to accept any Bid, to reject any or all Bids, to waive irregularities and/or informalities in any Bid, and to make the award in any manner the City believes to be in its best interest.

SIGNED THIS _____ DAY OF _____, 20__.

_____	_____
Bidder's Name	Authorized Signature of Bidder
_____	_____
Official Address	(Print Name of Signer Above)
_____	_____
Telephone Number	Email Address for Award Notice

LEGAL STATUS OF BIDDER

(The Bidder shall fill out the appropriate form and strike out the other two.)

By signing below the authorized representative of the Bidder hereby certifies that:

The Bidder is:

- A corporation organized and doing business under the laws of the state of _____, for whom _____ bearing the office title of _____, whose signature is affixed to this proposal, is authorized to execute contracts on behalf of respondent.*

  *If not incorporated in Michigan, please attach the corporation's Certificate of Authority

- A limited liability company doing business under the laws of the state of _____, whom _____ bearing the title of _____ whose signature is affixed to this proposal, is authorized to execute contract on behalf of the LLC.

- A partnership organized under the laws of the state of _____ and filed with the county of _____ , whose members are (attach list including street and mailing address for each.)

- An individual, whose signature with address, is affixed to this Bid.

_____Date: _____,
Signature

(Print) Name _____ Title _____

Firm: _____

Address: _____

Contact Phone _____ Fax _____

Email _____

BID FORM

Section 1 – Schedule of Prices

Project: Fuller Pool Boiler Replacement
ITB No.: 4315

Bidder's Name: _____

Notes:
1. All bidders shall provide a Unit Price and Total Price for all bid items specified.
2. Quantities included in the bid table represent estimated quantities for different work. The CONTRACTOR shall be compensated for the actual number of items completed using the unit prices provided.
3. The City, at its sole discretion, may elect to delete any portion of the work delineated below, with no change to the unit prices provided. Work shall be determined based upon the availability of funds.
4. Any item not provided in the following list shall be considered incidental.
5. Contract shall be awarded based on the base bid or any combination of the base bid and alternate bid areas in any manner the City believes to be in its best interest.

Bid Items

The Bidder agrees to complete the Project and all related work, as specified and shown on the drawings, for the following unit prices.

FULLER POOL BOILER REPLACEMENT – BASE BID					
Item No.	**Item Description**	**Qty**	**Unit**	**Unit Price**	**Total Price**
1.	General Conditions, Insurance, Bonds, Mobilization (max. 5% of bid)	1	LS	$	$
2.	Boiler Replacement, including all concrete, masonry, mechanical, plumbing, HVAC, electrical, controls, painting, roofing and all related work.	1	LS	$	$
3.	Start-up and Testing	1	LS	$	$
4.	Miscellaneous Repairs Allowance	1	LS	$ 15,000.00	$ 15,000.00
5.	Project Close Out	1	LS	$	$
				TOTAL BASE BID (ITEMS 1 THROUGH 5)	**$**

_____ Dollars ($_____)
(Amount shall be shown in both words and figures. In case of a discrepancy, the amount shown in words shall govern.)

BID FORM

Section 2 - Material and Equipment Alternates

The Base Bid proposal price shall include materials and equipment selected from the designated items and manufacturers listed in the bidding documents. This is done to establish uniformity in bidding and to establish standards of quality for the items named.

If the Contractor wishes to quote alternate items for consideration by the City, it may do so under this Section. A complete description of the item and the proposed price differential must be provided. Unless approved at the time of award, substitutions where items are specifically named will be considered only as a negotiated change in Contract Sum.

Item Number	Description	Add/Deduct Amount

If the Bidder does not suggest any material or equipment alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any material or equipment alternate under the Contract.

Signature of Authorized Representative of Bidder _____

BID FORM

Section 3 - Time Alternate

If the Bidder takes exception to the time stipulated in Article III of the Contract, Time of Completion, page C-1, it is requested to stipulate below its proposed time for performance of the work. Consideration will be given to time in evaluating bids.

If the Bidder does not suggest any time alternate, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT propose any time alternate under the Contract.

Signature of Authorized Representative of Bidder _____

BID FORM

Section 4 - Major Subcontractors

For purposes of this Contract, a Subcontractor is anyone (other than the Contractor) who performs work (other than or in addition to the furnishing of materials, plans or equipment) at or about the construction site, directly or indirectly for or on behalf of the Contractor (and whether or not in privity of Contract with the Contractor), but shall not include any individual who furnishes merely the individual's own personal labor or services.

For the work outlined in these documents the Bidder expects to engage the following major subcontractors to perform the work identified:

Subcontractor (Name and Address)	Work	Amount
Mechanical		
Electrical		
Roofing		
Boiler Manufacturer		

If the Bidder does not expect to engage any major subcontractor, the Bidder **MUST** complete the following statement:

For the work outlined in this request for bid, the bidder does NOT expect to engage any major subcontractor to perform work under the Contract.

Signature of Authorized Representative of Bidder _____

BID FORM

Section 5 – References

GENERAL CONTRACTOR (Name: _____)

Include a minimum of three references from similar projects completed within the past five (5) years involving boiler replacement and related work.

Refer also to Instructions to Bidders for additional requirements.

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

BID FORM

Section 6 – References

SUBCONTRACTOR (Name: _____)

Include a minimum of three references from similar projects completed within the past five (5) years.

Refer also to Instructions to Bidders for additional requirements.

1) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

_____
Description

2) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

_____
Description

3) _____ _____ _____
Project Name Cost Date Constructed

_____ _____
Contact Name Phone Number

_____
Description

CONTRACT

THIS AGREEMENT is made on the _____ day of _____, 20__, between the CITY OF ANN ARBOR, a Michigan Municipal Corporation, 301 East Huron Street, Ann Arbor, Michigan 48104 ("City") and _____ ("Contractor")

(An individual/partnership/corporation, include state of incorporation) (Address)

Based upon the mutual promises below, the Contractor and the City agree as follows:

ARTICLE I - Scope of Work

The Contractor agrees to furnish all of the materials, equipment and labor necessary; and to abide by all the duties and responsibilities applicable to it for the project titled "Fuller Pool Boiler Replacement" in accordance with the requirements and provisions of the following documents, including all written modifications incorporated into any of the documents, which are incorporated as part of this Contract:

Human Rights Division Contract
Living Wage Declaration of Compliance Forms (if applicable)
Bid Forms
Contract and Exhibits
Bonds
General Conditions
Standard Specifications
Detailed Specifications
Plans
Addenda

ARTICLE II - Definitions

Administering Service Area/Unit means Public Services Area.

Supervising Professional or Owner means Senior Utilities Engineer or other persons acting under the authorization of the Administrator/Manager of the Administering Service Area/Unit.

Engineer or Owner's Representative means Consulting Professional acting under the authorization of the Supervising Professional/Owner.

Project means, Fuller Pool Boiler Replacement, Bid No. ITB-4315

ARTICLE III - Time of Completion

(A) The work to be completed under this Contract shall begin immediately on the date specified in the Notice to Proceed issued by the City.

(B) The entire work for this Contract shall be completed within ten (10) consecutive weeks. Shorter completion times for certain portions of the work may be specified in the Detailed Specifications. Liquidated damages shall also apply to these intermediate milestones based on the amounts listed in the Detailed Specifications.

(C) Failure to complete all the work within the time specified above, including any extension granted in writing by the Supervising Professional, shall obligate the Contractor to pay the City, as liquidated damages and not as a penalty, an amount equal to $500.00 for each calendar day of delay in the completion of all the work. If any liquidated damages are unpaid by the Contractor, the City shall be entitled to deduct these unpaid liquidated damages from the monies due the Contractor.

As an independent requirement, where the Detailed Specifications or Plans identify certain portions of the work to be completed within a shorter period of time and the Contractor fails to complete each portion within the shorter period specified for each portion, including any extension granted in writing by the Project Supervisor, the City is entitled to deduct from the monies due the Contractor, as liquidated damages and not as a penalty, the amount equal to that identified in Specifications or Plans for each portion or Phase of the work not timely completed for each calendar day of delay in completion of each portion of the work.

The liquidated damages are for the non-quantifiable aspects of any of the previously identified events and do not cover actual damages that can be shown or quantified nor are they intended to preclude recovery of actual damages in addition to the recovery of liquidated damages.

Liquidated damages under this section are in addition to any liquidated damages due under Section 5 of the General Conditions.

ARTICLE IV - The Contract Sum

(A) The City shall pay to the Contractor for the performance of the Contract, the unit prices as given in the Bid Forms for the estimated bid total of:

_____Dollars ($_____)

(B) The amount paid shall be equitably adjusted to cover changes in the work ordered by the Supervising Professional but not required by the Contract Documents. Increases or decreases shall be determined only by written agreement between the City and Contractor.

ARTICLE V - Assignment

This Contract may not be assigned or subcontracted without the written consent of the City.

ARTICLE VI - Choice of Law

This Contract shall be construed, governed, and enforced in accordance with the laws of the State of Michigan. By executing this agreement, the Contractor and the City agree to venue in a court of appropriate jurisdiction sitting within Washtenaw County for purposes of any action arising under this Contract. The parties stipulate that the venue referenced in this Contract is for convenience and waive any claim of non-convenience.

Whenever possible, each provision of the Contract will be interpreted in a manner as to be effective and valid under applicable law. The prohibition or invalidity, under applicable law, of any provision will not invalidate the remainder of the Contract.

ARTICLE VII - Relationship of the Parties

The parties of the Contract agree that it is not a Contract of employment but is a Contract to accomplish a specific result. Contractor is an independent Contractor performing services for the City. Nothing contained in this Contract shall be deemed to constitute any other relationship between the City and the Contractor.

Contractor certifies that it has no personal or financial interest in the project other than the compensation it is to receive under the Contract. Contractor certifies that it is not, and shall not become, overdue or in default to the City for any Contract, debt, or any other obligation to the City including real or personal property taxes. City shall have the right to set off any such debt against compensation awarded for services under this agreement.

ARTICLE VIII - Notice

All notices given under this Contract shall be in writing, and shall be by personal delivery or by certified mail with return receipt requested to the parties at their respective addresses as specified in the Contract Documents or other address the Contractor may specify in writing.

ARTICLE IX - Indemnification

To the fullest extent permitted by law, Contractor shall indemnify, defend and hold harmless the City, its officers, employees and agents harmless from all suits, claims, judgments and expenses including attorney's fees resulting or alleged to result, in whole or in part, from any act or omission, which is in any way connected or associated with this Contract, by the Contractor or anyone acting on the Contractor's behalf under this Contract. Contractor shall not be responsible to indemnify the City for losses or damages caused by or resulting from the City's sole negligence.

ARTICLE X - Entire Agreement

This Contract represents the entire understanding between the City and the Contractor and it supersedes all prior representations or agreements whether written or oral. Neither party has relied on any prior representations in entering into this Contract. This Contract may be altered, amended or modified only by written amendment signed by the City and the Contractor.

FOR CONTRACTOR

By_____
Its:_____

FOR THE CITY OF ANN ARBOR

By_____
John Hieftje, Mayor

By_____
Jacqueline Beaudry, City Clerk

Approved as to substance

By_____
Steven D. Powers, City Administrator

By_____
Craig Hupy, Public Services
Area Administrator

Approved as to form and content

_____
Stephen K. Postema, City Attorney

PERFORMANCE BOND

(1) _____ of _____ (referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for

$ _____, the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City dated _____, 20__, for: _____ _____ and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq.

(3) Whenever the Principal is declared by the City to be in default under the Contract, the Surety may promptly remedy the default or shall promptly:

(a) complete the Contract in accordance with its terms and conditions; or

(b) obtain a bid or bids for submission to the City for completing the Contract in accordance with its terms and conditions, and upon determination by Surety of the lowest responsible bidder, arrange for a Contract between such bidder and the City, and make available, as work progresses, sufficient funds to pay the cost of completion less the balance of the Contract price; but not exceeding, including other costs and damages for which Surety may be liable hereunder, the amount set forth in paragraph 1.

(4) Surety shall have no obligation to the City if the Principal fully and promptly performs under the Contract.

(5) Surety agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder, or the specifications accompanying it shall in any way affect its obligations on this bond, and waives notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the work, or to the specifications.

SIGNED AND SEALED this _____ day of _____, 20__.

_____ (Name of Surety Company)	_____ (Name of Principal)
By _____ (Signature)	By _____ (Signature)
Its _____ (Title of Office)	Its _____ (Title of Office)
Approved as to form:	Name and address of agent:
_____ Stephen K. Postema, City Attorney	_____ _____ _____

LABOR AND MATERIAL BOND

(1) _____

of _____(referred to as "Principal"), and _____, a corporation duly authorized to do business in the State of Michigan, (referred to as "Surety"), are bound to the City of Ann Arbor, Michigan (referred to as "City"), for the use and benefit of claimants as defined in Act 213 of Michigan Public Acts of 1963, as amended, being MCL 129.201 et seq., in the amount of $ _____, for the payment of which Principal and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by this bond.

(2) The Principal has entered a written Contract with the City, dated _____, 20__, for _____ _____ _____; and this bond is given for that Contract in compliance with Act No. 213 of the Michigan Public Acts of 1963 as amended;

(3) If the Principal fails to promptly and fully repay claimants for labor and material reasonably required under the Contract, the Surety shall pay those claimants.

(4) Surety's obligations shall not exceed the amount stated in paragraph 1, and Surety shall have no obligation if the Principal promptly and fully pays the claimants.

SIGNED AND SEALED this _____ day of _____, 20__.

_____
(Name of Surety Company)

By _____
(Signature)

Its _____
(Title of Office)

_____
(Name of Principal)

By _____
(Signature)

Its _____
(Title of Office)

Approved as to form:

_____
Stephen K. Postema, City Attorney

Name and address of agent:

_____

_____

_____

GENERAL CONDITIONS

Section 1 - Execution, Correlation and Intent of Documents

The contract documents shall be signed in 2 copies by the City and the Contractor.

The contract documents are complementary and what is called for by any one shall be binding. The intention of the documents is to include all labor and materials, equipment and transportation necessary for the proper execution of the work. Materials or work described in words which so applied have a well-known technical or trade meaning have the meaning of those recognized standards.

In case of a conflict among the contract documents listed below in any requirement(s), the requirement(s) of the document listed first shall prevail over any conflicting requirement(s) of a document listed later.

(1) Addenda in reverse chronological order; (2) Detailed Specifications; (3) Standard Specifications; (4) Plans; (5) General Conditions; (6) Contract; (7) Bid Forms; (8) Bond Forms; (9) Bid.

Section 2 - Order of Completion

The Contractor shall submit with each invoice, and at other times reasonably requested by the Supervising Professional, schedules showing the order in which the Contractor proposes to carry on the work. They shall include the dates at which the Contractor will start the several parts of the work, the estimated dates of completion of the several parts, and important milestones within the several parts.

Section 3 - Familiarity with Work

The Bidder or its representative shall make personal investigations of the site of the work and of existing structures and shall determine to its own satisfaction the conditions to be encountered, the nature of the ground, the difficulties involved, and all other factors affecting the work proposed under this Contract. The Bidder to whom this Contract is awarded will not be entitled to any additional compensation unless conditions are clearly different from those which could reasonably have been anticipated by a person making diligent and thorough investigation of the site.

The Bidder shall immediately notify the City upon discovery, and in every case prior to submitting its Bid, of every error or omission in the bidding documents that would be identified by a reasonably competent, diligent Bidder. In no case will a Bidder be allowed the benefit of extra compensation or time to complete the work under this Contract for extra expenses or time spent as a result of the error or omission.

Under this Contract, the Contractor shall conform to Chapter 14 of Title I of the Code of the City of Ann Arbor as amended; which in part states "...that all craftsmen, mechanics and laborers employed directly on the site in connection with said improvements, including said employees of subcontractors, shall receive the prevailing wage for the corresponding classes of craftsmen, mechanics and laborers, as determined by statistics for the Ann Arbor area compiled by the United States Department of Labor. At the request of the City, any contractor or subcontractor shall provide satisfactory proof of compliance with the contract provisions required by the Section."

Where the Contract and the Ann Arbor City Ordinance are silent as to definitions of terms required in determining contract compliance with regard to prevailing wages, the definitions provided in the Davis-Bacon Act as amended (40 U.S.C. 278-a to 276-a-7) for the terms shall be used.

Further, to the extent that any employees of the Contractor providing services under this contract are not part of the class of craftsmen, mechanics and laborers who receive a prevailing wage in conformance with Section 1:319 of Chapter 14 of Title I of the Code of the City of Ann Arbor, the Contractor agrees to conform to Chapter 23 of Title I of the Code of the City of Ann Arbor, as amended, which in part states:

1:814. Applicability.

(1) This Chapter shall apply to any person that is a contractor/Bidder or grantee as defined in Section 1:813 that employs or contracts with five (5) or more individuals; provided, however, that this Chapter shall not apply to a non-profit contractor/Bidder or non-profit grantee unless it employs or contracts with ten (10) or more individuals.

(2) This Chapter shall apply to any grant, contract, or subcontract or other form of financial assistance awarded to or entered into with a contractor/Bidder or grantee after the effective date of this Chapter and to the extension or renewal after the effective date of this Chapter of any grant, contract, or subcontract or other form of financial assistance with a contractor/Bidder or grantee.

1:815. Living Wages Required.

(1) Every contractor/Bidder or grantee, as defined in Section 1:813, shall pay its covered employees a living wage as established in this Section.

(a) For a covered employer that provides employee health care to its employees, the living wage shall be $12.52 an hour, or the adjusted amount hereafter established under Section 1:815(3).

(b) For a covered employer that does not provide health care to its employees, the living wage shall be $13.96 a hour, or the adjusted amount hereafter established under Section 1:815(3).

(2) In order to qualify to pay the living wage rate for covered employers providing employee health care under subsection 1:815(1)(a), a covered employer shall furnish proof of said health care coverage and payment therefor to the City Administrator or his/her designee.

(3) The amount of the living wage established in this Section shall be adjusted upward no later than April 30, 2002, and every year thereafter by a percentage equal to the percentage increase, if any, in the federal poverty guidelines as published by the United States Department of Health and Human Services for the years 2001 and 2002. Subsequent annual adjustments shall be based upon the percentage increase, if any, in the United States Department of Health and Human Services poverty guidelines when comparing the prior calendar year's poverty guidelines to the present calendar year's guidelines. The applicable percentage amount will be converted to an amount in cents by multiplying the existing wage under Section 1.815(1)(b) by said percentage, rounding upward to the next cent, and adding this amount of cents to the existing living wage levels established under Sections 1:815(1)(a) and 1:815(1)(b). Prior to April 1 of each calendar year, the City will notify any covered employer of this adjustment by posting a written notice in a prominent place in City Hall, and, in the case of a covered employer that has provided an address of record to the City, by a written letter to each such covered employer.

Contractor agrees that all subcontracts entered into by the Contractor shall contain similar wage provision covering subcontractor's employees who perform work on this contract.

Section 5 - Non-Discrimination

The Contractor agrees to comply, and to require its subcontractor(s) to comply, with the nondiscrimination provisions of Section 209 of the Elliot-Larsen Civil Rights Act (MCL 37.2209). The Contractor further agrees to comply with the nondiscrimination provisions of Chapter 112 of the Ann Arbor City Code and to assure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity. The Contractor further agrees to comply with the provisions of Section 9:161 of Chapter 112 of the Ann Arbor City Code and in particular the following excerpts:

9:161 NONDISCRIMINATION BY CITY CONTRACTORS

(1) All Contractors proposing to do business with the City of Ann Arbor shall satisfy the nondiscrimination administrative policy adopted by the City Administrator in accordance with the guidelines of this section. All Contractors shall receive approval from the Director prior to entering into a contract with the City, unless specifically exempted by administrative policy. All City Contractors shall take affirmative action to insure that applicants are employed and that employees are treated during employment in a manner which provides equal employment opportunity and tends to eliminate inequality based upon race, national origin or sex.

(2) Each prospective contractor shall submit to the City data showing current total employment by occupational category, sex and minority group. If, after verifying this data, the Director concludes that it indicates total minority and female employment commensurate with their availability within the contractor's labor recruitment area, i.e., the area from which the contractor can reasonably be expected to recruit, said contractor shall be accepted by the

Director as having fulfilled affirmative action requirements for a period of one year at which time the Director shall conduct another review. Other Contractors shall develop an affirmative action program in conjunction with the Director. Said program shall include specific goals and timetables for the hiring and promotion of minorities and females. Said goals shall reflect the availability of minorities and females within the Contractor's labor recruitment area. In the case of construction Contractors, the Director shall use for employment verification the labor recruitment area of the Ann Arbor-Ypsilanti standard metropolitan statistical area. Construction Contractors determined to be in compliance shall be accepted by the Director as having fulfilled affirmative action requirements for a period of six (6) months at which time the Director shall conduct another review.

(3) In hiring for construction projects, contractors shall make good faith efforts to employ local persons, so as to enhance the local economy.

(4) All Contracts shall include provisions through which the Contractor agrees, in addition to any other applicable Federal or State labor laws:

(a) To set goals, in conference with the Human Resources Director, for each job category or division of the work force used in the completion of the City work;

(b) To provide periodic reports concerning the progress the Contractor has made in meeting the affirmative action goals it has agreed to;

(c) To permit the Director access to all books, records and accounts pertaining to its employment practices for the purpose of determining compliance with the affirmative action requirements.

(5) The Director shall monitor the compliance of each contractor with the nondiscrimination provisions of each contract. The Director shall develop procedures and regulations consistent with the administrative policy adopted by the City Administrator for notice and enforcement of non-compliance. Such procedures and regulations shall include a provision for the posting of Contractors not in compliance.

(6) All City Contracts shall provide further that breach of the obligation not to discriminate shall be a material breach of the Contract for which the City shall be entitled, at its option, to do any or all of the following:

(a) To cancel, terminate, or suspend the Contract in whole or part and/or refuse to make any required periodic payments under the Contract;

(b) Declare the Contractor ineligible for the award of any future contracts with the City for a specified length of time;

(c) To recover liquidated damages of a specified sum, said sum to be that percentage of the labor expenditure for the time period involved which would have accrued to minority group members had the affirmative action not been breached;

(d) Impose for each day of non-compliance, liquidated damages of a specified sum, based upon the following schedule:

Contract Amount	Assessed Damages Per Day of Non-Compliance
$ 10,000 - 24,999	$ 25.00
25,000 - 99,999	50.00
100,000 - 199,999	100.00
200,000 - 499,999	150.00
500,000 - 1,499,999	200.00
1,500,000 - 2,999,999	250.00
3,000,000 - 4,999,999	300.00
5,000,000 - and above	500.00

(e) In addition the Contractor shall be liable for any costs or expenses incurred by the City of Ann Arbor in obtaining from other sources the work and services to be rendered or performed or the goods or properties to be furnished or delivered to the City under this contract.

Section 6 - Materials, Appliances, Employees

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation, and other facilities necessary or used for the execution and completion of the work. Unless otherwise specified, all materials incorporated in the permanent work shall be new, and both workmanship and materials shall be of the highest quality. The Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of materials.

The Contractor shall at all times enforce strict discipline and good order among its employees, and shall seek to avoid employing on the work any unfit person or anyone not skilled in the work assigned.

Adequate sanitary facilities shall be provided by the Contractor.

Section 7 - Qualifications for Employment

The Contractor shall employ competent laborers and mechanics for the work under this Contract. For work performed under this Contract, employment preference shall be given to qualified local residents.

Section 8 - Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringements of any patent rights and shall hold the City harmless from loss on account of infringement except that the City shall be responsible for all infringement loss when a particular process or the product of a particular manufacturer or manufacturers is specified, unless the City has notified the Contractor prior to the signing of the Contract that the particular process or product is patented or is believed to be patented.

Section 9 - Permits and Regulations

The Contractor must secure and pay for all permits, permit or plan review fees and licenses necessary for the prosecution of the work. These include but are not limited to City building permits, right-of-way permits, lane closure permits, right-of-way occupancy permits, and the like. The City shall secure and pay for easements shown on the plans unless otherwise specified.

The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the contract documents are at variance with those requirements, it shall promptly notify the Supervising Professional in writing, and any necessary changes shall be adjusted as provided in the Contract for changes in the work.

Section 10 - Protection of the Public and of Work and Property

The Contractor is responsible for the means, methods, sequences, techniques and procedures of construction and safety programs associated with the work contemplated by this contract. The Contractor, its agents or sub-contractors, shall comply with the "General Rules and Regulations for the Construction Industry" as published by the Construction Safety Commission of the State of Michigan and to all other local, State and National laws, ordinances, rules and regulations pertaining to safety of persons and property.

The Contractor shall take all necessary and reasonable precautions to protect the safety of the public. It shall continuously maintain adequate protection of all work from damage, and shall take all necessary and reasonable precautions to adequately protect all public and private property from injury or loss arising in connection with this Contract. It shall make good any damage, injury or loss to its work and to public and private property resulting from lack of reasonable protective precautions, except as may be due to errors in the contract documents, or caused by agents or employees of the City. The Contractor shall obtain and maintain sufficient insurance to cover damage to any City property at the site by any cause.

In an emergency affecting the safety of life, or the work, or of adjoining property, the Contractor is, without special instructions or authorization from the Supervising Professional, permitted to act at its discretion to prevent the threatened loss or injury. It shall also so act, without appeal, if authorized or instructed by the Supervising Professional.

Any compensation claimed by the Contractor for emergency work shall be determined by agreement or in accordance with the terms of Claims for Extra Cost - Section 15.

Section 11 - Inspection of Work

The City shall provide sufficient competent personnel for the inspection of the work.

The Supervising Professional shall at all times have access to the work whenever it is in preparation or progress, and the Contractor shall provide proper facilities for access and for inspection.

If the specifications, the Supervising Professional's instructions, laws, ordinances, or any public authority require any work to be specially tested or approved, the Contractor shall give the Supervising Professional timely notice of its readiness for inspection, and if the inspection is by an

authority other than the Supervising Professional, of the date fixed for the inspection. Inspections by the Supervising Professional shall be made promptly, and where practicable at the source of supply. If any work should be covered up without approval or consent of the Supervising Professional, it must, if required by the Supervising Professional, be uncovered for examination and properly restored at the Contractor's expense.

Re-examination of any work may be ordered by the Supervising Professional, and, if so ordered, the work must be uncovered by the Contractor. If the work is found to be in accordance with the contract documents, the City shall pay the cost of re-examination and replacement. If the work is not in accordance with the contract documents, the Contractor shall pay the cost.

Section 12 - Superintendence

The Contractor shall keep on the work site, during its progress, a competent superintendent and any necessary assistants, all satisfactory to the Supervising Professional. The superintendent will be responsible to perform all on-site project management for the Contractor. The superintendent shall be experienced in the work required for this Contract. The superintendent shall represent the Contractor and all direction given to the superintendent shall be binding as if given to the Contractor. Important directions shall immediately be confirmed in writing to the Contractor. Other directions will be confirmed on written request. The Contractor shall give efficient superintendence to the work, using its best skill and attention.

Section 13 - Changes in the Work

The City may make changes to the quantities of work within the general scope of the Contract at any time by a written order and without notice to the sureties. If the changes add to or deduct from the extent of the work, the Contract Sum shall be adjusted accordingly. All the changes shall be executed under the conditions of the original Contract except that any claim for extension of time caused by the change shall be adjusted at the time of ordering the change.

In giving instructions, the Supervising Professional shall have authority to make minor changes in the work not involving extra cost and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Supervising Professional, and no claim for an addition to the Contract Sum shall be valid unless the additional work was ordered in writing.

The Contractor shall proceed with the work as changed and the value of the work shall be determined as provided in Claims for Extra Cost - Section 15.

Section 14 - Extension of Time

Extension of time stipulated in the Contract for completion of the work will be made if and as the Supervising Professional may deem proper under any of the following circumstances:

(1) When work under an extra work order is added to the work under this Contract;

(2) When the work is suspended as provided in Section 20;

(3) When the work of the Contractor is delayed on account of conditions which could not have been foreseen, or which were beyond the control of the Contractor, and which were not the result of its fault or negligence;

(4) Delays in the progress of the work caused by any act or neglect of the City or of its employees or by other Contractors employed by the City;

(5) Delay due to an act of Government;

(6) Delay by the Supervising Professional in the furnishing of plans and necessary information;

(7) Other cause which in the opinion of the Supervising Professional entitles the Contractor to an extension of time.

The Contractor shall notify the Supervising Professional within 7 days of an occurrence or conditions which, in the Contractor's opinion, entitle it to an extension of time. The notice shall be in writing and submitted in ample time to permit full investigation and evaluation of the Contractor's claim. The Supervising Professional shall acknowledge receipt of the Contractor's notice within 7 days of its receipt. Failure to timely provide the written notice shall constitute a waiver by the Contractor of any claim.

In situations where an extension of time in contract completion is appropriate under this or any other section of the contract, the Contractor understands and agrees that the only available adjustment for events that cause any delays in contract completion shall be extension of the required time for contract completion and that there shall be no adjustments in the money due the Contractor on account of the delay.

Section 15 - Claims for Extra Cost

If the Contractor claims that any instructions by drawings or other media issued after the date of the Contract involved extra cost under this Contract, it shall give the Supervising Professional written notice within 7 days after the receipt of the instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property. The procedure shall then be as provided for Changes in the Work-Section l3. No claim shall be valid unless so made.

If the Supervising Professional orders, in writing, the performance of any work not covered by the contract documents, and for which no item of work is provided in the Contract, and for which no unit price or lump sum basis can be agreed upon, then the extra work shall be done on a Cost-Plus-Percentage basis of payment as follows:

(1) The Contractor shall be reimbursed for all reasonable costs incurred in doing the work, and shall receive an additional payment of 15% of all the reasonable costs to cover both its indirect overhead costs and profit;

(2) The term "Cost" shall cover all payroll charges for employees and supervision required under the specific order, together with all worker's compensation, Social Security, pension and retirement allowances and social insurance, or other regular payroll charges on same; the cost of all material and supplies required of either temporary or permanent character; rental of all

power-driven equipment at agreed upon rates, together with cost of fuel and supply charges for the equipment; and any costs incurred by the Contractor as a direct result of executing the order, if approved by the Supervising Professional;

(3) If the extra is performed under subcontract, the subcontractor shall be allowed to compute its charges as described above. The Contractor shall be permitted to add an additional charge of 5% percent to that of the subcontractor for the Contractor's supervision and contractual responsibility;

(4) The quantities and items of work done each day shall be submitted to the Supervising Professional in a satisfactory form on the succeeding day, and shall be approved by the Supervising Professional and the Contractor or adjusted at once;

(5) Payments of all charges for work under this Section in any one month shall be made along with normal progress payments. Retainage shall be in accordance with Progress Payments-Section 16.

No additional compensation will be provided for additional equipment, materials, personnel, overtime or special charges required to perform the work within the time requirements of the Contract.

When extra work is required and no suitable price for machinery and equipment can be determined in accordance with this Section, the hourly rate paid shall be 1/40 of the basic weekly rate listed in the Rental Rate Blue Book published by Dataquest Incorporated and applicable to the time period the equipment was first used for the extra work. The hourly rate will be deemed to include all costs of operation such as bucket or blade, fuel, maintenance, "regional factors", insurance, taxes, and the like, but not the costs of the operator.

Section 16 - Progress Payments

The Contractor shall submit each month, or at longer intervals, if it so desires, an invoice covering work performed for which it believes payment, under the Contract terms, is due. The submission shall be to the City's Finance Department - Accounting Division. The Supervising Professional will, within 10 days following submission of the invoice, prepare a certificate for payment for the work in an amount to be determined by the Supervising Professional as fairly representing the acceptable work performed during the period covered by the Contractor's invoice. To insure the proper performance of this Contract, the City will retain a percentage of the estimate in accordance with Act 524, Public Acts of 1980. The City will then, following the receipt of the Supervising Professional's Certificate, make payment to the Contractor as soon as feasible, which is anticipated will be within 15 days.

An allowance may be made in progress payments if substantial quantities of permanent material have been delivered to the site but not incorporated in the completed work if the Contractor, in the opinion of the Supervising Professional, is diligently pursuing the work under this Contract. Such materials shall be properly stored and adequately protected. Allowance in the estimate shall be at the invoice price value of the items. Notwithstanding any payment of any allowance, all risk of loss due to vandalism or any damages to the stored materials remains with the Contractor.

In the case of Contracts which include only the Furnishing and Delivering of Equipment, the payments shall be; 60% of the Contract Sum upon the delivery of all equipment to be furnished, or in the case of delivery of a usable portion of the equipment in advance of the total equipment delivery, 60% of the estimated value of the portion of the equipment may be paid upon its delivery in advance of the time of the remainder of the equipment to be furnished; 30% of the Contract Sum upon completion of erection of all equipment furnished, but not later than 60 days after the date of delivery of all of the equipment to be furnished; and payment of the final 10% on final completion of erection, testing and acceptance of all the equipment to be furnished; but not later than l80 days after the date of delivery of all of the equipment to be furnished, unless testing has been completed and shows the equipment to be unacceptable.

With each invoice for periodic payment, the Contractor shall enclose a Contractor's Declaration - Section 43, and an updated project schedule per Order of Completion - Section 2.

Section 17 - Deductions for Uncorrected Work

If the Supervising Professional decides it is inexpedient to correct work that has been damaged or that was not done in accordance with the Contract, an equitable deduction from the Contract price shall be made.

Section 18 - Correction of Work Before Final Payment

The Contractor shall promptly remove from the premises all materials condemned by the Supervising Professional as failing to meet Contract requirements, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute the work in accordance with the Contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by the removal or replacement.

If the Contractor does not remove the condemned work and materials within l0 days after written notice, the City may remove them and, if the removed material has value, may store the material at the expense of the Contractor. If the Contractor does not pay the expense of the removal within 10 days thereafter, the City may, upon 10 days written notice, sell the removed materials at auction or private sale and shall pay to the Contractor the net proceeds, after deducting all costs and expenses that should have been borne by the Contractor. If the removed material has no value, the Contractor must pay the City the expenses for disposal within 10 days of invoice for the disposal costs.

The inspection or lack of inspection of any material or work pertaining to this Contract shall not relieve the Contractor of its obligation to fulfill this Contract and defective work shall be made good. Unsuitable materials may be rejected by the Supervising Professional notwithstanding that the work and materials have been previously overlooked by the Supervising Professional and accepted or estimated for payment or paid for. If the work or any part shall be found defective at any time before the final acceptance of the whole work, the Contractor shall forthwith make good the defect in a manner satisfactory to the Supervising Professional. The judgment and the decision of the Supervising Professional as to whether the materials supplied and the work done under this Contract comply with the requirements of the Contract shall be conclusive and final.

Section 19 - Acceptance and Final Payment

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Supervising Professional will promptly make the inspection. When the Supervising Professional finds the work acceptable under the Contract and the Contract fully performed, the Supervising Professional will promptly sign and issue a final certificate stating that the work required by this Contract has been completed and is accepted by the City under the terms and conditions of the Contract. The entire balance found to be due the Contractor, including the retained percentage, shall be paid to the Contractor by the City within 30 days after the date of the final certificate.

Before issuance of final certificates, the Contractor shall file with the City:

(1) The consent of the surety to payment of the final estimate;
(2) The Contractor's Affidavit in the form required by Section 44.

In case the Affidavit or consent is not furnished, the City may retain out of any amount due the Contractor, sums sufficient to cover all lienable claims.

The making and acceptance of the final payment shall constitute a waiver of all claims by the City except those arising from:

(1) unsettled liens;
(2) faulty work appearing within 12 months after final payment;
(3) hidden defects in meeting the requirements of the plans and specifications;
(4) manufacturer's guarantees.

It shall also constitute a waiver of all claims by the Contractor, except those previously made and still unsettled.

Section 20 - Suspension of Work

The City may at any time suspend the work, or any part by giving 5 days notice to the Contractor in writing. The work shall be resumed by the Contractor within 10 days after the date fixed in the written notice from the City to the Contractor to do so. The City shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this Contract as a result of the suspension.

If the work, or any part, shall be stopped by the notice in writing, and if the City does not give notice in writing to the Contractor to resume work at a date within 90 days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work suspended and will be entitled to the estimates and payments for all work done on the portions abandoned, if any, plus 10% of the value of the work abandoned, to compensate for loss of overhead, plant expense, and anticipated profit.

Section 21 - Delays and the City's Right to Terminate Contract

If the Contractor refuses or fails to prosecute the work, or any separate part of it, with the diligence required to insure completion, ready for operation, within the allowable number of consecutive calendar days specified plus extensions, or fails to complete the work within the required time, the City may, by written notice to the Contractor, terminate its right to proceed with the work or any part of the work as to which there has been delay. After providing the notice the City may take over the work and prosecute it to completion, by contract or otherwise, and the Contractor and its sureties shall be liable to the City for any excess cost to the City. If the Contractor's right to proceed is terminated, the City may take possession of and utilize in completing the work, any materials, appliances and plant as may be on the site of the work and useful for completing the work. The right of the Contractor to proceed shall not be terminated or the Contractor charged with liquidated damages where an extension of time is granted under Extension of Time - Section 14.

If the Contractor is adjudged a bankrupt, or if it makes a general assignment for the benefit of creditors, or if a receiver is appointed on account of its insolvency, or if it persistently or repeatedly refuses or fails except in cases for which extension of time is provided, to supply enough properly skilled workers or proper materials, or if it fails to make prompt payments to subcontractors or for material or labor, or persistently disregards laws, ordinances or the instructions of the Supervising Professional, or otherwise is guilty of a substantial violation of any provision of the Contract, then the City, upon the certificate of the Supervising Professional that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy and after giving the Contractor 3 days written notice, terminate this Contract. The City may then take possession of the premises and of all materials, tools and appliances thereon and without prejudice to any other remedy it may have, make good the deficiencies or finish the work by whatever method it may deem expedient, and deduct the cost from the payment due the Contractor. The Contractor shall not be entitled to receive any further payment until the work is finished. If the expense of finishing the work, including compensation for additional managerial and administrative services exceeds the unpaid balance of the Contract Sum, the Contractor and its surety are liable to the City for any excess cost incurred. The expense incurred by the City, and the damage incurred through the Contractor's default, shall be certified by the Supervising Professional.

Section 22 - Contractor's Right to Terminate Contract

If the work should be stopped under an order of any court, or other public authority, for a period of 3 months, through no act or fault of the Contractor or of anyone employed by it, then the Contractor may, upon 7 days written notice to the City, terminate this Contract and recover from the City payment for all acceptable work executed plus reasonable profit.

Section 23 - City's Right To Do Work

If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the City, 3 days after giving written notice to the Contractor and its surety may, without prejudice to any other remedy the City may have, make good the deficiencies and may deduct the cost from the payment due to the Contractor.

Section 24 - Removal of Equipment and Supplies

In case of termination of this Contract before completion, from any or no cause, the Contractor, if notified to do so by the City, shall promptly remove any part or all of its equipment and supplies from the property of the City, failing which the City shall have the right to remove the equipment and supplies at the expense of the Contractor.

The removed equipment and supplies may be stored by the City and, if all costs of removal and storage are not paid by the Contractor within 10 days of invoicing, the City upon 10 days written notice may sell the equipment and supplies at auction or private sale, and shall pay the Contractor the net proceeds after deducting all costs and expenses that should have been borne by the Contractor and after deducting all amounts claimed due by any lien holder of the equipment or supplies.

Section 25 - Responsibility for Work and Warranties

The Contractor assumes full responsibility for any and all materials and equipment used in the construction of the work and may not make claims against the City for damages to materials and equipment from any cause except negligence or willful act of the City. Until its final acceptance, the Contractor shall be responsible for damage to or destruction of the project (except for any part covered by Partial Completion and Acceptance - Section 26). The Contractor shall make good all work damaged or destroyed before acceptance. All risk of loss remains with the Contractor until final acceptance of the work (Section 19) or partial acceptance (Section 26). The Contractor is advised to investigate obtaining its own builders risk insurance.

The Contractor shall guarantee the quality of the work for a period of one year. The Contractor shall also unconditionally guarantee the quality of all equipment and materials that are furnished and installed under the contract for a period of one year. At the end of one year after the Contractor's receipt of final payment, the complete work, including equipment and materials furnished and installed under the contract, shall be inspected by the Contractor and the Supervising Professional. Any defects shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days. Any defects that are identified prior to the end of one year shall also be inspected by the Contractor and the Supervising Professional and shall be corrected by the Contractor at its expense as soon as practicable but in all cases within 60 days.

The Contractor shall assign all manufacturer or material supplier warranties to the City prior to final payment. The assignment shall not relieve the Contractor of its obligations under this paragraph to correct defects.

Section 26 - Partial Completion and Acceptance

If at any time prior to the issuance of the final certificate referred to in Acceptance and Final Payment - Section 19, any portion of the permanent construction has been satisfactorily completed, and if the Supervising Professional determines that portion of the permanent construction is not required for the operations of the Contractor but is needed by the City, the Supervising Professional shall issue to the Contractor a certificate of partial completion, and immediately the City may take over and use the portion of the permanent construction described in the certificate, and exclude the Contractor from that portion.

The issuance of a certificate of partial completion shall not constitute an extension of the Contractor's time to complete the portion of the permanent construction to which it relates if the Contractor has failed to complete it in accordance with the terms of this Contract. The issuance of the certificate shall not release the Contractor or its sureties from any obligations under this Contract including bonds.

If prior use increases the cost of, or delays the work, the Contractor shall be entitled to extra compensation, or extension of time, or both, as the Supervising Professional may determine.

Section 27 - Payments Withheld Prior to Final Acceptance of Work

The City may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to the extent reasonably appropriate to protect the City from loss on account of:

(1) Defective work not remedied;

(2) Claims filed or reasonable evidence indicating probable filing of claims by other parties against the Contractor;

(3) Failure of the Contractor to make payments properly to subcontractors or for material or labor;

(4) Damage to another Contractor.

When the above grounds are removed or the Contractor provides a Surety Bond satisfactory to the City which will protect the City in the amount withheld, payment shall be made for amounts withheld under this section.

Section 28 - Contractor's Insurance

A. The Contractor shall procure and maintain during the life of this Contract, including the guarantee period and during any warranty work, such insurance policies, including those set forth below, as will protect itself and the City from all claims for bodily injuries, death or property damage which may arise under this Contract; whether the acts were made by the Contractor or by any subcontractor or anyone employed by them directly or indirectly. The following insurance policies are required:

1. Worker's Compensation Insurance in accordance with all applicable state and federal statutes. Further, Employers Liability Coverage shall be obtained in the following minimum amounts:

   Bodily Injury by Accident - $500,000 each accident
   Bodily Injury by Disease - $500,000 each employee
   Bodily Injury by Disease - $500,000 each policy limit

2. Commercial General Liability Insurance equivalent to, as a minimum, Insurance Services Office form CG 00 01 07 98. The City of Ann Arbor shall be named as an additional

insured. There shall be no added exclusions or limiting endorsements including, but not limited to: Products and Completed Operations, Explosion, Collapse and Underground coverage or Pollution. Further, the following minimum limits of liability are required:

$1,000,000 Each occurrence as respect Bodily Injury Liability or Property Damage Liability, or both combined.

$2,000,000 Per Job General Aggregate

$1,000,000 Personal and Advertising Injury

$2,000,000 Products and Completed Operations Aggregate

3. Motor Vehicle Liability Insurance, including Michigan No-Fault Coverages, equivalent to, as a minimum, Insurance Services Office form CA 00 01 07 97. The City of Ann Arbor shall be named as an additional insured. There shall be no added exclusions or limiting endorsements. Coverage shall include all owned vehicles, all non-owned vehicles and all hired vehicles. Further, the limits of liability shall be $1,000,000 for each occurrence as respects Bodily Injury Liability or Property Damage Liability, or both combined.

4. Umbrella/Excess Liability Insurance shall be provided to apply excess of the Commercial General Liability, Employers Liability and the Motor Vehicle coverage enumerated above, for each occurrence and for aggregate in the amount of $1,000,000.

B. Insurance required under Section A.2 and A.3 of this Contract shall be considered primary as respects any other valid or collectible insurance that the City may possess, including any self-insured retentions the City may have; and any other insurance the City does possess shall be considered excess insurance only and shall not be required to contribute with this insurance. Further, the Contractor agrees to waive any right of recovery by its insurer against the City.

C. In the case of all Contracts involving on-site work, the Contractor shall provide to the City before the commencement of any work under this Contract documentation demonstrating it has obtained the above mentioned policies. Documentation must provide and demonstrate an unconditional 30 day written notice of cancellation in favor of the City of Ann Arbor. Further, the documentation must explicitly state the following: (a) the policy number; name of insurance company; name and address of the agent or authorized representative; name and address of insured; project name; policy expiration date; and specific coverage amounts; (b) any deductibles or self-insured retentions which shall be approved by the City, in its sole discretion; (c) that the policy conforms to the requirements specified. An original certificate of insurance may be provided as an initial indication of the required insurance, provided that no later than 21 calendar days after commencement of any work the Contractor supplies a copy of the endorsements required on the policies. Upon request, the Contractor shall provide within 30 days a copy of the policy(ies) to the City. If any of the above coverages expire by their terms during the term of this Contract, the Contractor shall deliver proof of renewal and/or new policies to the Administering Service Area/Unit at least ten days prior to the expiration date.

D. Any Insurance provider of Contractor shall be admitted and authorized to do business in the State of Michigan and shall carry and maintain a minimum rating assigned by A.M. Best & Company's Key Rating Guide of "A-" Overall and a minimum Financial Size Category of "V". Insurance policies and certificates issued by non-admitted insurance companies are not acceptable unless approved in writing by the City.

Section 29 - Surety Bonds

Bonds will be required from the successful bidder as follows:

(1) A Performance Bond to the City of Ann Arbor for the amount of the bid(s) accepted;
(2) A Labor and Material Bond to the City of Ann Arbor for the amount of the bid(s) accepted.

Bonds shall be executed on forms supplied by the City in a manner and by a Surety Company satisfactory to the City Attorney.

Section 30 - Damage Claims

The Contractor shall be held responsible for all damages to property of the City or others, caused by or resulting from the negligence of the Contractor, its employees, or agents during the progress of or connected with the prosecution of the work, whether within the limits of the work or elsewhere. The Contractor must restore all property injured including sidewalks, curbing, sodding, pipes, conduit, sewers or other public or private property to not less than its original condition with new work.

Section 31 - Refusal to Obey Instructions

If the Contractor refuses to obey the instructions of the Supervising Professional, the Supervising Professional shall withdraw inspection from the work, and no payments will be made for work performed thereafter nor may work be performed thereafter until the Supervising Professional shall have again authorized the work to proceed.

Section 32 - Assignment

Neither party to the Contract shall assign the Contract without the written consent of the other. The Contractor may assign any monies due to it to a third party acceptable to the City.

Section 33 - Rights of Various Interests

Whenever work being done by the City's forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Supervising Professional, to secure the completion of the various portions of the work in general harmony.

The Contractor is responsible to coordinate all aspects of the work, including coordination of, and with, utility companies and other contractors whose work impacts this project.

Section 34 - Subcontracts

The Contractor shall not award any work to any subcontractor without prior written approval of the City. The approval will not be given until the Contractor submits to the City a written statement concerning the proposed award to the subcontractor. The statement shall contain all information the City may require.

The Contractor shall be as fully responsible to the City for the acts and omissions of its subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the work to bind subcontractors to the Contractor by the terms of the General Conditions and all other contract documents applicable to the work of the subcontractors and to give the Contractor the same power to terminate any subcontract that the City may exercise over the Contractor under any provision of the contract documents.

Nothing contained in the contract documents shall create any contractual relation between any subcontractor and the City.

Section 35 - Supervising Professional's Status

The Supervising Professional has the right to inspect any or all work. The Supervising Professional has authority to stop the work whenever stoppage may be appropriate to insure the proper execution of the Contract. The Supervising Professional has the authority to reject all work and materials which do not conform to the Contract and to decide questions which arise in the execution of the work.

The Supervising Professional shall make all measurements and determinations of quantities. Those measurements and determinations are final and conclusive between the parties.

Section 36 - Supervising Professional's Decisions

The Supervising Professional shall, within a reasonable time after their presentation to the Supervising Professional, make decisions in writing on all claims of the City or the Contractor and on all other matters relating to the execution and progress of the work or the interpretation of the contract documents.

Section 37 - Storing Materials and Supplies

Materials and supplies may be stored at the site of the work at locations agreeable to the City unless specific exception is listed elsewhere in these documents. Ample way for foot traffic and drainage must be provided, and gutters must, at all times, be kept free from obstruction. Traffic on streets shall be interfered with as little as possible. The Contractor may not enter or occupy with agents, employees, tools, or material any private property without first obtaining written permission from its owner. A copy of the permission shall be furnished to the Supervising Professional.

Section 38 - Lands for Work

The Contractor shall provide, at its own expense and without liability to the City, any additional land and access that may be required for temporary construction facilities or for storage of materials.

Section 39 - Cleaning Up

The Contractor shall, as directed by the Supervising Professional, remove at its own expense from the City's property and from all public and private property all temporary structures, rubbish and waste materials resulting from its operations unless otherwise specifically approved, in writing, by the Supervising Professional.

Section 40 - Salvage

The Supervising Professional may designate for salvage any materials from existing structures or underground services. Materials so designated remain City property and shall be transported or stored at a location as the Supervising Professional may direct.

Section 41 - Night, Saturday or Sunday Work

No night or Sunday work (without prior written City approval) will be permitted except in the case of an emergency and then only to the extent absolutely necessary. The City may allow night work which, in the opinion of the Supervising Professional, can be satisfactorily performed at night. Night work is any work between 8:00 p.m. and 7:00 a.m. No Saturday work will be permitted unless the Contractor gives the Supervising Professional at least 48 hours but not more than 5 days notice of the Contractor's intention to work the upcoming Saturday.

Section 42 - Sales Taxes

Under State law the City is exempt from the assessment of State Sales Tax on its direct purchases. Contractors who acquire materials, equipment, supplies, etc. for incorporation in City projects are not likewise exempt. State Law shall prevail. The Bidder shall familiarize itself with the State Law and prepare its Bid accordingly. No extra payment will be allowed under this Contract for failure of the Contractor to make proper allowance in this bid for taxes it must pay.

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period _____, 20__, to _____, 20__, performed any work, furnished any materials, sustained any loss, damage or delay, or otherwise done anything in addition to the regular items (or executed change orders) set forth in the Contract titled Fuller Pool Boiler Replacement, for which I shall ask, demand, sue for, or claim compensation or extension of time from the City, except as I hereby make claim for additional compensation or extension of time as set forth on the attached itemized statement. I further declare that I have paid all payroll obligations related to this Contract that have become due during the above period and that all invoices related to this Contract received more than 30 days prior to this declaration have been paid in full except as listed below.

There is/is not (Contractor please circle one and strike one as appropriate) an itemized statement attached regarding a request for additional compensation or extension of time.

_____ _____

Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Past due invoices, if any, are listed below.

CONTRACTOR'S AFFIDAVIT

The undersigned Contractor,_____, represents that on _____, 20___, it was awarded a contract by the City of Ann Arbor, Michigan to_____ under the terms and conditions of a Contract titled Fuller Pool Boiler Replacement. The Contractor represents that all work has now been accomplished and the Contract is complete.

The Contractor warrants and certifies that all of its indebtedness arising by reason of the Contract has been fully paid or satisfactorily secured; and that all claims from subcontractors and others for labor and material used in accomplishing the project, as well as all other claims arising from the performance of the Contract, have been fully paid or satisfactorily settled. The Contractor agrees that, if any claim should hereafter arise, it shall assume responsibility for it immediately upon request to do so by the City of Ann Arbor.

The Contractor, for valuable consideration received, does further waive, release and relinquish any and all claims or right of lien which the Contractor now has or may acquire upon the subject premises for labor and material used in the project owned by the City of Ann Arbor.

This affidavit is freely and voluntarily given with full knowledge of the facts.

_____ _____
Contractor Date

By _____
(Signature)

Its _____
(Title of Office)

Subscribed and sworn to before me, on this _____ day of _____, 20__
_____ , _____ County, Michigan
Notary Public
_____ County, MI
My commission expires on:

STANDARD SPECIFICATIONS

All work under this contract shall be performed in accordance with the Public Services Department Standard Specifications in effect at the date of availability of the contract documents stipulated in the Advertisement. All work under this Contract which is not included in these Standard Specifications, or which is performed using modifications to these Standard Specifications, shall be performed in accordance with the Detailed Specifications included in these contract documents.

A copy of the Public Services Department Standard Specifications may be purchased from the Engineering Division, (Fourth Floor, City Hall, Ann Arbor, Michigan), for $35.00 per copy. In addition, a copy of these Standard Specifications is available for public viewing at the Engineering Division office, for review Monday through Friday between the hours of 8:30 a.m. and 4:00 p.m. Copies of the Standard Specifications can also be downloaded from the web link:

http://www.a2gov.org/government/publicservices/project_management/privatedev/pages/standardspecificationsbook.aspx.

DETAILED SPECIFICATIONS

SECTION 01000

GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Work under this Contract consists of replacement of an existing boiler including all necessary demolition, concrete work, piping, ducting, roof penetrations, roof repair, all mechanical, plumbing, gas, electrical, start-up, testing, training and all related work necessary for a complete and fully operational system.

B. It is the intent of these Contract Documents that the CONTRACTOR provide a complete and finished system. Items shown on the Drawings and Specifications not specifically connected to a heading in the Bid Form are to be considered as incidental to the work.

1.2 EXISTING FACILITIES ACCESS

A. The CONTRACTOR shall be responsible for maintaining safe access for the public to the existing park areas beyond the work zones. The CONTRACTOR shall install path barricades and signage to limit public access to the work zone during working hours. The signs and barricades shall be removed during non-working hours.

B. Access to the pool shall not be temporarily disrupted without coordination with and prior approval of the OWNER.

C. Prior to commencing work, the CONTRACTOR shall submit to the OWNER a plan for bringing construction traffic to and from the site.

1.3 CONSTRUCTION WATER

A. Water for construction is available from the OWNER and may be obtained from the existing facilities. The CONTRACTOR shall be responsible for providing all necessary backflow prevention.

1.4 CONSTRUCTION POWER

A. Power for construction is available at the site.

1.5 WORK SCHEDULE

A. The CONTRACTOR shall provide a work schedule. The schedule shall be complete and shall show in detail the manner in which he proposes to complete the work under this Contract and approximate monthly billing of the Contract. The purpose of the schedule is to assist the OWNER in notifying the public of inconveniences and to anticipate cash-flow on the job, and to determine if the CONTRACTOR is reasonably proceeding with the work to assure completion within the specified time.

B. Work hours shall be restricted to Monday through Friday, 7AM to 7PM. Work shall not be conducted on City holidays. Exceptions to work hour limits shall by only by written permission of the OWNER.

1.6 CONSTRUCTION SEQUENCE

A. The CONTRACTOR shall coordinate and schedule his work with the OWNER when his operation may affect access to existing facilities or interfere with dam operations.

B. Prior to commencing the work, the CONTRACTOR shall provide the ENGINEER a detailed schedule of the proposed work. The schedule shall include a list of tasks required to complete the work; their relevancy to each other; expected duration; and completion dates.

1.7 CONSTRUCTION PERMITS

A. The CONTRACTOR will be required to follow the requirements established by all permits necessary for the construction of this project. The following is a list of permits that must be obtained prior to the beginning of construction.

1. City of Ann Arbor Building Permits (all trades).

B. The City of Ann Arbor Building permits (all trades) shall be issued by the City of Ann Arbor. The CONTRACTOR will be required to apply for, pay all fees, obtain and adhere to all requirements of the permit.

1.8 DIGITAL PHOTOGRAPHIC RECORD

A. The CONTRACTOR shall furnish to the OWNER a digital photographic record for all areas proposed for improvement and all access ways to the work area. In general, the CONTRACTOR shall include parking lots, access paths for construction traffic, storage and staging areas and other areas that may be impacted by his activities.

B. The photographs shall be stored on a CD or DVD of such quality to accurately show the existing conditions. The record shall be produced one (1) week prior to the placement of materials or equipment in the construction area.

C. The record shall include overview photos of each entire area; and detailed photos of key features, including railings, decking, pavements, structures, utilities, equipment, etc. The photographs shall be ordered in sequential sets as follows: photograph of a sign board identifying each separate area; overview photo or photos of that area; and detailed views relevant only to that particular area. The overview photographs should enable to viewer to identify both the area in question and the particular items that are shown in detail in the photographs immediately following.

D. The photographs must be recorded while the visibility is clear and at no time will it be allowed during periods of ground cover.

E. The photographic record shall include date, time, and location at appropriate intervals. The location shall be easily referenced to the Contract Drawings.

1.9 PROJECT PROGRESS MEETING

A. It shall be the responsibility of the CONTRACTOR to have a representative, including key subcontractors, present at each meeting. The CONTRACTOR shall be available for meetings shall be held at least twice a month as necessary.

1.10 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

A. GENERAL

The method of measurement and the basis of payment for each item in the Proposal will be as specified by the Bid Forms. The items are generally grouped by the section of the Specifications under which the particular unit of work is detailed. There will be no payment allowed for any unit of work not specifically mentioned in the Proposal as a bid item, and any such unit of work not mentioned in the Proposal, but necessary for the completion of the Project, will be considered as incidental to the construction of the Project.

B. PAYMENT

In each and every instance in the following Measurement and Payment Schedule, where a Basis of Payment is specified, it shall be understood to be prefaced by the following statement, "**The contract unit price bid in the Proposal will be payment in full for all labor, materials, and equipment necessary to do the following according to the Plans and Specifications**." Payment shall be made on the basis of the actual quantity of the item completed and accepted at the unit price for such item named in the Proposal.

END OF SECTION

SECTION 01210

ALLOWANCES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cash Allowances

1.2 DEFINITIONS

A. Cash Allowance: A monetary sum that includes, as part of the contract price, the associated costs and requirements to complete the specified allowance.

1.3 SUBMITTALS

A. Submit detailed invoices to indicate the work performed or delivery slips to indicate actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.4 OWNER'S INSTRUCTIONS

A. Use allowances only as directed by the OWNER for OWNER's purposes, and only by Change Orders which designate amounts to be charged to the allowance.

B. If the actual price for the specified allowance is more or less than the stated allowance, the contract price shall be adjusted accordingly by Change Order. The adjustment in contract price shall be made in accordance with the General Conditions.

C. At project closeout, any amounts remaining in allowances will be credited to OWNER by Change Order.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related construction activities.

3.2 CASH ALLOWANCE FOR MISCELLANEOUS REPAIRS

A. A cash allowance of $15,000 shall be included in the contract price for miscellaneous repairs as directed by the City. All administrative work and coordination between the CONTRACTOR and City shall be considered incidental to the Contract.

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Submittal Procedures

B. Certifications

C Shop Drawings

D. Product Data

E. Samples

F. Manufacturers' Instructions

G. Manufacturers' Field Reports

H. Construction Schedule

I. Submittal Schedule

1.2 SUBMITTAL PROCEDURES

A. Package each submittal appropriately for shipping and handling. This shall include an index either on the transmittal or within the submittal itself. Transmit each submittal from CONTRACTOR to ENGINEER using a transmittal form. Submittals received from sources other than CONTRACTOR will be returned without action. Use separate transmittals for items from different specification sections. Number each submittal consecutively. Resubmittals should have the same number as the original, plus a letter designation for each Resubmittal (i.e. 7-A, 7-B, etc.)

B. Indicate on the transmittal relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitations. Include CONTRACTOR's certification that information complies with Contract Document requirements. On Resubmittal, all changes shall be clearly identified for ease of review. Resubmittals shall be reviewed for the clearly identified changes only. Any changes not clearly identified will not be reviewed and original submittal shall govern.

C. Include the following information on the label for processing and recording action taken.

1. Project name.

2. Date.

3. Name and address of ENGINEER.

4. Name and address of CONTRACTOR.

5. Name and address of subcontractor.

6. Name and address of supplier.

7. Name of manufacturer.

8. Number and title of appropriate specification sections.

9. Drawing number and detail references, as appropriate.

D. Schedule submittals to expedite the Project, and deliver to ENGINEER at business address. Coordinate submission of related items. Coordinate related activities that require sequential activity.

E. Submit a schedule of shop drawing submittals.

F. Review and approve shop drawings, project data, and samples before submitting them.

G. Verify field measurements, field construction criteria, catalog numbers, and similar data. Indicate on the submission exactly what was verified.

H. Any markings done by CONTRACTOR shall be done in a color other than red. Red is reserved for ENGINEER's marking.

I. The number of copies to be submitted will be determined at the pre-construction conference. Reproducible may be submitted and will be marked and returned to CONTRACTOR. Blue or black line prints shall be submitted in sufficient quantity for distribution to ENGINEER and OWNER recipients.

J. Coordinate each submittal with the requirements of the Contract Documents.

K. Provide space for CONTRACTOR and ENGINEER review stamps.

L. Apply CONTRACTOR's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.

M. Submit the number of copies that the CONTRACTOR requires, plus four copies that will be retained by the OWNER and ENGINEER.

N. Identify variations from Contract Documents and Product or system limitations that may be detrimental to successful performance of the completed Work.

O. No claim will be allowed for damages or extension of time because of delays in the work resulting from rejection of material or from revision and resubmittal of shop drawings, project data, or samples.

P. No extension of contract time will be authorized because of failure to transmit submittals to ENGINEER sufficiently in advance of the work to permit processing.

Q. ENGINEER reserves the right to withhold action on a submittal required coordination with other submittals until related submittals are received.

R. Do not install materials or equipment which requires submittals until the submittals are returned with ENGINEER's/OWNER's stamp and initials or signature indicating approval. The OWNER shall have final approval authority.

S. CONTRACTOR's responsibility of errors, omissions, and deviations from requirements of Contract Documents in submittals is not relieved by the ENGINEER's review.

T. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with requirements.

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

V. Submittals not requested in conformance with this Specification will not be recognized or processed.

W. Revise and resubmit as required, identify all changes made since the previous submittal.

X. In the event that more than two re-submittals of any submittal is necessary to achieve conformance to the contract requirements, CONTRACTOR shall be charged for excess engineering. The OWNER shall deduct these charges from the CONTRACTOR's final payment. Charges will be $115.00/hr. minimum 4 hours, for each additional submittal of an item. A tabulated record of such charges will be provided for the CONTRACTOR’s review prior to the processing of the final payment.

Y. Submit new project data and samples when the initial submittal is returned disapproved.

1.3 CERTIFICATIONS

A. When specified in individual specification sections, submit certification by the manufacturer, installation/application subcontractor, or the CONTRACTOR to ENGINEER, in quantities specified for Product Data.

B. Indicate that the material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certifications may be recent or previous test results of the material or product, but must be acceptable to ENGINEER.

1.4 SHOP DRAWINGS

A. Shop Drawings: Submit to ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with Paragraph 1.2 - Submittal Procedures.

B. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of shop drawings. Standard information prepared without specific reference to the project is not considered shop drawings.

C. Shop drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates, and similar drawings. Include the following information:

1. Dimension.

2. Identification of products and materials included.

3. Compliance with specified standards.

4. Notation of coordination requirements.

5. Notation of dimensions established by field measurements.

D. Standard manufactured items in the form of catalog work sheets showing illustrated cuts of the items to be furnished, scale details, sizes, dimensions, quantity, and all other pertinent information should be submitted and approved in a similar manner.

E. Measurements given on shop drawings or standard catalog sheets, as established from contract drawings and as approved by ENGINEER, shall be followed. When it is necessary to verify field measurements, they shall be checked and established by CONTRACTOR. The field measurements so established shall be followed by CONTRACTOR and by all affected trades.

F. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.5 PRODUCT DATA

A. Product Data: Submit to ENGINEER for review for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with Paragraph 1.2 - Submittal Procedures.

B. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

1.6 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to ENGINEER for delivery to OWNER in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.7 MANUFACTURER'S FIELD REPORTS

A. Submit reports for the OWNER.

B. Submit report in duplicate, within 7 days of observation, to ENGINEER and OWNER for Information.

C. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the Contract Documents.

1.8 CONSTRUCTION SCHEDULE

A. Bar Chart Schedule:

1. Prepare a fully developed, horizontal bar chart type construction schedule. Schedule shall be prepared electronically in Microsoft Project with critical path and links shown. Submit color copies of the schedule within 30 days of the date established for commencement of the work.

2. Provide a separate item bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated on schedule of values.

3. Prepare schedule of sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for entire construction period.

4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.

5. Coordinate construction schedule with schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other schedules.

6. Indicate completion in advance of the date established for substantial completion. Indicate substantial completion of schedule to allow time for ENGINEER's procedures necessary for certification of substantial completion

B. Schedule Updating: Provide an updated construction schedule at each progress meeting. Color copies of the updated schedule shall be prepared for all attendees.

1.9 SUBMITTAL SCHEDULE

A. After development and acceptance of the construction schedule, prepare a complete schedule of submittals. Submit schedule within 10 days of the date required for establishment of construction schedule.

B. Coordinate submittal schedule with the list of subcontracts, schedule of values, and the list of products as well as construction schedule.

C. Prepare schedule in chronological order; include submittals required during the first 90 days. Provide the following information:

1. Scheduled date for the first submittal.

2. Related section number.

3. Submittal category.

4. Name of subcontractor.

5. Description of the part of the work covered.

6. Scheduled date for Resubmittal.

7. Scheduled date ENGINEER's final release or approval.

D. The submittal schedule shall reflect critical path shop drawings that must be expedited.

E. Following response to initial submittal, print and distribute copies to ENGINEER, OWNER, subcontractors, and other parities required to comply with submittal dates indicated. Post copies in the project meeting room and field office.

F. When revisions are made, distribute to the same parities and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the work and are no longer involved in construction activities.

G. Schedule Updating: Provide an updated submittal schedule at each progress meeting.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 ENGINEER'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, ENGINEER will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is CONTRACTOR's responsibility.

B. Action Stamp: ENGINEER will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken" that part of the work covered by the submittal may proceed provided it complies with the requirements of the Contract Documents; final acceptance will depend upon the compliance.

2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted" that part of the work covered by the submittal may proceed, provided it complies with notation or correction on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.

3. Returned for Resubmittal: When submittal is marked "Rejected" or "Revise and Resubmit" do not proceed with the part of the work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.

a. Do not permit submittals marked "Rejected" or "Revise and Resubmit" to be used at site, or elsewhere where work is in progress.

4. Additional Information Needed: When submittal is marked “Submit Specified Item” CONTRACTOR shall submit requested information.

5. Other Action: Where a submittal is primarily for information or record purposes, special processing or other activity, the submittal will be returned, marked “Acknowledge Receipt”.

6. The approval of ENGINEER shall not relieve CONTRACTOR of responsibility for errors on drawings or submittals as ENGINEER’s checking is intended to cover compliance with drawings and specifications and not enter into every detail of the shop work.

END OF SECTION

SECTION 01770

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Substantial Completion

B. Final Inspection

C. Request for Final Payment

1.2 SUBSTANTIAL COMPLETION

A. Substantial completion shall be the date as certified by the ENGINEER when the construction of the Project, or a specified part thereof, is sufficiently completed, in accordance with the Contract Documents, so that the Project, or specified part, can be fully utilized for the purposes for which it was intended.

B. Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.

1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the work claimed as substantially complete. Include supporting documents for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the contract price.

2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the work is not complete.

3. Advise OWNER of pending insurance changeover requirements.

4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

5. Obtain and submit releases enabling OWNER unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificate, and similar releases.

6. Complete final cleanup requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

7. Provide all required demonstration and training sessions.

C. Inspection Procedures: On receipt of a request for inspection, ENGINEER will either proceed with inspection or advise CONTRACTOR of unfilled requirements.

1. ENGINEER will prepare the Certificate of Substantial Completion following inspection, or advise CONTRACTOR of construction that must be completed or corrected before the certificate will be issued.

2. ENGINEER will repeat inspection when requested and assured that the work has been substantially completed.

3. Results of completed inspection will be for the basis of requirements for final acceptance.

4. Date of Substantial Completion will begin the warranty period unless noted otherwise.

1.3 FINAL ACCEPTANCE

A. Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the contract price.

3. Submit a copy of ENGINEER's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance. The list shall be endorsed and dated by the ENGINEER.

4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion, or when OWNER took possession of and responsibility for corresponding elements of the work.

5. Submit consent of surety to final payment.

6. Submit a final liquidated damages settlement statement.

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

8. Submit record drawings, maintenance manuals, damage or settlement survey, property survey, and similar final record information.

9. Deliver tools, spare parts, extra stock, and similar items.

10. Make final changeover of permanent locks and transmit keys to OWNER. Advise OWNER's personnel of changeover in security provisions.

11. Complete commissioning and training of OWNER's personnel.

12. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.

B. Re-inspection Procedure: ENGINEER will inspect the work upon receipt of notice that work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the ENGINEER.

1. Upon completion of re-inspection, ENGINEER will prepare a certificate of final acceptance, or advise CONTRACTOR of work that is incomplete or of obligations that have not been fulfilled bet are required for final acceptance. If necessary, re-inspection will be repeated.

1.4 REQUEST FOR FINAL PAYMENT

A. Submit request for final payment in accordance with the Agreement and General Conditions.

B. Request for final payment shall include:

1. Documents required in the General Conditions, as may be modified by the Supplementary Conditions.

2. Releases or Waivers of Lien Rights:

a. When submitting releases or waivers of Lien rights, provide release or waiver by CONTRACTOR and each Subcontractor and Supplier that provided CONTRACTOR with labor, material, or equipment.

b. Provide list of Subcontractors and Suppliers for which release or waiver of Lien is required.

c. Each release or waiver of Lien shall be signed by an authorized representative of entity submitting release or waiver to CONTRACTOR, and shall include Subcontractor's or Supplier's corporate seal if applicable.

d. Release or waiver of Lien may be conditional upon receipt of final payment.

3. Consent of Surety.

4. Documentation that all punch list items are complete.

5. Warranties.

6. Operation and Maintenance Manuals.

7. Record Drawings being maintained by the CONTRACTOR.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

SECTION 02010

SITE GENERAL PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools and equipment necessary to perform the work.

1.2 SECURITY

A. CONTRACTOR shall provide written documentation of his safety plan for the work.

B. All work shall be performed in accordance with MIOSHA.

C. The site is accessible to the public; therefore additional precautions shall be taken for securing work areas, stores and equipment.

D. The OWNER's security requirements shall be met at both locations.

E. Existing access gates and chains shall remain locked at all times. The CONTRACTOR shall daisy chain all closures so that the OWNER can access as required.

F. All security precautions and measures shall be the responsibility of the CONTRACTOR.

G. Provide safety fencing around material or equipment storage.

1.3 CONSTRUCTION ACCESS

A. There is limited access for construction equipment and materials at the site.

B. The CONTRACTOR shall coordinate ongoing pedestrian access to the pedestrian footpaths throughout construction. In general, the footpaths within the work zone may be closed to pedestrian traffic during work hours.

C. Upon completion of work, the CONTRACTOR shall restore the site to its original condition.

1.4 WORK AREA AND STORAGE OF MATERIALS

A. The staging area shall be restored to existing conditions upon completion of the CONTRACTOR's work.

B. The working area shall be organized in an orderly manner with storage and tool sheds, sanitary facilities, parking areas for employees, and all other necessary facilities developed and maintained by the CONTRACTOR. The CONTRACTOR shall keep the work site and all access routes clean and dust free.

C. CONTRACTOR shall not allow any trash, concrete or other construction debris to enter the river. Any materials that fall into the river shall be retrieved and removed by the CONTRACTOR.

D. All materials, supplies and equipment, whether furnished by the CONTRACTOR or by the OWNER, shall be delivered, stored and handled as to prevent the inclusion of foreign

materials and/or damage by water, freezing, breakage or other causes. Packaged materials shall be delivered in the original unopened containers and shall be stored until ready for use. All materials which have been stored shall meet the requirements of the Specifications at the time they are used in the project.

1.5 NOTIFICATION TO UTILITIES

A. Prior to the start of any operations in the vicinity of any utilities, the CONTRACTOR shall notify the utility companies and request that they stake out the locations of the utilities in question.

1.6 EXISTING PUBLIC UTILITIES

A. The CONTRACTOR shall conduct his operations so as not to damage any existing utility. The CONTRACTOR shall correct, at his own expense, any injury caused during the operations of his subcontractors or suppliers.

1.7 SANITARY REQUIREMENTS

A. The CONTRACTOR shall provide adequate sanitary facilities for all persons employed on the project. The sanitary facilities shall conform in every way to the requirements of the "General Safety Rules and Regulations for the Construction Industry".

B. The sanitary facility shall be securely fixed to the ground to prevent vandalism.

C. The sanitary facility shall be locked by the CONTRACTOR during non-working hours.

1.8 WINTER CONSTRUCTION

A. The ENGINEER shall have permissive authority over the work which is proposed to be done during the winter months. The CONTRACTOR shall provide adequate weather protection, temporary heating and take any other measures which are necessary to insure that the work performed during the winter months is properly installed and protected against damage from freezing.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.1 RESTORATION

A. All areas disturbed or damaged as a result of construction activities shall be repaired to original conditions or better.

B. After all construction has been completed, the CONTRACTOR shall spread 4 inches of approved top soil over all disturbed areas. The CONTRACTOR shall secure and deliver to the site whatever amount is required at his own expense.

END OF SECTION

SECTION 03100

CONCRETE WORK

PART 1 – GENERAL

1.1 DESCRIPTION

A. Concrete work shall include the furnishing of all labor, materials, formwork, reinforcing, tools and equipment required to construct, place and finish all monolithic concrete work for a complete and functioning installation in accordance with the Contract Documents, including the following items:

1. Reinforcing;
2. Concrete bases for machinery; housekeeping pads.
3. Installing all inserts, anchors and anchor bolts as shown and/or specified.

1.2 REFERENCE SPECIFICATIONS

A. The American Concrete Institute's Standard Specifications for Structural Concrete for Buildings (ACI 301) is hereby made part of this Section as amended below, unless otherwise noted on the Plans or specified herein. The CONTRACTOR shall familiarize himself with, and his work shall be guided by, the ACI 301 and the Supplemental Requirements listed below. All ASTM or ACI Standards and Recommended Practices as referenced in ACI 301 are also hereby made parts of these Specifications.

1.3 QUALITY ASSURANCE

A. At least one person shall be present at all times during the execution of this work who shall be thoroughly trained and experienced in the handling and placing of the concrete work and who shall direct all work performed under this Section.

B. Only thoroughly trained and experienced journeyman concrete finishers shall be used in finishing exposed concrete surfaces.

PART 2 – PRODUCTS

2.1 SUPPLEMENTAL REQUIREMENTS

A. The supplemental requirements listed below are to be used in conjunction with ACI 301. Their numbering refers to the chapter and paragraph number of ACI 301 and intends to explain and/or modify the requirements therein:

2.1.2. Use Type I or Type III Portland Cement.

3.2 All monolithic concrete shall have minimum 4,000 psi, 28-day compressive strength. All concrete shall be fiber reinforced.

3.4.1. The water-cement ratio shall not exceed 0.44 by weight.

3.6. Use ASTM C33 Size 467 aggregate for footings and foundations; Size 57 aggregate for beams, slabs, and walls 12 inches or thicker; Size 67 aggregate for balance of work.

3.7.1. Calcium chloride or admixtures containing calcium chloride shall not be used.

3.8.1.2. Cement content shall not be less than 564 lbs per cubic yard of concrete.

4.1.3. Earth cuts as forms for vertical surfaces shall be permitted when neat and clean for footings and foundations, subject to ENGINEER's review.

4.2.4. Chamfer strips shall be required in the corners of concrete forms to produce beveled edges on permanently exposed surfaces. Chamfers shall be 3/4-inch x 3/4-inch unless otherwise noted on the Plans.

4.3.1. The tolerance limits as specified in Table 4.3.1. of ACI 301 shall apply.

4.5.5. Forms and shoring which support the weight of concrete in beams and slabs shall not be removed until the concrete has reached a minimum strength of 3,000 psi.

5.1.1. Reinforcing shop drawings shall be one reproducible (mylar or sepia) copy and one print.

5.2.1. All reinforcement shall be ASTM A615 Grade 60.

Plain bars are not permitted.

6.1.1. Construction joints shall be located as described in ACI 301. In general, slab and wall pours shall not exceed 1,200 sq ft surface area in one concrete placement between construction joints. The longer edge shall not be greater than twice the shorter edge for any one concrete pour between construction joints.

6.1.4. Bond through construction joints shall generally be obtained by method outlined in 6.1.4.1. or 6.1.4.3. of ACI 301, unless otherwise noted on the Plans.

6.2.2. Use bituminous type of expansion joint filler at intersections of walls and slabs on grade except where noted otherwise on the Plans.

Use a non-extruding and resilient bituminous type of expansion joint filler in slabs on grade, where slab to slab is joined.

8.6. Concreting under water will not be permitted except when so reviewed by the ENGINEER.

9.3. Tie holes shall be thoroughly filled with non-shrink patching mortar. The layout of tie holes and exterior finish of the tie holes on surfaces permanently exposed to view on the outside shall be submitted to the ENGINEER for review.

10.2.2. Smooth form finish, as described in paragraph 10.2.2. of ACI 301 shall be used on all surfaces exposed to view.

PART 3 – EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection

1. Before starting the work of this Section, the installed work of all other trades shall be inspected and verified complete to the point that concrete work may properly begin.

2. Verify that all items to be embedded in concrete are in place.

3. Verify that concrete may be placed to the lines and elevations indicated on the Plans with all required clearances from reinforcement.

B. Discrepancies

1. In the event of any discrepancy between Plans and Specification requirements, and actual field conditions, the ENGINEER shall be immediately notified before beginning work.

2. In areas of discrepancy, concrete work shall not proceed until all such discrepancies are fully and correctly resolved.

3.2 PREPARATION

A. General

1. All construction scrap and debris shall be removed from the areas in which concrete will be placed.

2. Areas in which concrete will be placed shall be thoroughly cleaned to ensure the proper placement and bonding of concrete.

3. All concrete handling and transporting equipment shall be clean and free of dirt or other deleterious materials which would affect the quality of concrete work.

4. Substrate shall be roughened, saturate surface dry, and apply bonding agent per manufacturer's requirements.

B. Notification

1. The ENGINEER shall be notified of the placing of concrete at least 48 hours in advance of such work.

3.3 PERFORMANCE OF WORK

A. All concrete work in this Section shall be performed in full accordance with the previously stated requirements of this Section.

B. All work shall be wet cured for 3-days. Apply burlene and wet as-needed.

3.4 CLEANING UP

A. At the completion of the concrete work required in this Section to the satisfaction of and review by the ENGINEER, all extraneous concrete debris, materials and equipment shall be removed from the job site.

END OF SECTION

SECTION 07530

EPDM SINGLE-PLY MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section includes the following:

1. Adhered sheet roofing.
2. Vapor retarder.
3. Roof Insulation.

1.2 RELATED SECTIONS

A. Section 07600 – Flashing and Sheet Metal.

B. Section 07700 – Roof Specialties and Accessories

C. Section 07900 – Joint Sealants.

1.3 REFERENCES

A. ASTM D448, Sizes of Aggregate for Road and Bridge Construction

B. ASTM D4637, EPDM Sheet Used in Single-Ply Roof Membrane

C. ASTM D4811, Nonvulcanized (Uncured) Rubber Sheet Used as Roof Flashing

D. ASTM D6369, Design of Standard Flashing Details for EPDM Roof Membranes

E. ASTM E108, Fire Tests of Roof Coverings

F. FM 4450, Class 1 Insulated Steel Deck Roofs

G. FM 4470, Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction.

H. National Roofing Contractors Association, NRCA Roofing Manual

I. ANSI/SPRI WD-1, Wind Design Standard Practice for Roofing Assemblies

J. UL 790, Standard Test Methods for Fire Tests of Roof Coverings

K. UL RMSD, Roofing Materials and Systems Directory

1.4 DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in this Section.

1.5 PERFORMANCE REQUIREMENTS

A. General: Install sheet membrane roofing and base flashing that are watertight; will not permit the passage of liquid water; and will withstand wind loads, thermally induced movement, and exposure to weather without failure.

B. Material Compatibility: Provide roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. FM Listing: Provide sheet membrane, base flashings, and component materials that meet requirements of FM 4450 and FM 4470 as part of a roofing system and that are listed in FM's "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FM markings.

1. Roofing system shall comply with the following:

a. Fire/Windstorm Classification: Class 1A-90.

1.6 SUBMITTALS

A. Product Data: For each type of roofing product specified. Include data substantiating that materials comply with requirements.

B. Shop Drawings: Include plans, sections, and details of the following:

1. Base flashings and membrane terminations.

2. Tapered insulation, including slopes.

3. Expansion joint details.

C. Samples for Verification of the following products:

1. 12-by-12-inch square of sheet roofing, of color specified, including T-shaped side and end lap seam.

2. 12-by-12-inch square of roof insulation.

3. 12-by-12-inch square of walkway pads or rolls.

4. 12-inch length of metal termination bars.

D. Installer Certificates: Signed by roofing system manufacturer certifying that Installer is approved, authorized, or licensed by manufacturer to install specified roofing system.

E. Manufacturer Certificates: Signed by roofing manufacturer certifying that the roofing system complies with requirements specified in the "Performance Requirements" Article. Upon request, submit evidence of meeting requirements.

F. Qualification Data: For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

G. Product Test Reports: Based on evaluation of tests performed by manufacturer and witnessed by a qualified independent testing agency, indicate compliance of components of roofing system with requirements based on comprehensive testing of current product compositions.

H. Research/Evaluation Reports: Evidence of roofing system's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

I. Maintenance Data: For roofing system to include in the maintenance manuals specified in Division 1.

J. Warranty: Sample copy of standard roofing system manufacturer's warranty stating obligations, remedies, limitations, and exclusions of warranty.

K. Inspection Report: Copy of roofing system manufacturer's inspection report of completed roofing installation.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing roofing similar to that required for this Project and who is approved, authorized, or licensed by the roofing system manufacturer to install manufacturer's product.

B. Fire-Test-Response Characteristics: Provide roofing materials with the fire-test-response characteristics indicated as determined by testing identical products per test method indicated below by UL, FM, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Exterior Fire-Test Exposure: Class A; ASTM E 108, for application and slopes indicated.

C. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at Project site. Meet with the same participants and review the same items listed for the preinstallation conference. In addition, review status of submittals and coordination of work related to roof construction. Notify participants at least 5 working days before conference.

D. Preinstallation Conference: Before installing roofing system, conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Notify participants at least 5 working days before conference.

1. Meet with OWNER; Architect; Construction Manager and OWNER's insurer, testing and inspecting agency representative; roofing Installer; roofing system manufacturer's representative; deck Installer; and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.

2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.

3. Examine deck substrate conditions and finishes for compliance with requirements, including flatness and fastening.

4. Review loading limitations of deck during and after roofing.

5. Review flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect roofing.

6. Review governing regulations and requirements for insurance, certificates, and inspection and testing, if applicable.

7. Review temporary protection requirements for roofing system during and after installation.

8. Review roof observation and repair procedures after roofing installation.

9. Document proceedings, including corrective measures or actions required, and furnish copy of record to each participant.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.9 PROJECT CONDITIONS

A. Weather Limitations: Proceed with roofing work only when existing and forecasted weather conditions permit roofing to be installed according to manufacturers' written instructions and warranty requirements.

1.10 WARRANTY

A. General Warranty: The warranties specified in this Article shall not deprive the OWNER of other rights the OWNER may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the CONTRACTOR under requirements of the Contract Documents.

B. Standard Roofing Manufacturer's Warranty: Submit a written warranty, without monetary limitation, signed by roofing system manufacturer agreeing to promptly repair leaks resulting from defects in materials or workmanship for the following warranty period:

1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

1. EPDM Adhered Membrane System:

a. Carlisle Syntec Systems; Carlisle Corp.

b. Duro-Last

c. Firestone Building Products Co.

2.2 EPDM SHEET

A. EPDM Sheet: Uniform, flexible sheet formed from a terpolymer of ethylene-propylene-diene, complying with ASTM D4637, Type 1, of the following grade, class, thickness, backing, and exposed face color:

1. Grade and Class: Grade 1 or 2 and Class SR, scrim or fabric internal reinforced.

2. Thickness: 60 mils, nominal.

3. Backing: Unbacked.

4. Exposed Face Color: White.

2.3 AUXILLARY MATERIALS

A. General: Furnish auxiliary materials recommended by roofing system manufacturer for intended use and compatible with EPDM membrane roofing.

1. Furnish liquid-type auxiliary materials that meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: 60-mil- thick EPDM, uncured or cured, according to application.

C. Epichlorohydrin Sheet: 60-mil thick, unreinforced flexible sheet with the following properties as determined per ASTM test method indicated:

1. Tensile Strength: 1500 psi; ASTM D412.

2. Ultimate Elongation: 200 percent; ASTM D412.

3. Tear Resistance: 150 lbf/in.; ASTM D412.

4. Brittleness Temperature: Minus 20 deg F; ASTM D746.

5. Resistance to Ozone Aging: No cracks after 168 hours' exposure of 50 percent elongated sample at 104 deg F and 100-pphm ozone; ASTM D1149.

6. Resistance to Oil Aging: 15 percent maximum mass change after 168 hours' immersion in diesel fuel No. 2 at 158 deg F; ASTM D471.

D. Bonding Adhesive: Manufacturer's standard bonding adhesive.

E. Splice Adhesive and Cleaner: Single-component butyl splicing adhesive and solvent-based splice cleaner.

F. Splice Primer and Tape: Manufacturer's standard synthetic rubber polymer primer and 3-inch wide minimum, butyl splice tape with release film.

G. Lap Sealant: Manufacturer's standard single-component sealant.

H. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

I. Metal Termination Bars: Manufacturer's standard aluminum bars, approximately 1 inch wide, roll formed and prepunched.

J. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening sheet to substrate, and acceptable to roofing system manufacturer.

K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, in-seam sealants, termination reglets, and other accessories recommended by roofing system manufacturer for intended use.

2.4 VAPOR RETARDER

A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.

1. Adhesive: Manufacturer's standard roofing adhesive, FM approved for vapor-retarder application.

2.5 INSULATION MATERIALS

A. General: Provide preformed roof insulation boards that comply with requirements, selected from manufacturer's standard sizes and of thicknesses indicated.

1. Provide preformed, tapered insulation boards where indicated for sloping to drain. Fabricate with the following taper:

a. 1/8 inch per 12 inches, unless otherwise indicated.

2. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

B. Polyisocyanurate Board Insulation: Rigid, cellular polyisocyanurate thermal insulation with core formed by using HCFCs as blowing agents to comply with ASTM C1289, classified by facer type as follows:

1. Facer Type: Type II, felt or glass-fiber mat on both major surfaces.

2.6 INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatible with sheet roofing material.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions of FM 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

C. Cover Board: Cellulosic-fiber insulating board, ASTM C208, Type II, Grade 2, 1/2 inch thick.

D. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric mat, water permeable and resistant to ultraviolet degradation, type and weight as recommended by roofing system manufacturer for application.

2.7 ASPHALT MATERIALS

A. Roofing Asphalt: ASTM D312, Type III or IV.

B. Asphalt Primer: ASTM D41.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which roofing will be applied, with Installer present, for compliance with requirements.

B. Verify that roof openings and penetrations are in place and set and braced and that roof drains are properly clamped into position.

C. Verify that wood nailers are in place and secured and match thicknesses of insulation required.

D. Do not proceed with installation until after the minimum concrete curing period recommended by roofing system manufacturer.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

C. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.3 VAPOR-RETARDER INSTALLATION

A. Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 inches and 6 inches, respectively.

1. Seal laps with roofing membrane manufacturer's standard adhesive.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations.

3.4 INSULATION INSTALLATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with roofing system manufacturer's written instructions for installing roof insulation.

C. Install tapered insulation under area of roofing to conform to slopes indicated and to Shop Drawings.

D. Install one or more layers of insulation under area of roofing to achieve required thickness. Where overall insulation thickness is 2 inches or greater, install required thickness in 2 or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

E. Trim surface of insulation where necessary at roof drains so completed surface is flush and does not restrict flow of water.

F. Install insulation with long joints of insulation in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.

1. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

G. Attached Insulation: Prime surface of concrete deck with asphalt primer at rate of 3/4 gal./100 sq. ft. and allow primer to dry. Set each layer of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature and at a rate required by insulation manufacturer.

H. Attached Insulation: Secure first layer of insulation to deck using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to deck type indicated. Install subsequent layers of insulation in a solid mopping of hot roofing asphalt, applied within plus or minus 25 deg F of equiviscous temperature and at a rate required by insulation manufacturer.

1. Fasten insulation according to requirements of FM's "Approval Guide" for specified Windstorm Resistance Classification and the insulation and roofing system manufacturers' written instructions.

I. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Loosely butt cover boards together and fasten to roof deck according to roofing system manufacturer's written instructions.

3.5 ADHERED SHEET INSTALLATION

A. Install EPDM sheet over area to receive roofing according to roofing system manufacturer's written instructions. Unroll sheet and allow to relax for a minimum of 30 minutes.

B. Start installation of sheet in presence of roofing system manufacturer's technical personnel.

C. Accurately align sheets and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

D. Apply bonding adhesive to substrate and underside of sheet at rate required by manufacturer and allow to partially dry. Do not apply bonding adhesive to splice area of sheet.

E. Mechanically or adhesively fasten sheet securely at terminations and perimeter of roofing.

F. Apply roofing sheet with side laps shingled with slope of roof deck where possible.

G. Spread sealant or mastic bed over deck drain flange at deck drains and securely seal roofing sheet in place with clamping ring.

H. Apply epichlorohydrin sheet over EPDM sheet at locations indicated according to roofing system manufacturer's written instructions.

3.6 SEAM INSTALLATION

A. Clean both faces of splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.

B. Clean and prime both faces of splice areas, apply splice tape, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet terminations.

C. Repair tears, voids, and lapped seams in roofing that does not meet requirements.

3.7 FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of flashing sheet at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing as recommended by manufacturer.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets according to manufacturer's written instructions to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.8 WALKWAY INSTALLATION

A. Walkways: Install walkway products typically around roof top units and to natural connections to rooftop access via doors, ladders or hatches and in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.9 FIELD QUALITY CONTROL

A. Roof Drain Test

1. After completing roofing but prior to acceptance, perform the following test for watertightness. Plug roof drains and fill with water to edge of drain sump for 8 hours. Retrofit roof drains must conform to ANSI/SPRI RD-1. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion and submit report to Architect.

1. Notify ENGINEER or OWNER 48 hours in advance of the date and time of inspection.

3.10 PROTECTING AND CLEANING

A. Protect sheet membrane roofing from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and OWNER.

B. Correct deficiencies in or remove roofing that does not comply with requirements, repair substrates, reinstall roofing, and repair sheet flashings to a condition free of damage and deterioration at the time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07600

FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. Provide all flashing, trim and sheet metal Work as indicated on the Drawings, and as required for the completed Work, and as specified herein. The Work shall include, but shall not be limited to, the following:

1. Roof Flashings (various types)

2. Wall Flashings (various types)

3. Flashing at expansion joints

4. Flashing at roof/wall mounted equipment and roof/wall penetrations.

1.2 REFERENCES

A. References and industry standards listed in this Section are applicable to the Work. Unless more restrictive criteria or differing requirements are explicitly stated in the Specifications, or mandated by governing codes or regulations, the recommendations, suggestions, and requirements described in the referenced standards shall be deemed mandatory and applicable to the Work.

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA).

C. Copper Development Association (CDA).

D. American Society for Testing and Materials (ASTM).

E. Federal Specifications (FS).

1.3 SUBMITTALS

A. Shop Drawings

1. Show the manner of forming, jointing, and securing the metal flashings and trim. Include expansion joint connections, and the method of forming waterproof connections to adjoining construction.

B. Product Data

1. Catalog sheets, specifications, installation instructions for each item specified except for shop or job formed items, solder, flux, and bituminous coating.

C. Color samples: Color chart showing standard available color finishes for selected metal products.

D. Guarantee

E. Certificates of Qualifications

1.4 QUALITY ASSURANCE

A. Except as otherwise shown or specified, comply with applicable recommendations, details, and standards of CDA, and SMACNA.

B. All metal Work shall ink-stamped at intervals, identifying Manufacturer, type metal, and gage or thickness.

C. Manufacturer's Recommendations

1. For factory fabricated items, follow the manufacturer's recommendations and installation instructions unless specifically shown or specified otherwise.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products of this Section in such manner to protect them from damage.

1.6 PROJECT CONDITIONS

A. Make the roof and all uncompleted flashings watertight at the end of each work day.

PART 2 - PRODUCTS

2.1 MATERIALS FOR FLASHING FABRICATION

A. Plain Copper Sheet

1. Cold rolled copper, ASTM B 370, 16 ounce, mill finish.

B. Lead Coated copper Sheet

Cold rolled copper, ASTM B 370. Lead coating; ASTM B101, Type 1 weighing 0.06 to 0.07 lbs per sq ft applied to each side.

C. Stainless Steel Sheet: Counterflashings

Dead soft fully annealed stainless steel sheet, ASTM A167, Type 302/304, 2D dull finish, 26 gauge.

D. Sheet Lead at drains and pipe flashings:

ASTM B29. Minimum Wgt. 4 lbs per sq ft.

2.2 MANUFACTURED MATERIALS

A. Copper/fabric flashing: consisting of a full sheet of copper, weight of copper core not less than 5 ounces per square foot, permanently bonded to and between 2 layers of asphalt impregnated fiberglass fabric.

1. Manufacturers

a. Afco Products, Inc.: Copper-fabric Flashing.

b. York Manufacturing, Inc.: Copper Fabric Flashing.

c. Hohmann & Barnard, Inc.: Copper Fabric Flashing.

B. Pre-engineered Metal Edge at Upper Roof Perimeters: TremLock Fascia: Manufactured, three-piece, canted roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 10 feet, with extended vertical leg terminating in a drip-edge cleat. Provide matching corner units.

1. Manufacturers:

a. Tremco, Inc.: TremLock Fascia (Basis of Design) Fascia Cover: Fabricated from the following exposed metal:

1. Formed Aluminum: 0.050 inch thick.

2. Finish: Kynar paint finish, as chosen by Architect from manufacturer's standard color selection.

3. Hidden retainer/water dam: Galvanized Steel.

4. Corners & End Caps: Factory mitered, folded or welded, and sealed watertight.

5. Splice Plates: Concealed, of same material, finish, and shape as fascia cover.

2.3 FASTENERS

A. Nails

1. "Stronghold" type large flat head roofing nail.

a. For Copper: Hardened copper.

b. For Stainless Steel: Stainless steel.

B. Screws, Bolts, and other Fastening Accessories

1. For Copper: Copper or brass.

2. For Stainless Steel: Stainless steel.

C. Anchors

1. Provide one of the following types:

a. Hammer driven anchors, consisting of a stainless steel drive pin and a corrosion resistant metal expansion shield inserted thru a stainless steel disc with an EPDM sealing washer.

b. Self-tapping, corrosion resistant, concrete and masonry screw inserted thru a stainless steel disc with an EPDM sealing washer.

2.4 MISCELLANEOUS MATERIALS

A. Solder

Composition of block tin/pig lead of proportion recommended by the metal manufacturer, stamped either 50/50 or 60/40 "Warranted".

B. Flux

Paste or acid type as recommended by the metal manufacturer.

C. Bituminous Coating (for separating dissimilar metals):

FS TT-C494.

D. Type 2 Sealant (For concealed sealant joints of thru-wall cap receivers and other areas which require concealed sealant).

One part butyl rubber sealant; Tremco Reglet Joint Sealant, Pecora BC-158, PTI 707, or Woodmont chem-Calk 300.

E. Thru Wall Flashing Joint sealant:

Trowel grade asphalt flashing cement or gun-grade sealant, as recommended by the flashing manufacturer.

2.5 FABRICATION

A. Where practicable, form and fabricate sheet metal Work in the factory or shop. Produce bends and profiles accurately to the indicated shapes. Where not indicated or specified, follow the applicable requirements of the reference standards listed in PART 1.

B. Counterflashings:

1. Stainless Steel: 26 gauge (0.018") minimum.

C. Pitch Pans & Hoods:

1. Copper: 16 oz.

D. Cap Flashing: (one-piece)

1. Copper: 16 oz.

2. Lead Coated copper: 16 oz.

3. Stainless Steel: 26 ga (0.018").

E. Cap Flashing: (two-piece) With In-Wall or Thru-Wall cap Receiver: Thru-wall Coping Flashing. (Same metals as in B., above).

1. Cap Flashing: Three way mortar bond type receiver with snap fit cap flashing. Acceptable products: "Keystone Two-Piece cap Flashing" as manufactured by Keystone Flashing Co., 5119 N. Second Street, Philadelphia, PA 19120 and "Cheney Prefabricated Snap Lock Cap Flashing" as manufactured by Cheney Flashing Co., 623 Prospect St., Trenton, NJ 08605.

2. Thru-wall Coping Flashing: Three way mortar bond flashing. Acceptable Products: "Keystone Thru-wall Flashing" as manufactured by Keystone Flashing Co., 5119 North Second Street, Philadelphia, PA 19120 and "Cheney 3-way Sawtooth Thru-Wall Flashing" as manufactured by Cheney Flashing Co., 623 Prospect St., Trenton, NJ 08605.

F. Base Flashing:

Note: This base flashing is not to be used for roofs; refer to Roofing Sections for roof base flashing.

1. Copper: 20 oz.

2. Lead Coated copper: 20 oz.

3. Stainless Steel: 24 ga (0.025").

G. Formed Gravel Stops:

1. Copper: 20 oz.

2. Lead Coated Copper: 20 oz.

3. Stainless steel: 24 ga (0.025").

H. Extruded Aluminum Gravel Stop:

Complete system including gravel stop, extruded aluminum joint cover plates, concealed 0.025" aluminum joint flashing, fasteners and all other accessory components. Type F gravel stop as manufactured by Architectural Products Company, Covington, KY., or equivalent by W.P. Hickman Co., Asheville, NC.

1. Face Height: Closest manufacturer's standard dimension to face height shown on Drawings.

2. Finish: Anodized; Color: As selected by the Project Architect.

I. Shop-Formed Coping:

1. Copper: 20 oz.

2. Lead Coated Copper: 20 oz.

3. Stainless Steel: 24 ga (0.025").

J. Factory Fabricated Formed Coping:

Complete system including 0.063" aluminum coping, anchor plates, joint drainage system, concealed joint covers and all other accessory components. "Permasnap Coping" as manufactured by W.P. Hickman Company, Asheville, NC; or "Snap-Lok Coping" as manufactured by MM Systems Corp, Tucker, GA.

1. Finish: Anodized; color: as selected by Architect.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Coordinate the work of this Section with other Work for the correct sequencing of items which make up the entire system of weatherproofing or waterproofing.

3.2 PREPARATION

A. Do not install the Work of this Section unless all necessary nailers, blocking and other supporting components have been provided.

B. Do not install the Work of this Section unless all substrates are clean and dry.

3.3 INSTALLATION

A. Isolation

Separate dissimilar metals from each other with bituminous coating.

B. Tinning and Soldering

1. Use soldering irons (heavy coppers) as Industry Standard. Torch soldering is not acceptable.

2. Clean, flux and tin all surfaces to be soldered.

3. Sweat solder thoroughly into seams, completely filling the seam for the full width.

4. Upon completion of soldering, remove all traces of flux residue, and if required, apply a neutralizing wash followed by a clean water wash.

C. Installing In-Wall and Thru-Wall Cap Flashing Receivers

1. Set the receiver so there is mortar above and below the built-in portion.

2. Do not mallet, bend or deform the exposed portion.

3. Lap all end joints so they interlock at the first raised rib. Apply Type 3 sealant between the mating surfaces of the built-in portion of the receiver before interlocking end joints.

D. Installing Cap Flashing Counterflashings

1. Form and install the cap counterflashings to provide a spring tight fit against the base flashing. Lap all end joints and base flashing a minimum of 3". Extend the cap continuously around corners or provide lock seams. Install waterstop flashing at expansion joints.

2. Cap Flashing for Installation In Reglets:

a. Extend the built-in portion of the cap a min., of 3/4" into the reglet. Form the edge of the built in portion with a 1/4" hook dam.

b. Secure the cap with lead wedges 8" oc. Fill joint completely with Type 2 sealant and tool to a slightly concave surface.

3. Surface Mounted Cap Flashing Counterflashing:

   a. Form the top portion of the cap flashing which comes in contact with the wall surface with a 1" wide bearing surface. Form a 45 degree x 1/4" wide stiffener and calking flange along the top edge.

   b. Apply Type 2 sealant on the back side of the bearing surface.

   c. Secure the cap flashing to the wall with fasteners spaced 12" oc thru the bearing surface.

   d. Apply Type 2 sealant along the calking flange.

4. Pre-tin and solder with soldering irons (heavy coppers) all inside and outside corners.

5. Where applicable, release existing soldered lap with soldering iron, install base flashing, dress down and re-solder existing lap.

E. Dressing Down Existing Cap Flashing

1. Turn up all cap flashings as required to perform the Work. Upon completion of the Work, dress down all disturbed cap flashings so they lie flat against the base flashing.

2. Secure the cap flashing to the wall surface with fasteners spaced 18" oc.

3. Install matching metal patches at corners of cap flashings which have been cut to perform the Work. Lap the patches a minimum of 1" on each side of the cap flashing.

   a. Secure the patch by pop-riveting or by soldering.

F. Installing Base Flashings

1. Form the base flashing with locked and soldered joints into lengths not more than 24'-0" oc.

2. Provide expansion joints a maximum of 24'-0" oc on straight runs and a maximum of 4' from corners. Form expansion joints with a 3" loose locked seam filled with Type 2 Sealant.

   a. Expansion Joint: slit the cross folded portion of the flashing where it is bent at a right angle. Solder a patch over the slit to avoid binding at the cross fold.

3. Extend the vertical portion of the base flashing a minimum of 3" up behind the cap flashing.

   a. Where shown on the Drawings, lock the base flashing to the cap flashing with a minimum 3/4" loose lock joint.

4. Extend the horizontal portion of the base flashing onto the roof surface a minimum of 4" and terminate in a 1/2" folded edge. Secure with nails spaced 3" oc staggered.

G. Install ES-1 rated TremLock Fascia flashings at Upper Roof perimeters.

1. Fasten metal cant over installed roofing plies and into wood blocking per manufacturer's requirements.

2. Install CSPE membrane adhered in Sheeting Bond adhesive over metal cant and six (6) inches past toe of cant onto field of roofing.

3. Install three course elastomeric stripping of PolyRoof LV and BURmesh over CSPE edge on built-up roofing.

4. Fasten metal fascia retainer to wood blocking per manufacturer's written instructions.

5. Install fascia per manufacturer's written instructions.

6. Complete all flashing details in accordance with attached drawings and manufacturer's requirements. Complete details to meet FM 1-49 approval and manufacturer's requirements utilizing wood nailers and cants.

H. Installing Formed Metal Coping

1. Form the coping into lengths not exceeding 8'-0".

2. Join coping sections with 1-1/2" loose locked seams filled with Type 3 sealant.

3. Hook the front and back edges of the coping over continuous metal edge strips. Nail the edge strip 6" oc.

I. Installing Factory Fabricated Formed Metal Coping

Install in accordance with the manufacturer's written instructions unless shown or specified otherwise.

J. Installing manufactured copper/fabric flashing.

1. Installation

a. All surfaces to receive the copper/fiberglass fiber flashing shall be reasonably smooth, free from irregularities.

b. On all horizontal surfaces lay flashing either in a fresh bed of mortar above and below or, when recommended by the manufacturer, a trowel coat of mastic. Spot vertical surfaces with asphalt mastic to hold flashing in place and secure as detailed.

c. Install the flashing in continuous lengths with the minimum number of joints. Door and window flashing shall be installed in one continuous length from side to side.

d. At corners, beams, columns, and at other junctures, fit flashing to the proper contour.

e. Terminate the flashing 1/16" back from the exposed face of masonry wall, except at masonry indicated to have deeply raked joints.

2. Joints: Lap joints at least 4", cemented with asphalt mastic.

3. Provide stainless steel sealant edge flashing as indicated on the Drawings, for proper sealant adhesion. Form flashing as required to suit lipped brick or other configuration. Adhere to relieving angle with mastic where necessary.

END OF SECTION

SECTION 07700

ROOF SPECIALTIES AND ACCESSORIES

PART 1 – GENERAL

1.1 THE REQUIREMENT

A. Furnish all labor, materials, equipment and appliances required for the complete execution of Work shown on Drawings and specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 07600 - Flashing and Sheet Metal

B. Section 07900 - Joint Fillers, Sealants and Caulking

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Without limiting the generality of these specifications Work shall conform to the applicable requirements of the following documents:

1. TT-P-641 (1) Primer Coating, Zinc Dust - Zinc Oxide (for galvanized surfaces

2. ASTM A 525 Specification for General Requirements for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process.

3. ASTM A 526 Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Commercial Quality.

4. ASTM B 209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

5. Sheet Metal and Air Conditioning Contractors National Association "Architectural Sheet Metal Manual" (ASMM).

6. The Aluminum Association "Specification for Aluminum Sheet Metal Work in Building Construction."

7. American Welding Society (AWS).

1.4 SUBMITTALS

A. In accordance with the procedures and requirements set forth in Section 01300, Submittals, submit the following:

1. Manufacturers literature and installation instructions.

2. Samples, of each material listed.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in factory packed unopened cartons and crating bearing the manufacturer's labels.

B. Store materials in clean, dry protected area in such manner to preclude damage of any nature.

C. Handle all materials with proper care to avoid denting, marring, warping or other distortions during delivery, storage and handling.

PART 2 – PRODUCTS

2.1 MATERIALS

A. General: Provide roof specialties and accessories of design and construction compatible and approved for use with roofing manufacturer.

B. Fasteners: Provide all fasteners and attachments required to secure item to substrate and support loads required by applicable Building Code. Use only non-corrosive fasteners which are compatible with materials being joined.

C. Colors: Colors shall be selected by Owner.

2.2 ROOF CURBS

A. Material: 18 gauge, G-90 galvanized steel, 12 inches high with mitered and continuous welded corners and seams, factory installed pressure treated wood nailers, and rigid fiberglass insulation.

B. Design: Provide roof curb units manufactured to fit manufactured roof panels. Provide integral water diverter. Design roof curb to support weight of equipment. Coordinate roof curb unit with roof panel manufacturer to ensure proper fit. Roof curb shall be approved for use by manufacturer.

C. Accessories: Provide interior liner, flashing, trim and other items required for a complete installation.

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Install roof accessories and specialties in accordance with the manufacturer's instructions. Provide a complete watertight and weatherproof installation. Install with provision for expansion and contraction.

3.2 DAMAGED MATERIAL

A. Repair or replace materials damaged during installation.

3.3 ADJUSTING AND CLEANING

A. Check levels and adjust as necessary after roofing and flashing is complete.

B. Protect materials from damage by other trades. Remove protective coatings at completion of project.

END OF SECTION

SECTION 07900

JOINT SEALANTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. CONTRACTOR shall provide all labor, materials, tools, equipment and incidentals as shown, specified and required to furnish and install calking and sealants.

1.2 REFERENCES

A. ASTM C510, Test Method for Staining and Color Change of Single-or Multicomponent Joint Sealants.

B. ASTM C661, Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.

C. ASTM C793, Test Method for Effects of Accelerated Weathering on Elastomeric Joint Sealants.

D. ASTM C794, Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.

E. ASTM C920, Standard Specification for Elastomeric Joint Sealants

F. Federal Specification, FS TT-S-00227, Sealing Compound - Elastomeric Type, Multi-component for Calking, Sealing, and Glazing in Buildings and Other Structures.

G. Federal Specification, FS TT-S-001657 Sealing Compound - Single Component, Butyl Rubber Based, Solvent Release Type.

1.3 PERFORMANCE REQUIREMENTS

A. Extent of each type of caulking and sealant includes the following:

1. All joints between concrete members and masonry.

2. All concrete to concrete joints.

3. All metal to metal joints.

4. All joints between masonry and metal.

5. All expansion joints in masonry and concrete.

6. All control joints.

7. All sound-sealed and air-sealed joints.

8. As an exposed-to-view finish on the exposed face of all fire-rated sealants.

9. On both sides of all terminations of all construction systems, specified to receive caulking and sealants, where construction system remains exposed to view in the finished Work.

10. All isolation joints between equipment and other items.

11. All joints where construction systems are discontinuous or inherently non-watertight.

12. All locations whether or not shown, required to render the building watertight, except where a construction system is specified or shown as not relying upon the use of sealants in order to achieve weather-and watertightness.

1.4 SUBMITTALS

A. Samples:

1. Each type of actual cured material samples of each calking and sealant specified, 3-inches long, in each of the manufacturer's standard colors.

2. Each size and type of sealant backer rod, 3-inches long, as recommended by the calking and sealant manufacturer.

3. Bond breaker tape as recommended by the manufacturer.

4. Samples will be reviewed by ENGINEER for color and texture only. Compliance with other requirements is the responsibility of CONTRACTOR.

B. Shop Drawings:

1. Copies of manufacturer's specifications, recommendations and installation instructions for each type of sealant, caulking compound and associated miscellaneous material required. Include manufacturer's published data, indicating that each material complies with the requirements and is intended for the applications shown.

C. Test Reports:

1. Compatibility tests for substrates, based on adhesion-in-peel standard test procedures and FS TT-S-0027.

2. Certified laboratory test reports indicating conformance with the requirements.

D. Guarantee:

1. Copies of written guarantee agreeing to repair or replace sealants which fail to perform as specified.

1.5 WARRANTY

A. Provide a written guarantee agreeing to repair or replace sealants which fail to perform as air-tight and watertight joints; or fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability; or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data, as an inherent quality of the material for the exposure indicated. Provide guarantee signed by installer and CONTRACTOR. Provide guarantee period of two years from Final Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type of product used shall be per the Sealant Schedule.

B. Sealants:

1. Type 1: Multi-component, non-sag, low-modulus polyurethane rubber sealant meeting ASTM C920, Type M, Grade NS, Class 25, use NT, M, A, and O. Capable of withstanding 50% in extension or compression such as Sikaflex-2C NS/SL, Sika Corporation Lyndhurst, NY, or Sonolastic SL-1, Sonneborn, Minneapolis, MN, or DynaTrol II by Pecora Corporation.

2. Type 2: Single component polyurethane sealant meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, A, and O. Capable of withstanding 25% in extension or compression such as Magnum NS-100, Tamms Industries, or Sikaflex 1A, Sika Corporation, Lyndhurst, NY, DynaTrol 1-XL by Pecora Corporation.

3. Type 3: Single component, low-modulus moisture curing silicone meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Capable of withstanding 50% extension and compression. Pecora 890 by Pecora Corporation or equal as approved by Engineer and Owner.

4. Type 4: Single component, mildew resistant, moisture-curing silicone meeting ASTM C920, Type S, Grade NS, Class 25, Use NT, M, G, and A. Pecora 898 by Pecora Corporation or equal as approved by Engineer and Owner.

5. Type 5: Single component, acrylic latex meeting ASTM C834. AC-20+ Silicone by Pecora Corporation or equal as approved by Engineer and Owner.

6. Type 6: High grade butyl sealant meeting Federal Specification TT-S-00-1657. BC-158 by Pecora Corporation or equal as approved by Engineer and Owner.

7. Type 7: Multi-component chemical resistant polysulfide sealant conforming to ASTM C920, Type M, Grade NS, Class 25 such as Sonolastic Two-part, Sonneborn, Minneapolis, MN, Hornflex-L, Tamms, Beltsville, MD, or Cormax PSC, DuPont, Synthacalk GC2+ by Pecora Corporation.

8. Type 8: Nonsag, multi component, traffic grate polyurethane sealant meeting ASTM C920, Type 19, Grate NS, Class 25, use T, M, A, and O. DynaTread by Pecora Corporation.

B. Primer: Non-staining primer recommended by sealant manufacturer for the substrates on this project.

C. Backer Rod: Closed cell foam, nonreactive with caulking materials, non-oily, and approved by the sealant manufacturer. Minimum density shall be 3.24 pounds per cubic foot. Use no asphalt or bitumen-impregnated fiber with sealants.

D. Joint Cleaner: Recommended by sealant or caulking compound manufacturer.

E. Bond breaker: Either polyethylene film or plastic tape as recommended by the sealant manufacturer.

F. Color: Where manufacturer's standard colors do not closely match materials being sealed, provide a custom color.

PART 3 - EXECUTION

3.1 INSPECTION

A. CONTRACTOR and installer shall examine joint surfaces, substrates, backing, and anchorage of units forming sealant rabbet, and the conditions under which the caulking and sealant Work is to be performed, and notify ENGINEER, in writing, of any conditions detrimental to the proper and timely completion of the Work and performance of the sealants. Do not proceed with the caulking and sealant Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 PREPARATION

A. Protect finished surfaces adjoining by using masking tape or other suitable materials.

B. Clean joint surfaces immediately before installation of sealant compound. Remove dirt, weakly adhering coatings, moisture and other substances which would interfere with bonds of sealant compound as recommended by sealant manufacturer's written instructions as shown on approved Shop Drawings.

C. Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's written instructions, as shown on approved Shop Drawings, indicate that alkalinity does not interfere with sealant bond and performance.

1. Etch with five percent solution of muriatic acid.

2. Neutralize with dilute ammonia solution.

3. Rinse thoroughly with water and allow to dry before sealant installation.

D. If necessary, clean porous materials such as concrete and masonry by grinding, sand blasting or mechanical abrading. Blow out joints with oil-free compressed air, or by vacuuming joints prior to application of primer or sealant.

E. Roughen joint surfaces on vitreous coated and similar non-porous materials, wherever sealant manufacturer's data indicates lower bond strength than for porous surfaces. Rub with fine abrasive cloth or steel wool to produce a dull sheen.

3.3 INSTALLATION

A. Comply with sealant manufacturer's written instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise; but only as approved by ENGINEER.

B. Prime or seal the joint surfaces as shown on approved Shop Drawings. Do not allow prime or sealer to spill or migrate onto adjoining surfaces. Allow primer to dry prior to application of sealants.

C. Apply masking tape before installation of primer, in continuous strips in alignment with the joint edge to produce sharp, clean interface with adjoining materials. Remove tape immediately after joints have been sealed and tooled as directed.

D. Do not install sealants without backer rods or bond breaker tape.

E. Roll the back-up rod stock into the joint to avoid lengthwise stretching. Do not twist, braid, puncture or prime backer-rods.

F. Employ only proven installation techniques, which will ensure that sealants will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of the joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

G. Install sealants to depths as recommended by the sealant manufacturer but within the following general limitations, measured at the center (thin) section of the bead.

1. For horizontal joints in sidewalks, pavements and similar locations sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but not more than 5/8-inch deep or less than 3/8-inch deep.

2. For vertical joints subjected to normal movement and sealed with elastomeric sealants, but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2-inch deep or less than 1/4-inch deep.

H. Remove excess and spillage of compounds promptly as the Work progresses.

I. Cure caulking and sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

3.4 FIELD QUALITY CONTROL

A. Where questions of compatibility of sealants and substrate arise, the sealant manufacturer shall test the substrate in question for compatibility with the specified sealant and report his findings, along with recommendations, to ENGINEER.

B. Do not proceed with installation of elastomeric sealants over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with FS TT-S-00227 has successfully demonstrated that sealant bond is not impaired by the coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

C. After nominal cure of exterior joint sealants which are exposed to the weather, test for water leaks. Flood the joint exposure with water directed from a 3/4-inch diameter garden hose, without nozzle, held perpendicular to wall face, 2 feet -0 inch from joint and connected to a water system with 30 psi minimum normal water pressure. Move stream of water along joint at an approximate rate of 20 feet per minute.

D. Test approximately five percent of total joint system, in locations which are typical of every joint condition, and which can be inspected easily for leakage on opposite face. Conduct test in the presence of ENGINEER, who will determine the actual percentage of joints to be tested and the actual period of exposure to water from the hose, based upon the extent of observed leakage, or lack thereof.

E. Where nature of observed leakage indicates the possibility of inadequate joint bond strength, ENGINEER may direct that additional testing be performed at a time when joints are fully cured, and before Substantial Completion of the Work.

F. Do not paint sealant, unless recommended by sealant and paint manufacturer.

3.5 ADJUSTING

A. Allow sealants to cure and remove protective edging, of doors, louvers, saddles windows etc. as directed by the OWNER.

B. Repair sealant installation at leaks or, if leakage is excessive, replace sealant installation.

3.6 CLEANING

A. Clean adjacent surfaces of sealant and soiling resulting from the Work. Use solvent or cleaning agent recommended by the sealant manufacturer. Leave all finish Work in a neat and clean condition.

B. Remove misplaced sealant compounds promptly using methods and materials recommended by the manufacturer, as the work progresses.

SEALANT SCHEDULE

Application	Sealant	Color
Vertical and horizontal joints bordered on both sides by concrete, masonry, precast concrete, natural stone or other porous building material.	Type 2	To closely match adjacent surfaces or mortar and as selected by the OWNER.
Vertical and horizontal joints bordered on both sides by painted metals, anodized aluminum, mill finished aluminum, PVC, glass or other non-porous building material.	Type 3	To closely match adjacent surfaces and as selected by the OWNER.
Masonry expansion and control joints less than 1¼" wide.	Type 2	To closely match adjacent surfaces and as selected by the OWNER.
Masonry expansion and control joints equal or greater than 1 ¼ inches wide.	Type 1	To closely match adjacent surfaces and as selected by the OWNER.
Interior – wood trim and finish joints.	Type 5	Color to be selected by OWNER
Sanitary areas, joints in ceramic tile, around plumbing fixtures, countertops, and back splashes. See Note 1.	Type 4	To closely match adjacent surfaces and as selected by the OWNER.
Perimeter sealing of doors, windows, louvers, piping, ducts, and electrical conduit. See Note 2.	Type 2 or Type 3	To closely match adjacent surfaces and as selected by the OWNER.
Below thresholds.	Type 6	Manufacturer's standard
Submerged in liquids. See Note 4.	Type 1	Manufacturer's standard
Submerged in liquids with high concentration of chlorine (> 2 ppm).	Type 7	Manufacturer’s standard
Horizontal Joints exposed to vehicular or pedestrian traffic.	Type 8	To closely match adjacent surfaces.

Application	Sealant	Color
Other joints indicated on the drawings or customarily sealed but not listed.	Type recommended by manufacturer	To closely match adjacent surfaces and as selected by the OWNER.

Notes:

1. Not all applications may be used on this project.

2. Sealant for Laboratory Countertop shall be as recommended by countertop manufacturer.

3. Provide UL approved sealants for penetrations thru fire-rated walls and as specified in Section 07270.

4. Sealants which will come in contact with potable water shall meet the requirements of NSF 61.

5. Where sealant will be immersed in liquid chemicals verify compatibility prior to installation of sealant.

END OF SECTION

SECTION 09900

PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. It is the intent of this Section that all painting necessary to result in a complete, finished appearing system be accomplished. As part of the work of this Section, prepare surfaces that are to be painted and furnish and apply paint materials. Paint schedules follow the text of this Section and define the surface preparation and coating systems required to paint the various types of surfaces that are to be painted. The Paint Application Table below identifies the areas to receive the paint systems specified in the paint schedules. For items or areas not listed in the Paint Application Table, consult the ENGINEER for the proper system to be used. Exclusion from the Paint Application table does not necessarily indicate that an item or area does not require painting.

B. Acceptable manufacturers shall be Tnemec and Carboline.

1. The paint schedules that follow this specification have been developed for Tnemec products. If Carboline products are to be used, submit schedules describing Carboline's equal products and colors for review and approval.

C. Paint Application Table

Schedule M1: Exterior Metal

Paint all new metal piping, valves, louvers, dampers, accessories, hardware and all related materials.

Painting work under Schedule M1 is not required on prefinished metal, aluminum, galvanized or stainless steel. Pretreatment (Schedule M7) followed by touch-up painting of damaged galvanizing on galvanized metal items with a zinc-rich primer shall be performed.

Choice of colors required. Multiple colors may be required for certain items. Number of colors: Six (max).

Schedule M2: Interior Metal

Paint the following interior metal items: all new metal piping, valves, louvers, dampers accessories, hardware and all related materials. Process piping, pumps, motor stands, equipment base plates, steel and copper piping and plumbing, piping and plumbing hangers and supports, metallic electrical conduits and wiring device enclosures, gas piping, all mechanical and electrical equipment except equipment with a baked-on factory finish, and all related work.

Painting work under Schedule M2 is not required on aluminum, stainless steel items, galvanized or stainless steel ductwork. Pretreatment (Schedule M7) followed by touch-up painting of damaged galvanizing on galvanized metal items with a zinc-rich primer shall be performed before application of paint.

Painting of piping shall not occur with water moving through the piping.

Choice of colors required. Multiple colors will be required for different items. Number of colors: Twelve (max).

Schedule M7: Pretreatment of Galvanized and Nonferrous Metals

Pretreating is required on copper and galvanized pipe, aluminum items that will be painted under schedules M1 and M2, items in contact with concrete or dissimilar metals, and on damaged galvanizing of galvanized metal items prior to touch-up painting. Pretreating is not required on galvanized steel, aluminum or other nonferrous materials for items that do not require touch-up painting or are not specified to be painted.

D. In addition to the painting indicated in the above Paint Application Table, paint all aluminum surfaces that will be in contact with concrete or dissimilar metals using two coats of the prime coat specified for Exterior Metal. Coordinate painting with the fabrication of components and with the work of other trades so as to ensure the full and correct application of paint materials.

E. In addition to the painting indicated in the above Paint Application Table, apply touch-up paint to finish defects and field cuts, welds, and penetrations of galvanized metal. Prepare and pretreat surfaces in accordance with Schedule M7 above and finish paint according to the appropriate paint schedule.

F. Prime and finish painting, regardless of the location in which the work is performed, shall conform to all requirements of this Section. Coordinate painting with the fabrication of components and with the work of other trades so as to ensure the full and correct application of paint materials.

1.2 DEFINITIONS

A. For the purposes of this Section, the following definitions apply: "Exposed to View" means all surfaces in the final work that could be seen from any vantage point from any height. "Paint" means all pretreatment, prime, intermediate and final coatings specified herein including clear, translucent and opaque materials.

1.3 QUALITY ASSURANCE

A. Applicator's Quality Assurance: Submit list of a minimum of 3 completed projects of similar size and complexity to this Work completed within the last 5 years. Projects shall demonstrate experience working on comparable structures. Include for each project:

1. Project name and location.

2. Name of project Owner, include a contact name and phone number.

3. Name of General Contractor is different than Contractor holding this contract.

4. Name of Engineer, include a contact name and phone number.

5. Name of coating manufacturer.

6. Approximate area of coatings applied.

7. Date of completion.

B. Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. In the acceptance or rejection of installed painting, no allowance will be made for lack of skill on the part of painters.

C. Apply paints following the recommendations in the "Applications Manual for Paint and Protective Coatings" published by McGraw-Hill.

1.4 FIELD QUALITY CONTROL

A. Inspector's Services: The CONTRACTOR shall hire Dixon Engineering or Nelson Tank (third party satisfactory to the OWNER), at no additional expense to the OWNER, to perform field inspections of items 1-4 below and prepare the field inspection reports described in item 5 below:

1. Verify coatings and other materials are as specified.

2. Verify surface preparation and applications are as specified.

3. Visually inspect all welds prior to coating.

4. Verify DFT of each coat and total DFT of each coating systems are as specified using wet film and dry film gauges.

5. Coating Defects: Check coatings for film characteristics or defects that would adversely affect performance or appearance of coating systems.

6. Report:

   a. Submit written reports describing inspections made and actions taken to correct nonconforming work.

   b. Report nonconforming work no corrected.

   c. Submit copies of report to Owner and Contractor.

1.5 SUBMITTALS

A. Provide submittals in accordance with Division 1 of the Specifications. Prior to ordering and delivering paint materials to the project site, submit the following:

1. Manufacturer literature demonstrating compliance with these Specifications and indicating paint formulation, rate of coverage, recommended uses and recommended application method.

2. Color chips for the full range of colors available in each product.

B. The paint products indicated in these Specifications establish the required standard of paint quality. Requests for substitution will not be considered.

1.6 PRODUCT HANDLING

A. Deliver all paint materials to the job site in their original unopened containers with all labels intact and legible at time of use. Store only the approved materials at the job site. Store them in a suitable and designated area restricted to the storage of paint materials

and related equipment. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste. Store volatile solvents, rags and cleaning materials in a well ventilated area.

B. Use all means necessary to protect paint materials before, during, and after application and to protect the installed work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the OWNER.

1.7 EXTRA STOCK

A. Upon completion of the work of this Section, deliver to the OWNER an extra stock of paint equaling approximately 2% of each color and gloss used in each coating material with all such extra stock tightly sealed in clearly labeled containers that have not been previously opened.

1.8 GUARANTEE

A. Furnish a 1-year warranty from the date of substantial completion on workmanship. Manufacturer to provide an unlimited warranty on the materials.

2.0 PRODUCTS

2.1 PAINT MATERIALS

A. Provide paint materials in accordance with the paint schedules that follow the text of this Section.

B. All paint materials for each paint system shall be the products of a single manufacturer. All paint materials and equipment shall be compatible in use: finish coats shall be compatible with prime coats, prime coats shall be compatible with the surface to be coated, and all tools and equipment shall be compatible with the coating to be applied. Thinners, when used, shall be only those thinners specifically recommended for that purpose by the manufacturer of the material to be thinned.

C. Furnish finish paint in the colors selected by the OWNER from the manufacturer's standard available colors (a minimum of 12 colors must be available for each finish paint requiring color choice). Specially mixed colors may be required to achieve OSHA approved safety colors and to provide the piping and plumbing line colors to meet the OWNER’s color scheme. The City of Ann Arbor Color Coding of Piping schedule is appended to this specification for reference.

3.0 EXECUTION

3.1 SURFACE CONDITIONS

A. Prior to beginning the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this application may properly commence. Verify that paint finishes may be applied in strict accordance with all pertinent codes and regulations and the requirements of these Specifications. In the event of discrepancy, immediately notify the ENGINEER. Do not proceed with application in areas of discrepancy until all such discrepancies have been fully resolved. Application of paint materials shall be deemed to indicate acceptability of the existing surface conditions.

3.2 SURFACE PREPARATION

A. General

1. Prior to beginning surface preparation and painting operations, completely mask, remove, or otherwise adequately protect all hardware, accessories, machined surfaces, plates, equipment identification tags/nameplates, lighting fixtures, and all work of other trades that are not to receive the paint coating. Before applying paint, thoroughly clean and prepare all surfaces according to the specified surface preparation method. Schedule all cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

2. Spot prime all necessary areas prior to beginning field painting.

C. Preparation of Metal Surfaces

1. Prepare metal surfaces for painting by following the method indicated on the appropriate paint schedule. Preparation methods are referenced to the Steel Structures Painting Council (SSPC) Specifications. Do not prepare metal for painting when the relative humidity is higher than 85% or the metal is less than 5°F above the dew point. After surface preparation, thoroughly clean all surfaces of any remaining dirt, oil and grease and leave it ready to receive prime paint.

3.3 PAINT APPLICATION

A. Apply paint in accordance with paint schedule requirements, the cited reference, all codes and regulations, and the recommendations of the paint manufacturer. Apply prime paint to metal surfaces within 24 hrs after surface preparation. Do not apply paint in areas where dust is being generated.

B. Do not apply paint when the surrounding air temperature as measured in the shade is below 40°F or when the temperature of the surface to be painted is below 35°F. Do not apply paint when it is expected that the relative humidity will exceed 85% or that the air temperature will drop below 40°F within 18 hrs after the application of paint. Dew or moisture condensation should be anticipated and if such conditions are prevalent, delay painting until certain that the surfaces can be kept above the dew point. Follow all additional environmental limitation requirements of the paint manufacturer.

C. Paint material mil thicknesses and numbers of coats that are indicated in the paint schedules are based on brush or roller application. Spray application of paint materials will be allowed in the field only for areas or surfaces that are very difficult to paint with brush or roller. Field spray application must be approved by the ENGINEER before its initiation. For areas that are spray painted, apply as many coats as necessary to achieve specified mil thicknesses.

D. Allow sufficient drying time between coats of paint. During adverse weather, extend length of drying time as recommended by the paint manufacturer.

E. Prior to applying each paint coating after the first, check mil thickness of previously applied coating(s). Correct for insufficient paint thickness by increasing the mil thickness of subsequent applications, if allowed by the paint manufacturer or by applying additional coatings to provide the specified paint thickness.

F. Spot sand between coatings to remove paint defects visible to the unaided eye from a distance of five feet.

G. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with AWWAD 102.

H. Paint system for the concrete floors shall not be applied until all other work by other trades is complete.

3.4 CLEAN UP

A. During the progress of the work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose. Following completion of painting in each area, promptly remove all masking and temporary protection. After paint has dried, reinstall all items removed for painting. Upon completion of this portion of the work, visually inspect all surfaces and remove paint and traces of paint from surfaces not scheduled to be painted.

SCHEDULES FOLLOW

Surface Preparation: **SSPC-SP6 Commercial Blast Cleaning**

Paint Manufacturer	Application	Product Name	Generic Type	No. of Coats	Dry Mils/ Coat	Sq Ft Covered/ Gallon	Comments
Tnemec	Shop Primer	Hi-Build Epoxoline Series 66	Polyamide Epoxy	one	3-5		
Tnemec	Field Primer	Hi-Build Epoxoline Series 66	Polyamide Epoxy	touch-up	3-5		
Tnemec	Finish	Endura-shield Series 1074	Aliphatic Acrylic Polyurethane	two	2-3		Not for immersion service

SERVICE: INTERIOR METAL

Surface Preparation: **SSPC-SP6 Commercial Blast Cleaning**

Paint Manufacturer	Application	Product Name	Generic Type	No. of Coats	Dry Mils/ Coat	Sq Ft Covered/ Gallon	Comments
Tnemec	Shop Primer	F.C. Typoxy Series 27	Polyamide Epoxy	one	4-6		
Tnemec	Field Primer	F.C. Typoxy Series 27	Polyamide Epoxy	touch-up	4-6		
Tnemec	Finish	H.B. Tneme-Tufcoat Series 114	Waterborne Acrylic Epoxy	one	4-6		Series 114 - Gloss

Surface Preparation:	**Prepare surfaces by sanding, abrading or using Clean N Etch as manufactured by Great Lake Laboratories or owner approved equal. SSPC-SP1 Solvent Cleaning**

For all galvanized items that require touch-up painting, pretreat items as indicated in the surface preparation, then apply a zinc-rich primer to all areas requiring touch up.

For galvanized and non-ferrous metal items to be painted following pretreatment and touch-up, refer to Schedule M1 for Exterior Metal items and Schedule M2 for Interior Metal Items.

CITY OF ANN ARBOR WTP
STANDARD PAINT SCHEDULE

COLOR CODING OF PIPING

Potable Water: High Service, Transfer, & Wash Water (includes manhole covers)	Clear Sky en17 (tnemec)
Plant Pressure	PL12 (tnemec)
Non-Potable Water: River, Filter Infl. & Effl. (Includes manhole covers)	Frosted mint GB48 (tnemec)
Sludge (includes pipes, equipment and manhole covers)	Chipmunk yb23 (tnemec)
Natural Gas	Safety Yellow SC01 (tnemec)
Fire Service Water	Safety Red sc09 (Tnemec)
Compressed Air	Safety Green sc07 (tnemec)
Steam	Safety Purple sc08 (tnemec)
Used Wash Water	Light gray IN01 (tnemec)
Carbon Dioxide	White wh01 (tnemec)
valve handles and handrails indoors	Safety Orange sc03 (tnemec)
Fluoride	Hunter Green pl20 (tnemec)
Ammonia	lemonade yb16 (tnemec)
Sodium Hydroxide	Kastrel blue gr18 (tnemec)
Handrails and Platforms outside	beige yb38 (tnemec)
shafts for basins and flocs	pota-pox series beige yb38 (tnemec)
exterior tanks, containments, reservoir vents, fence	foliage en08 (tnemec)
new door frames	terra cotta en13 (tnemec)
new black doors	black IN06 (tnemec)
hot water	mountain shadow gb07 (tnemec)
	blue summit pl11 (tnemec)

END OF SECTION

SECTION 15010

MECHANICAL BASIC MATERIALS AND METHODS

PART 1 – GENERAL

1.1 DESCRIPTION

A. Basic materials and methods and related items for heating, ventilating, air conditioning systems and plumbing systems.

1.2 RELATED DOCUMENTS

A. General Conditions and requirements of Division 1 apply to Work of this Section.

B. Related work specified in other Division 15 Sections:

1. 15020 – Cleaning and Startup of Mechanical Piping System
2. 15030 – Installation of Pipework
3. 15075 - Mechanical Identification
4. 15250 - Mechanical Insulation
5. 15510 – Pool Heating Boiler
6. 15990 – Mechanical Testing and Balancing

1.3 SUBMITTALS

A. Submit under provision of Section 01330 – Submittal Procedures.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver new, unused materials to the job site in original, unbroken factory packaging.

PART 2 – PRODUCTS

2.1 MECHANICAL PIPING & FITTINGS

A. Provide mechanical piping and fittings per the specification.

B. Mechanically formed tee connections in copper piping.

1. CONTRACTOR may use mechanically formed Tee connections in copper piping in-lieu-of tee fitting only where main piping is 2 1/2" or larger and where branch connection is 3/4" or smaller. Joint must be brazed. Tool manufacturer: T-Drill.

2.2 UNIONS AND COUPLINGS

A. Size 2 inch and under: 300 psi malleable iron, bronze to iron ground joint unions for threaded ferrous piping. Provide wrought copper or brass couplings for copper piping. Provide brass unions for all ferrous to copper piping connections.

B. Size 2-1/2 inch and over: 150 psi forged steel slip-on flanges for ferrous piping and 150 psi bronze flanges for copper piping. Gaskets: 1/8 inch thick, preformed synthetic rubber with impregnate cloth suitable for service intended, high temperature type, 286°F.

C. Use grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some annular deflection, contraction and expansion. Couplings consist of malleable iron housing-clamps, C-shaped composition sealing gasket and steel bolts. Use galvanized couplings for galvanized pipe. For di-electric connection in grooved piping, use manufacturer's di-electric nipple. Manufacturers: Grinnell/Gruvlok Di-Lok Nipple, Victaulic Style 47 Di-electric Waterway.

D. Unions shall be installed preceding and after each control valve, strainer, pump, coil & any other piece of equipment to enable removal.

E. Di-electric unions are not allowed, unless noted otherwise.

2.3 BOLTS, STUDS AND NUTS

A. Steel bolts, studs, and nuts: Comply with the current ASTM A-307, Grade B, or equal.

B. Threads: American National form right hand machine cut threads complying with the current American Standard for Screw Threads ANSI B1-1, Coarse Thread Series, Class 2 fit.

C. Provide zinc plated carbon steel bolts and nuts for flanged pipe joints.

D. Provide stainless steel Type 304 bolts and nuts for underground pipe joints, for all bolts set into concrete, for all bolts securing mechanical equipment, and for all exterior/rooftop bolts

E. Bolt heads and nuts: Semi-finished, hexagonal, complying with the dimensions for the current American Standard for Wrench Head Bolts and Nuts and Wrench Openings, ANSI B18.2, Heavy Series.

2.4 PIPE SLEEVE

A. Provide pipe sleeve for all new piping thru existing or new building construction.

B. Material: Seamless pipe, galvanized, ASTM A120 for penetrations through outside walls and floors, unless noted otherwise. Provide seamless, black steel ASTM A53 elsewhere, unless noted otherwise.

C. Sleeve Size: Large enough to accommodate the pipe, link seal, and its covering, wall sleeves to be flush on both sides, and floor sleeves to be extended 2 inch above floor level. Where escutcheon plates are required, extend the sleeves 1/4 inch above the floor.

D. Modular mechanical type seal: Use for the annular space between pipes and sleeves to seal against water or earth, consisting of interlocking synthetic rubber links compressed to positive seal by through bolts bearing on delrin plastic pressure plates. Provide 316 stainless steel bolts. Provide linkseal by PSI/ Thunderline.

2.5 VALVES

A. General

1. All valves shall comply with the applicable Manufacturers Standardization Society of the Valves and Fittings Industry.

2. All valves shall have fullport openings and be of the serviceable type.

3. Manually operated valves used in fuel systems shall have levers with locking devices.

4. Manually operated valves 10 feet A.F.F. or higher shall have chain wheel operators with chains reaching to within 4'-0" A.F.F.

5. Unless otherwise noted, valves shall be rated for a minimum of 125 psi W.S.P/250 psi (cold water, oil, gas).

6. Valves through 2" shall have screwed connections for steel piping and sweat connections for copper piping. Valves 2-1/2" and larger shall be flanged. Grooved connections are permitted where specified.

7. Gate valves shall be repackable under pressure whether open or closed.

8. Provide extended valve stems for insulated piping.

9. Where valves are installed outdoors, all components including the gear wheel operators shall be weatherproofed.

10. Unless noted otherwise, all butterfly valves shall be full lug construction, suitable for bi-directional dead end service, and have open position memory stop. Manually operated butterfly valves 4" and larger shall have enclosed worm gear operators with position indicators.

11. Unless noted otherwise, valves shall be same size as piping.

B. Shut-Off Valve and Check Valve Application Schedule (unless noted otherwise on drawings or specifications)

System	Shut-Off Valve and Check Valve Type and Size		
	2" and Less	2" - 4"	6" and Larger
Cold Water	A, E	B, F	B, F
Natural Gas	A	G	G

C. Shut-Off Valve and Check Valve Types

1. Type A: Ball Valves provide 2-piece, full port, bronze body, stainless steel ball and stem with PTFE seats. Valves for natural gas shall be AGA approved.

2. Type B: High Performance Butterfly Valves, provide iron body, PTFE seat, one-piece stainless steel shaft and bearing, 316 stainless steel disk, Teflon stem packing, memory stop and lug pattern rated for 150 psi, 450 degrees F., ANSI class.

3. Type C: Standard Butterfly Valve, full lug, carbon steel body, stainless steel disc, shaft and bearing, EPDM seat, Teflon stem packing. Rated for 125 psi, 250 degrees F.

4. Type D: Gate Valve, bronze body and trim, screwed, rising stem, double wedge or disc. Deep stuffing box with gland and back seating capacity.

5. Type E: Swing Check Valve, bronze body and trim.

6. Type F: Silent Check Valve, proved stainless steel spring loaded, resilient disc, silent type, bronze body.

7. Type G: Lubricated Plug Valve, semi-steel body, single gland, wrench operated, flanged ends, MSS SP-78, 175 psi.

D. Drain Valve

1. Ball valve with 3/4" hose thread and cap. Bronze body, stainless steel ball and stem.

E. Water Pressure Relief Valves

1. ASME rated, sized for the full installed capacity of the low pressure side of the regulating station. Factory set valve at not more than 20% above low side pressure. Furnish seat material suited for the service.

2.7 FLEXIBLE METAL HOSE CONNECTORS:

A. Length and end fittings as shown in drawings, with an inner corrugated hose made of type 304, 321, or 316 stainless steel and outer braid made of 304 stainless steel.

B. For copper piping systems, use copper construction braided hoses.

C. Connectors shall be rated for minimum 125 psi and 450°F.

2.8 PRESSURE AND VACUUM GAUGES

A. Install all pressure gauges at 5 feet from the floor or as shown on the drawings complete with name plates. Provide needle valves and pulsation dampeners on gauges.

B. Range shall be 2 times the indicated operating pressure or 5 PSIG above the relief valve setting.

C. Pressure Gauges:

1. Provide 6 inch dial gauges encased in all stainless steel housing with a threaded access safety glass cover.

2. Body shall be water and dust tight with back flange and 2inch NPT connection, or as shown on the drawings.

3. Movements shall be Rotary geared stainless steel with Grade "A" phosphor bronze Bourdon tube rated from 30 inch vacuum to 1000 PSIG maximum. Accuracy within 1/2% of the scale range.

4. Dial shall be white laminated phenol with black graduations and a micrometer recalibration type pointer, glycerin filled.

5. Provide 2 inch capillary tube runs of 7 feet and longer, or over aisles. Provide 1/4" stainless steel snubbers for all gauges.

7. Gauges for water shall be liquid filled.

8. Manufacturer: Trerice

D. Ranges:

1. Water: 0-150 PSIG (1 psi divisions)

2.9 FIRE STOPPING

A. Provide UL classified fire stopping system for mechanical penetrations through rated walls and floors to maintain the fire rating.

B. Manufacturers: TREMCO Fyrshield, Manville Duxseal, 3M.

2.10 ACCESS PANELS

A. Furnish access panels to access valves, traps, control valves or devices, dampers, damper motors, etc. Access panels shall be sized as necessary for ample access, or as indicated on drawings, but no smaller than 12" x 12" where devices are within easy reach of operator, and at least 24" x 24" when operator must pass through opening in order to reach the devices. Architectural Trades shall install access panels coordinated with Mechanical Trades.

B. Access panels in fire rated walls or ceiling must be U.L. labeled for intended use. Unless otherwise indicated on plans, access doors shall be hinged flush type steel framed panel, 14 gauge minimum for frame, and with anchor straps. Only narrow border shall be exposed. Hinges shall be concealed type. Locking device shall be flush type and screw driver operated. Metal surfaces shall be prime coated with rust-inhibitive paint. Panels shall be compatible with architectural adjacent materials. Color by Owner.

2.11 EQUIPMENT MOTORS

A. Provide motors with all motor driven equipment, complete with drives and controls. Electrical starters will be provided by electrical trade unless part of packaged equipment. See equipment specifications.

B. All motors used shall conform to all applicable requirements of NEMA, IEEE, ANSI & NEC standards. All motors shall comply with:

1. NFPA 70, “National Electric Code”, 1999.

2. NEMA MG-1, “Motors and Generators”, 1998.

3. UL 1004, “Motors, Electric”.

C. General

1. Frequency Rating: 60 Hz.

2. Voltage rating of motor shall be determined by voltage of circuit to which motor is connected.

   120 V Circuit: 115 V - motor rating
   208 V Circuit: 200 V - motor rating
   240 V Circuit: 230 V - motor rating
   480 V Circuit: 460 V - motor rating

3. Temperature Rise: Based on 40 degree ambient except as otherwise indicated.

4. Service Factor: 1.15 unless noted otherwise.

D. Three Phase Motors

1. General: Energy Efficient, squirrel-cage induction-type, NEMA Design B conforming to the following requirements except as otherwise indicated.

2. Enclosure: Totally Enclosed Fan Cooled (TEFC) unless otherwise noted in equipment specifications and schedules.

3. Motor Efficiency: Nominal (nameplate) full load efficiency and corresponding minimum efficiency equal to or greater than that stated in NEMA MG-1, Table 12-10 for that type and rating of motor.

NEMA TABLE 12-10 - ENERGY EFFICIENT MOTORS
NOMINAL FULL LOAD EFFICIENCIES

Horse-power	Open Drip Proof (ODP)			Total Enclosed Fan Cooled (TEFC)		
	2-Pole 3600 rpm	4-Pole 1800 rpm	6-Pole 1200 rpm	2-Pole 3600 rpm	4-Pole 1800 rpm	6-Pole 1200 rpm
1.0		82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2.0	84.0	84.0	85.5	84.0	84.0	86.5
3.0	84.0	86.5	86.5	85.5	87.5	87.5
5.0	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10	88.5	89.5	90.2	89.5	89.5	89.5
15	89.5	91.0	90.2	90.2	91.0	90.2
20	90.2	91.0	91.0	90.2	91.0	90.2
25	91.0	91.7	91.7	91.0	92.4	91.7
30	91.0	92.4	92.4	91.0	92.4	91.7
40	91.7	93.0	93.0	91.7	93.0	93.0
50	92.4	93.0	93.0	92.4	93.0	93.0
60	93.0	93.6	96.6	93.0	93.6	93.6
75	93.0	94.1	93.6	93.0	94.1	93.6
100	93.0	94.1	94.1	93.6	94.5	94.1
125	93.6	94.5	94.1	94.5	94.5	94.1
150	94.5	95	94.5	94.5	95.0	95.0
200	94.5	95	94.5	95.0	95.0	95.0

4. For motors used with variable speed drives, provide inverter duty motors in accordance with NEMA MG-1 Part 31, with insulation Class F and insulation temperature rise rating of Class B.

E. Single-Phase Motors

1. Provide internal thermal overload protection for motors.

F. Manufacturers

1. Motors 2 HP and larger shall be manufactured by one of the following: Reliance, Baldor, Dayton, Toshiba, General Electric, U.S. Motor.

2. Requirements in other Sections shall apply.

2.12 ACCEPTABLE MANUFACTURERS

A. Caulking

1. Interchem Presstite
2. Foster Sealer

B. Hatches with safety grating

1. ITT
2. Bilco

C. Flexible Connectors in Pipe

1. Flexonics
2. Twin City Hose
3. Metraflex
4. Mason

D. Pipe Thread Sealing Compound

1. Teflon Seal Tape-Jomar
2. Teflon Dope-Jomar “Gimme the Teflon Stuff”
3. Teflon Whitlam T-U Type 555

E. Couplings

1. Dresser w/ S.S. Hardware

F. Pressure Gauges

1. Trerice

G. Pressure and Temperature Plugs

1. Pete’s Plug
2. Schrader
3. Sisco

H. Strainers

1. Mueller
2. Armstrong
3. Grinnell
4. Conbraco Industries
5. Metraflex
6. Sprirax-Sarco
7. NIBCO
8. Watts

I. Thermometers (Industrial Grade)

1. Ashcroft
2. Trerice
3. Weiss Instruments
4. Weksler

J. Vacuum Breakers

1. Hoffman
2. Watts
3. Zurn

K. Ball Valve

1.	Jomar	S-100-SS and T-100-SS
2.	NIBCO	S-585-70-66
3.	Watts	B-6081-SS
4.	Grinnell	3700-6 and 3700-SJ-6

L. Swing Check Valve

1.	Milwaukee	509
2.	Crane	37
3.	Grinnell	3300
4.	NIBCO	

M. Silent Check Valve

1.	APCO	300
2.	Milwaukee	Series 1400
3.	Keystone	Prince
4.	Grinnell	Series 400

N. High Performance Butterfly Valve

1.	Dezurik	BHP
2.	Keystone	K-LOK 32
3.	Grinnell	WINN
4.	Watts	QF Series X

O. Standard Butterfly Valve

1.	Grinnell Series	8000
2.	Dezurik	BRS
3.	Keystone	Model K-LOK 312
4.	NIBCO	Series 2000 or 3000
5.	Watts	Series BG

P. Gate Valves

1.	Grinnell	3090
2.	NIBCO	T134
3.	Crane	428

Q. Water Pressure Regulating Valves

1.	Watts	
2.	Bell & Gossett	Model 350
3.	Conbraco	
4.	Wilkins	

R. Water Pressure Relief Valves

1.	Bell & Gossett	
2.	McDonnel Miller	
3.	Watts	

S. PVC/CPVC Pipe, Fittings & Valves

1. Orion
2. Enfield
3. Spears

PART 3 – EXECUTION

3.1 INSTALLATION

A. For soldered joints, use non-acidic and lead-free flux on cleaned pipe and fittings. Cut pipe square and ream ends before assembly. Fill joints with solder by capillary actions, with solder covering joint periphery. Wipe joints clean. Apply heat carefully to prevent overheating and damage to pipe, fittings, and valves. Strict adherence to manufacturer's installation recommendations when heating and soldering valves is mandatory.

B. Terminal units shall be properly supported to wall studs by use of backing plate spanning stud-to-stud.

C. Cut copper tube square and ream before assembly. Keep piping capped during construction to prevent intrusion of construction debris.

D. Support piping drops through finished ceiling from structure above to prevent any lateral or up/down movement. Other outlet drops shall be supported from walls, columns, or work benches using appropriate hangers, anchors, or unistrut.

E. CONTRACTOR shall provide his own survey to locate pipes, elevations, ducts, conduits, etc. and prepare his own shop drawings. Variations to suit existing conditions, structural features or mechanical equipment shall be his responsibility.

F. Cut pipe accurately and install without springing or forcing. All burrs shall be removed after cutting.

G. Install plumbing to applicable code requirements.

H. Install all domestic supply piping for fixtures through the sidewalls unless otherwise noted on the Plans.

I. Install shock absorbers on the water supply at flush valves or self-closing valves and at equipment with solenoid valves.

J. Install above ground water piping so as to be completely drainable with accessible drain valves installed at the low points of the system.

K. Lubricate domestic clean out plugs with mixture of graphite and linseed oil.

L. Install chrome-plated compression stops for all fixtures.

M. Make screwed joints with full cut standard taper pipe threads.

N. Install piping to permit complete draining. Provide capped hose end ball drain valves at all low points.

O. Installed piping shall be free from sagging. Provide for expansion and contraction of piping in an approved and safe manner by means of loops or offsets, where mechanical expansion joints are not specifically called for.

P. Branch connections for gaseous systems shall be taken off mains on top, up at a 45E angle, or off the side.

Q. Branch piping shall be valved at the branch connection points.

R. Provide fittings and specialties necessary to properly interconnect all items and specialities whether or not shown in detail.

S. Clean and swab-out all piping before installation. Piping left open for extended periods shall be capped.

T. Lay out pipe lines straight, plumb and in true alignment. Offset as required to avoid interference with other work, to conceal piping, to allow maximum headroom and to avoid interference with windows and doors. Lay out all pipes and establish their levels from bench marks, existing floors or finished grades.

U. Piping shall be concealed unless indicated otherwise on drawings. Do not conceal piping until it has been inspected, tested, flushed and approved.

V. Route pipes in groups where possible.

W. Run pipes perpendicular and parallel to building walls.

X. Use eccentric reducing fittings to increase or decrease pipe sizes. Bushings are not acceptable. Orient reducers to prevent trapping of water.

Y. Pipe extending into finished areas shall have chrome plated escutcheons large enough to cover pipe sleeves and shall fit snugly over pipe or insulation.

Z. Pitch piping as follows (unless noted otherwise):

1. Vent piping back toward waste at 1/16" per foot.

2. Waste, and compressed air piping down in direction of flow at 1/8" per foot.

3. Natural gas piping level or at 1/4" per 15 foot toward drip leg.

3.2 INSTALLATION OF WELDED PIPING

A. CONTRACTOR Qualification:

1. CONTRACTOR shall submit the welding procedure and the welder qualification per ASME - Boiler and Pressure Vessel Code, Section IX, in order to perform welding in accordance with the ASME - Boiler and Pressure Vessel Code and the ASME B31 Code for Pressure Piping.

B. Preparation:

1. The edge of surface or part to be joined by welding shall be prepared by flame cutting or machining and shall be cleaned of oil or grease and excessive amount of scale, rust or other foreign material.

2. The work area shall be kept clean at all times.

3. Tie-ins to existing pipes shall be done after emptying the pipe and blowing the pipe with nitrogen.

4. The following precautions must be followed when welding or torch cutting is required in area which contains flammable liquids processing equipment in services:

   a. All open-ended lines and valves shall be blind flanged prior to commencing of the job.

   b. As much piping as practical shall be prefabricated.

   c. Tie-ins to existing pipes shall be cold cut, stople and flange procedure.

5. No welding allowed on materials to be joined when their temperature is below 40 degrees F. The material must be preheated to 65 degrees F.

C. Welding Criteria:

1. Carbon steel piping:

   a. In sizes 1-1/2 inches and smaller, the welding shall be performed by means of the gas welding (oxyacetylene) process.

   b. In sizes 2 inches and larger, the welding shall be performed by the metallic arc process with coated electrodes.

   c. In sizes 1 inches and larger the welding may be done by wire welding process (gas metal arc welding).

2. Stainless steel piping, type 304 SS or 316 SS.

   a. The welding shall be done by gas tungsten arc welding process using a non-consumable electrode of thoriated tungsten.

   b. Filler metal shall be 316 ELC (extra low carbon).

   c. Shielding gas and internal purge gas shall be welding grade argon.

   d. Post weld heat treatment: Annealed min. 1925 degrees F and rapidly cooled if corrosion resistance is required.

D. Weld Quality and Repairs:

1. 100 percent penetration is required on the entire length of the welded joints. Welds shall be free of defects, (undercoating, lack of penetration, cracks, etc.) Inside and outside of welds shall be smooth as possible. Add filler rod as necessary. The outside of all welds shall be cleaned by brushing.

2. All welds should be made with one pass.

3. CONTRACTOR shall be responsible for any defective welds, including the labor costs to repair or replace the defective weld and the cost of the x-ray of any such welds, until the welds pass inspection.

4. Weld repairs failing three attempts shall be cut out and replaced with new spool piece at CONTRACTOR'S expense. Quality procedures shall then apply as new weld.

3.3 FLASHING

A. Flash and counterflash where mechanical equipment passes through weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 12 inch minimum above finished roof surface with galvanized steel or aluminum flashing and neoprene boots. Flashing to match equipment materials. For pipes through outside walls turn flange back into wall and caulk.

B. Secure all flashing w/ S.S. hardware.

3.4 SLEEVES

A. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.

B. Install seals and provide floor plate.

C. Where piping or ductwork passes through floor, ceiling or wall where no potential moisture exists, close off space between pipe or duct and construction with non-combustible insulation. Provide tight fitting metal caps on both sides and caulk.

D. Install chrome plated escutcheons where piping passes through finished surfaces.

3.5 VALVES

A. General:

1. Provide valves of same manufacturer throughout where possible.

2. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.

3. Install valves with stems upright or horizontal, not inverted.

4. Install ball valves for shut-off and isolating service, to isolate equipment, part of systems or vertical risers.

3.6 EXPANSION COMPENSATION

A. Installation:

1. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation.

2. Accomplish structural work and provide equipment required to control expansion and contraction of piping, loops, pipe offsets, and swing joints and provide corrugated bellows type expansion joints where required.

3. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end.

4. Rigidly anchor pipe to building structure where necessary. Provide guides so that movement takes place along axis of pipe only.

5. Install flexible connections on the suction and discharge lines of each pump, except in-line booster pumps, unless noted otherwise.

3.7 TESTING

A. General:

1. Test new systems only, from point of connection to the existing systems. Perform initial tests and correct deficiencies prior to requesting acceptance test.

2. Perform acceptance pressure tests in the presence of the owner and authorities having jurisdiction. Acceptance test must be satisfactorily completed before piping surfaces are concealed.

3. Pneumatic tests shall be conducted using dry, oil free compressed air, carbon dioxide or nitrogen. Evacuate personnel not directly involved in testing prior to performing pneumatic testing. Perform testing in two stages, initial and acceptance. Conduct initial testing at 5 psi or less. Swab joints with a commercial leak detector. Repair deficiencies prior to testing at higher pressure.

4. Components shall be removed or isolated during testing if damage may occur due to test pressure and/or test media.

5. Provide pumps, gauges, instruments, test equipment personnel and clean auxiliary water. After tests have been made, remove all test equipment and drain all pipes.

6. Submit a complete test report to the OWNER.

7. Operate pumps which have mechanical seal only with water in the system.

8. Test prior to painting, installation and insulation, or concealment.

9. Tests may be made on sections of piping as installed.

10. Re-test repaired or revised piping.

B. Pressure Systems:

1. Test pressure: 150 percent of the operating pressure or at test pressure in table below, whichever is greater.

2. Refer to Division 11 for other requirements.

System	Test Media	Test Pressure	Permissible Pressure Drop
Underground Potable Water	Water	150 psig	0 psig in 4 hours
Above Ground Water	Water	150 psig	1 psig in 2 hours
Compressed Air	Air	150 psig	2 psig in 2 hours
Natural Gas	Air	100 psig	0 psig in 2 hours
Refrigerant			
1st	Dry Carbon Dioxide	250 psig	no leaks by soap test
2nd	CO2	150 psig	no leaks by halide torch
3rd	N/A	28" vacuum	0 psig in 12 hours

C. Gravity System

1. Waste, drain, and vet systems, downspouts, rain leaders and their branches.

2. Entire System: Close all openings except the highest and fill system with water to point of overflow.

3. Sections: Close all opening, except highest, and provide a head of 10 feet. In testing successive sections, at least the upper 10 feet of next preceding section shall be included so that every joint and pipe in the whole system (except the uppermost 10 feet) shall have been subjected to a head of 10 feet of water.

4. After system or section under test has been filled with water, wait at least 15 minutes before starting inspection.

5. After 2 hours (minimum) there shall be no evidence of leakage.

6. Test waste, drain and vent pipe system before fixtures are installed and retest after fixtures have been installed.

3.8 LUBRICATION

A. Ensure that all motors and equipment, as required, are properly lubricated before such items are accepted by the OWNER.

3.9 CLEANING OF DOMESTIC PIPING SYSTEMS

A. All work shall comply with AWWA, NSF and the City of Ann-Arbor Standards.

B. Domestic water: Flush with chlorine solution-AWWA C6-168 “Disinfecting Water Mains”.

C. Compressed Air and Natural Gas: Blow clear of chips and scale with 100 psig air.

3.10 PIPE AND EQUIPMENT IDENTIFICATION

A. Pipe and equipment identification is specified in Section 15075 - Mechanical Identification.

3.11 SPARE FILTERS

A. Provide two years of spare filters for all equipments.

B. Store filters in a location designated by the OWNER.

C. Label the filters to indicate the matching piece of equipments,

END OF SECTION

SECTION 15020

CLEANING AND STARTUP OF MECHANICAL PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide complete cleaning and flushing consisting of all materials, equipment, labor, services, and tests necessary to completely clean all piping before installation and to flush all piping and systems after installation.

B. Provide all equipment, material, labor and testing required to properly pacify hydronic system piping so that it may be integrated into the existing hydronic system with no adverse affects or contamination.

C. Provide all equipment, material, labor and testing required for proper disinfection of city water piping.

D. CONTRACTOR to count for one week-end for flushing and cleaning of piping system (Off regular working hours)

PART 2 - PRODUCTS

2.1 MATERIALS

A. Detergents, solvents, and other cleaning agents shall be compatible with materials of fabrication of systems where they are used. No cleaning agent shall adversely affect materials or mechanisms in systems and cleaning agents shall be acceptable to equipment manufacturers and the plant environmental coordinator.

B. Detergents, solvents, and other cleaning agents shall be compatible with process streams to be handled by systems in which the cleaning agents are used.

C. OWNER will provide water for pipe cleaning and flushing. Other cleaning fluids, agents, and equipment shall be provided by CONTRACTOR.

D. Hydronic systems shall use the following products or an equal substitute and shall be approved by the owner prior to flush.

1. Ferroquest FQ7103: Use prior to any other for the removal of iron oxides from the metal surfaces, and passivation of the base metal.

    a. A 3 percent Ferrroquest concentration is recommended for the removal of deposits. Ferroquest shall be circulated until a steady iron concentration is reached in the circulating water. As the Ferrroquest dissolves iron oxide deposits, ferric hydroxide is formed and the pH rises it is necessary to maintain a pH range of

6.5 to 7.5, therefore, supplemental feeding of our Ferroquest FQ7102 Neutralizer may be required in extremely dirty systems.

2. CorrShield MD409, Corrosion Protection: Shall be placed in the pacified pipe after the system has been cleaned and flushed.

3. Provide all necessary temporary equipment required for cleaning and flushing operations.

E. Provide temporary/permanent hose connections for supply, discharge and recirculating lines for the new piping system.

F. Provide temporary hoses or piping at the ends of the main and branch lines of the piping system as required to accomplish flush of the piping.

G. Provide a temporary pump of sufficient head and GPM required to achieve a flushing velocity of at least 6 feet per second.

H. Provide temporary chemical skids with tote tanks as required for mixing chemicals and serving as a source reservoir and/or collection point for cleaning and flushing solutions.

I. Provide temporary bag filters (with filter bags) as required for removal of contaminants from flushing process.

J. Provide all hose, electrical leads and supply connections for completion of system required to fill, drain and refill of the lines utilizing plant supplied water and power.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION CLEANING

A. Before installation, piping, unless otherwise specified, shall be cleaned as follows:

1. Hammer, brush, scrub with soapy rags, etc. to loosen sand, dirt, or scale when necessary. Remove excess grease and oil from exterior surface.

2. Blow with air, or flush with clean water, and inspect before erection.

3. Pipe cleaned and stored before installation shall be dried and ends sealed with a rigid plug or flange protector and tape.

B. Physical cleaning procedures shall not damage materials or mar surfaces of such materials. Hammering shall not be used on cast iron, fiberglass-reinforced plastic or plastic pipe.

3.2 PRIOR TO FLUSHING

A. Removals

1. Remove orifice plates, traps, strainer elements, flow control valves, etc. prior to or during process of cleaning. Remove instruments which might be damaged by cleaning procedures. All such items shall be replaced with spool pieces, plugs, or blind flanges. A "blind list" shall be prepared listing where blinds have been installed for cleaning and shall be provided to Owner after cleaning is complete to verify that all blinds have been removed.

2. Items removed from piping system shall be cleaned separately.

3. Valves shall be blocked in open position.

4. New gaskets, thread lubricants, etc. shall be used when removed items are reinstalled after cleaning.

B. Temporary Bypass Piping: Provide full size bypass piping and valves at coils and heat exchangers such that the coils and heat exchangers can be isolated.

C. Temporary Strainers: Disconnect piping to be flushed from equipment or install temporary strainers immediately upstream of such equipment.

D. System Protection

1. Protect piping and equipment against overpressure, collapse from vacuum and hydraulic shock during flushing and draining procedures.

2. Exercise special care with polyvinyl chloride (PVC) and fiberglass-reinforced plastic (FRP) piping and upon initial filling of long pipe runs to determine that pipe is in contact with hangers and supports before filling. Piping bowed out of hangers or supports will settle or lengthen during filling and resulting forces may be damaging at changes in direction.

3. Install high point vents and low point drains required to remove trapped air and to drain flushing liquid.

3.3 HYDRONIC SYSTEM PIPING FLUSHING

A. By its design, hydronic systems have a supply and return and therefore are best flushed by recirculation. This method works well for the mains and large branches, but smaller branches require flushed flow out of the system without return. The process of pacifying the piping after flushing however is best accomplished with all branch supply and return piping in its normal in service flow configuration.

B. Isolate the new piping from the existing system using valves and blind flanges. Each of the connection points should have fill/drain piping, valves and connection points should be installed off the bottom of elevated pipe. The piping should also

have vent valves at the high points of the piping and on all high points of isolated legs of branch piping.

1. Note: Care should be taken during installation of both temporary flush and permanent components, to assure that they are free of debris, oil and other potential contamination.

C. Install temporary drain piping and/or hoses to drain locations as required or collect the water in a portable tote tank for transfer to the proper disposal location. Coordinate disposal of all flushing and pacifying water with the plant environmental coordinator.

D. Install temporary fill connection and start filling the piping, venting continuously until the system has been completely filled and as much air as possible has been eliminated from the system.

E. The chemical supplier should start chemical injection through the temporary chemical tote until the predetermined concentration of chemical (if required) has been achieved.

F. Flush through the piping mains from the extreme end to extreme end of the system until solution is well mixed and stable. Recirculate the water through the piping system until the desired cleanliness has been achieved. If the water is very dirty and the tote tank does not provide enough settling time to remove the debris prior to being suctioned out by the recirculation pumps, install a temporary bag housing with a filter or wire mesh strainer in the flow path.

G. After the mains have been flushed, flush all of the branch lines starting with the branch closest to the supply point and progress toward the extreme end of the piping that is furthest from the source. Repeat the flushing through each branch until the desired cleanliness has been achieved.

H. Collect water samples and label them with a location and time/date, for analysis of cleanliness. Continue to sample the new piping system piping until it is completely flushed clean of all contaminants and matches the influent source for cleanliness.

I. When desired cleanliness has been achieved, all flushing water should be drained from the system and then refilled, circulated throughout the mains and branches to rinse out the flushing chemicals, and dumped again.

J. Restore all piping to its design state (remove all temporary piping and close all valves), and refill the system with water and the proper amount of pacifying chemical as directed by the chemical supplier. Recirculate the chemicals throughout the system for a sufficient amount of time as the chemical supplier requires for proper mixing and metal exposure.

1. Note: The pacifying period may require 24 to 72 hours.

K. Drain the system, refill with water and coordinate with the OWNER to open the new piping to the existing hydronic system for final mixing of OWNERS chemical into the newly refilled piping via the existing system pumps and chemical injection system.

L. In the event that the new piping is not to be integrated into the existing hydronic system for more than a month, coordinate with the OWNER as to whether the system is to remain in “wet layup” with the pacifying chemicals in place or “dry layup” in which case the piping is to be drained and a nitrogen purge applied.

3.5 NATURAL GAS PIPING CLEANING

A. CONTRACTOR shall comply with local gas company standards for cleaning natural gas piping systems.

END OF SECTION

SECTION 15030

INSTALLATION OF PIPEWORK

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Requirements for the installation of mechanical piping systems.

PART 2 – PRODUCTS

NOT USED

PART 3 – EXECUTION

3.1 CONNECTIONS TO EQUIPMENT

A. In accordance with manufacturer's instructions unless otherwise indicated.

B. Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

C. Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

3.2 CLEARANCES

A. Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.

B. Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment and components.

3.3 DRAINS

A. Install piping with grade in direction of flow except as indicated.

B. Install drain valve at low points in piping systems, at equipment and at section isolating valves.

C. Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.

D. Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

3.4 AIR VENTS

A. Install manual air vents at high points in piping systems.

B. Install isolating valve at each automatic air valve.

C. Install drain piping to approved location and terminate where discharge is visible.

3.5 DIELECTRIC COUPLINGS

A. General: Compatible with system, to suit pressure rating of system.

B. Locations: Where dissimilar metals are joined.

C. NPS 2 and under: isolating unions or bronze valves.

D. Over NPS 2: Isolating flanges.

3.6 PIPEWORK INSTALLATION

A. Screwed fittings jointed with Teflon tape.

B. Protect openings against entry of foreign material.

C. Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.

D. Assemble piping using fittings manufactured to ANSI standards.

E. Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main.

1. Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.

F. Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

G. Install concealed pipework to minimize furring space, maximize headroom, and conserve space.

H. Slope piping, except where indicated, in direction of flow for positive drainage and venting.

I. Install, except where indicated, to permit separate thermal insulation of each pipe.

J. Group piping wherever possible and as indicated.

K. Ream pipes; remove scale and other foreign material before assembly.

L. Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

M. Valves:

1. Install in accessible locations.

2. Remove interior parts before soldering.

3. Install with stems above horizontal position unless otherwise indicated.

4. Valves accessible for maintenance without removing adjacent piping.

5. Install globe valves in bypass around control valves.

6. Use gate or butterfly valves at branch take-offs for isolating purposes except where otherwise specified.

7. Install butterfly valves between weld neck flanges to ensure full compression of liner.

8. Use chain operators on valves NPS 2-1/2" and larger where installed more than 5' above floor.

N. Check Valves:

1. Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

3.7 SLEEVES

A. General: Install where pipes pass through existing masonry, concrete structures, fire rated assemblies, and elsewhere.

B. Material: Schedule 40 black steel pipe.

C. Construction: Foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.

D. Sizes: ¼" minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.

E. Sealing:

1. Foundation walls and below grade floors: Fire retardant, waterproof non-hardening mastic.

2. Elsewhere: Provide space for fire-stopping. Maintain fire rating integrity.

3. Sleeves installed for future use: Fill with lime plaster or other easily removable filler.

4. Ensure no contact between copper pipe or tube and sleeve.

3.8 ESCUTCHEONS

A. Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.

B. Construction: One piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.

C. Sizes: Outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

3.9 PREPARATION FOR FIRESTOPPING

A. Un-insulated unheated pipes not subject to movement: No special preparation.

B. Un-insulated heated pipes subject to movement: Wrap with non-combustible smooth material to permit pipe movement without damaging fire-stopping material or installation.

C. Insulated pipes and ducts: Ensure integrity of insulation and vapor barriers.

3.10 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

A. Advise Engineer 48 hour's minimum prior to performance of pressure tests.

B. Pipework: Test as specified in relevant sections.

C. Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period.

D. Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure.

E. Pay costs for repairs or replacement, retesting, and making good. ENGINEER to determine whether repair or replacement is appropriate.

F. Insulate or conceal work only after approval and certification of tests by ENGINEER.

3.11 EXISTING SYSTEMS

A. Connect into existing piping systems at times approved by Engineer.

B. Request written approval 10 days minimum, prior to commencement of work.

C. Be responsible for damage to existing plant by this work.

D. Ensure daily clean-up of existing areas.

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes identification of all process, mechanical and plumbing piping, equipment and ductwork.

1.2 RELATED DOCUMENTS

A. General and Supplementary Conditions and requirements of Division 1 apply to work of this Section.

B. Related work specified in other Sections:

1. Division 15 – All Sections

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 of these Specifications.

B. Submit product data information including a description of all markers, paint and tags.

C. Submit comprehensive list of all pipes, pumps, valves, ducts and other equipment to be labeled. List shall include label and equipment number as required by the OWNER.

1.4 QUALITY ASSURANCE

A. All identification markers shall comply with ANSI A13.1.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. Pre-printed, color-coded, pre-curled plastic pipe markers of the full-bank semi-rigid, snap-on type, extending 360 degrees around pipe.

B. Piping identification materials shall be large, legible labels, 3-1/2" high on piping 10" and larger, 2-1/2" high on piping smaller than 10", and 3/4" lettering on piping 3/4" and smaller.

C. Provide marker with lettering describing piping system and flow arrow. Abbreviations for pipe flow type will be provided by the OWNER.

2.2 DUCT MARKERS

A. Plastic, adhesive type color-coded duct markers with arrow indicating direction of flow and with fan system identified (see Table 2, below).

TABLE 2

Service/Duct Label	Drawing	Letter and Label Color
Supply Air (Equip #)	SA	White on Green
Return Air (Equip #)	RA	White on Green
Exhaust Air (Equip #)	EA	Black on Yellow
Outdoor Air (Equip #)	OA	White on Green

B. Provide plastic adhesive duct access door markers indicating item and associated equipment accessed, and appropriate safety and procedural information (eg. Fire Damper AHU-1).

2.3 EQUIPMENT MARKERS

A. Provide engraved plastic equipment markers on **ALL EQUIPMENT AND ACCESSORIES**, indicating drawing identification and service (i.e.: HWP-1 Heating Hot Water Pump) and nominal capacity (cfm, tons or gpm). Scale marker and lettering to equipment labeled.

B. Contact OWNER for next available equipment number for all equipment.

C. Markers shall be phenolic tags with white background and black engraved lettering. Markers shall be securely pinned to equipment with stainless steel pins, stainless steel chains or provided with self-sticking backing, as appropriate to the individual equipment and surfaces to which markers are to be attached.

1. Lettering shall be as large as possible up to 1-1/2” in height. For equipment with limited tag spacing, lettering may be reduced in size to a minimum 1/2” as necessary.

D. Submit a list of all items to be marked as Shop Drawing for OWNER approval prior to ordering markers.

2.4 VALVE IDENTIFICATION

A. Mechanical CONTRACTORSshall tag all valves with phenolic tags with white background and ¼” black engraved lettering attach securely to valve by stainless steel chain. Include valve tag charts bound in operating manuals and submit one set of charts, under glass, in metal frames to OWNER.

B. All main and branch line valves are to be tagged in accordance with the OWNER’s numbering system.

C. Contact OWNER for next available valve number where adding valves to existing buildings.

2.5 ACCEPTABLE MANUFACTURERS

A. Identification Labels:

1. Seton

2. Brady

3. Bramer

4. Markcraft

PART 3 - EXECUTION

3.1 LOCATION OF MARKERS

A. Arrows and markers shall be mounted to provide unobstructed visibility from floor level.

B. Locations for pipe and duct markers in equipment rooms, chases, tunnels and shafts shall be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).

2. At each branch and riser take-off.

3. At each passage through wall, floor and ceiling construction.

4. At each passage to underground.

5. At each access panel location.

6. On all horizontal runs-marked every 10-0".

C. Locations for pipe and duct markers above ceilings in finished areas:

1. Adjacent to each valve.

2. On all horizontal runs-marked every 10'-0".

END OF SECTION

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes identification of all process, mechanical and plumbing piping, equipment and ductwork.

1.2 RELATED DOCUMENTS

A. General and Supplementary Conditions and requirements of Division 1 apply to work of this Section.

B. Related work specified in other Sections:

1. Division 15 – All Sections

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Division 1 of these Specifications.

B. Submit product data information including a description of all markers, paint and tags.

C. Submit comprehensive list of all pipes, pumps, valves, ducts and other equipment to be labeled. List shall include label and equipment number as required by the OWNER.

1.4 QUALITY ASSURANCE

A. All identification markers shall comply with ANSI A13.1.

PART 2 - PRODUCTS

2.1 PIPE MARKERS

A. Pre-printed, color-coded, pre-curled plastic pipe markers of the full-bank semi-rigid, snap-on type, extending 360 degrees around pipe.

B. Piping identification materials shall be large, legible labels, 3-1/2" high on piping 10" and larger, 2-1/2" high on piping smaller than 10", and 3/4" lettering on piping 3/4" and smaller.

C. Provide marker with lettering describing piping system and flow arrow. Abbreviations for pipe flow type will be provided by the OWNER.

2.2 DUCT MARKERS

A. Plastic, adhesive type color-coded duct markers with arrow indicating direction of flow and with fan system identified (see Table 2, below).

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Supply Air (Equip #)	SA	White on Green
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Exhaust Air (Equip #)	EA	Black on Yellow
Outdoor Air (Equip #)	OA	White on Green

B. Provide plastic adhesive duct access door markers indicating item and associated equipment accessed, and appropriate safety and procedural information (eg. Fire Damper AHU-1).

2.3 EQUIPMENT MARKERS

A. Provide engraved plastic equipment markers on **ALL EQUIPMENT AND ACCESSORIES**, indicating drawing identification and service (i.e.: HWP-1 Heating Hot Water Pump) and nominal capacity (cfm, tons or gpm). Scale marker and lettering to equipment labeled.

B. Contact OWNER for next available equipment number for all equipment.

C. Markers shall be phenolic tags with white background and black engraved lettering. Markers shall be securely pinned to equipment with stainless steel pins, stainless steel chains or provided with self-sticking backing, as appropriate to the individual equipment and surfaces to which markers are to be attached.

1. Lettering shall be as large as possible up to 1-1/2” in height. For equipment with limited tag spacing, lettering may be reduced in size to a minimum 1/2” as necessary.

D. Submit a list of all items to be marked as Shop Drawing for OWNER approval prior to ordering markers.

2.4 VALVE IDENTIFICATION

A. Mechanical CONTRACTORSshall tag all valves with phenolic tags with white background and ¼” black engraved lettering attach securely to valve by stainless steel chain. Include valve tag charts bound in operating manuals and submit one set of charts, under glass, in metal frames to OWNER.

B. All main and branch line valves are to be tagged in accordance with the OWNER’s numbering system.

C. Contact OWNER for next available valve number where adding valves to existing buildings.

2.5 ACCEPTABLE MANUFACTURERS

A. Identification Labels:

1. Seton

2. Brady

3. Bramer

4. Markcraft

PART 3 - EXECUTION

3.1 LOCATION OF MARKERS

A. Arrows and markers shall be mounted to provide unobstructed visibility from floor level.

B. Locations for pipe and duct markers in equipment rooms, chases, tunnels and shafts shall be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).

2. At each branch and riser take-off.

3. At each passage through wall, floor and ceiling construction.

4. At each passage to underground.

5. At each access panel location.

6. On all horizontal runs-marked every 10-0".

C. Locations for pipe and duct markers above ceilings in finished areas:

1. Adjacent to each valve.

2. On all horizontal runs-marked every 10'-0".

END OF SECTION

SECTION 15112

VALVES

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes

1. Bronze Valves
2. Cast Iron Valves

B. Related Sections

1. Section 01300 – Submittals
2. Section 15185 – Heating Piping and Fittings

1.2 REFERENCES

A. American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).

1. ANSI/ASME B1.20.1-1983 (R2001), Pipe Threads, General Purpose (Inch).
2. ANSI/ASME B16.18-2001, Cast Copper Alloy Solder Joint Pressure Fittings.

B. American Society for Testing and Materials International (ASTM).

1. ASTM A276-04, Specification for Stainless Steel Bars and Shapes.
2. ASTM B62-02, Specification for Composition Bronze or Ounce Metal Castings.
3. ASTM B283-99a, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
4. ASTM B505/B505M-02, Specification for Copper-Base Alloy Continuous Castings.

C. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

1. MSS-SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.
2. MSS-SP-80-2003, Bronze Gate Globe, Angle and Check Valves.
3. MSS-SP-110-1996, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Submittals in accordance with Section 01300 - Submittals.

1.4 MATERIALS

A. Valves

1. Except for specialty valves, to be single manufacturer.

B. End Connections

1. Connection into adjacent piping/tubing:

a. Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.

b. Copper tube systems: Solder ends to ANSI/ASME B16.18.

C. Gate Valves

1. Requirements common to gate valves, unless specified otherwise:

a. Standard specification: MSS SP-80.

b. Bonnet: union with hexagonal shoulders.

c. Connections: screwed with hexagonal shoulders.

d. Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.

e. Packing: non-asbestos.

2. NPS 2 and under, rising stem, split wedge disc, Class 125:

a. Body: with long disc guides, screwed bonnet.

b. Disc: solid wedge, bronze to ASTM B283, loosely secured to stem.

c. Accepted manufacturers:

1) Crane, Figure 428.

2) Jenkins, Figure 810J.

3) Nibco, Model T-111.

4) Approved equal.

3. NPS 2½ and above, Cast Iron Flanged Class 125:

a. Bolted Bonnet, Outside Screw and Yoke, Solid Wedge, Bronze Mounted - Flanged.

b. Accepted manufacturers:

1) Crane, Figure 465.

2) Jenkins, Figure 454J.

3) Nibco, Model F-617-O.

4) Approved equal

D. Butterfly Valves (for throttling)

1. General

a. All valve components shall be suitable for chlorinated pool water. Valve manufacturer to provide chemical resistance charts.

b. Valve operators to be designed to operate the valves with a differential line pressure of 150 psi.

c. All exterior and interior surfaces including disc and gear actuator to be suitable and chemical resistant for chlorinated pool water, and epoxy painted in conformance with AWWA C550 and NSF 61.

d. All external fasteners to be Type 316 stainless steel.

e. Provide operators and related accessories with factory epoxy or enamelled finish, where applicable, unless noted otherwise.

f. Valves 6 inches and larger shall have a cast iron body, neck and top piece with a minimum non-shock W.O.G. working pressure rating as specified in the valve schedule. Seats shall be Buna-N or Hycar providing leak-proof shutoff with the disc and acting as a body liner to prevent corrosion. Disc shall be ni-resist, cast iron with stainless steel mating surfaces and stainless steel shaft rotating in permanently lubricated bearings. Stem seal shall be Buna-N or Hycar. Valves shall be flanged type with gear operators unless otherwise specified or shown on the Plans. Handwheels shall be 18" diameter.

g. Butterfly valves shall be manufactured in accordance with the latest revision of ANSI/AWWA C504 for Class 150B service. Butterfly valves shall be manufactured by Henry-Pratt Company, DeZurik or ENGINEER approved equal.

E. Globe Valves

1. Requirements common to globe valves, unless specified otherwise:

a. Standard specification: MSS SP-80.

b. Bonnet: union with hexagonal shoulders.

c. Connections: screwed with hexagonal shoulders.

d. Pressure testing: to MSS SP-80. Tests to be hydrostatic.

e. Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.

2. NPS 2 and under, Class 125:

a. Body and bonnet: screwed bonnet.

b. Accepted manufacturers:

1) Crane, Figure7TF.

2) Jenkins, Figure 106BJ.

3) Nibco, Model T-235-Y.

4) Approved equal

F. Check Valves

1. Requirements common to check valves, unless specified otherwise:

a. Standard specification: MSS SP-80.

b. Connections: screwed with hexagonal shoulders.

2. NPS 2 and under, swing type, bronze disc, Class 125:

a. Horizontal Swing, Regrinding Type, Y-Pattern -Renewable Seat and Disc, Threaded

b. Accepted Manufacturers:

1) Crane Figure 37.

2) Jankins Model 4092J.

3) Nibco Model T-413.

4) Approved equal.

3. NPS 2½ and above, swing type, Class 125:

a. Bolted Bonne, Horizontal Swing, Renewable Seat and Disc, Flanged

b. Accepted Manufacturers:

1) Crane Figure 373.

2) Jankins Model 590J.

3) Nibco Model F-918-B.

4) Approved equal.

G. Ball Valves

1. NPS 2 and under:

a. Threaded, Reduced Port, Stainless Trim, Vented Ball, Blowout-Proof Stem.

b. Body and cap: cast high tensile bronze to ASTM B62.

c. Pressure rating: Class125.

d. Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders.

e. Stem: tamperproof ball drive.

f. Stem packing nut: external to body.

g. Ball and seat: replaceable stainless steel hard chrome solid ball and teflon seats.

h. Stem seal: TFE with external packing nut.

i. Operator: removable lever handle.

j. Accepted Manufacturers:

1) Crane 9200 Series

2) Jenkins, Model 210J

3) Nibco Model T-560-BR-66

4) Approved equal.

2. Accepted manufacturers:

   a. Watts, Series 007

   b. Febco, Model 850

   c. Approved equal

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install Rising Stem valves in upright position with stem above horizontal.

B. Remove internal parts before soldering.

C. Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

END OF SECTION

SECTION 15181

HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes

1. The supply and installation of Hydronic Specialties Equipment.

1.2 REFERENCES

A. American Society of Mechanical Engineers (ASME).

1. ASME-04, Boiler and Pressure Vessel Code.

B. American Society for Testing and Materials, (ASTM).

1. ASTM A47/A47M-99, Specification for Ferritic Malleable Iron Castings.

2. ASTM A278M-01, Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F.

3. ASTM A516/A516M-96 (e1), Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.

4. ASTM A536-84 (1999)e1, Specification for Ductile Iron Castings.

5. ASTM B62-93, Specification for Composition Bronze or Ounce Metal Castings.

1.3 SUBMITTALS

A. Submittals in accordance with Section 01330 - Submittal Procedures.

B. Submit shop drawings and product data and include manufacturer's literature.

C. Provide maintenance data for incorporation into manual and include following:

1. Special servicing requirements.

2. List of recommended spare parts.

D. All products and materials shall be in accordance with the boiler manufacturer's recommendations. Boiler manufacturer shall provide concurrent approval of all products.

PART 2 - PRODUCTS

2.1 LIQUID FLOW SWITCH

A. Application: as shown on the drawings.

B. Stainless steel paddles.

C. Maximum working pressure is 160 PSI.

D. Working temperature Range is 32°F - 300°F.

E. Maximum Velocity is 10 ft/sec

F. Electrical Enclosure Rating is Nema Type 3

G. Accepted manufacturers:

1. ITT Series FS4-3.

2. Approved equal.

2.2 FLEXIBLE CONNECTIONS

A. Install flexible connection on the suction and discharge of the Hot Water Pumps.

B. Flexible connection shall be with inner core or annularly corrugated stainless steel with an outer casing of two layers braided high tensile steel. Connections shall be complete with couplings and fittings of steel with flanged connection.

C. Accepted Manufacturers:

1. Flexonics

2. Hydro-Flex.

3. Approved equal.

2.3 PRESSURE GAUGES

A. Install pressure gauge on the suction and discharge of the Hot Water Pumps.

B. Gauge shall be 4½" black cast aluminum, black figures on white dial face, phosphor bronze tube, brass rotary movement.

C. Range shall be 0-160 PSI, Dual scale.

D. Accepted Manufacturers:

1. Trerice Series 600C

2. Winter, 300 series

3. Weiss

4. Approved Equal.

2.4 TEMPERATURE GAUGES

A. Thermometers shall be 4” diameter, aluminum case, Bi-metal thermometer, dual scale (°F and °C) with thermowell.

B. Range shall be 0-220°F, dual scale.

C. Install thermometer on the boiler intake pipe, boiler supply pipe and main hot water pipe.

D. Accepted manufacturers:

1. Winters

2. Trerice

3. Weiss

4. Approved equal.

2.5 CONDENSATE NEUTRALIZER

A. Application:

1. Fuel burning Condensing Boiler, and exhaust stack drain

2. Neutralizes condensate to 7.0 PH for safe discharge into sewer.

B. Codes:

1. Complies with Section 314, 2006 Michigan Plumbing Code

C. Accepted manufacturer:

1. Lochinvar Model KIT3087, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Install all equipments as indicated and to manufacturer's recommendations.

B. Install all heating pipes in such a way that all high points are vented and all low points are drainable. Provide drain valves with end hose adapter, screw caps and retainer chains.

C. Provide dielectric unions between piping of different materials.

D. Keep openings in pipes or fittings plugged and capped during installation to keep out dirt.

E. Install as indicated and to manufacturer's recommendations.

F. Run drain lines to terminate above nearest drain.

G. Maintain proper clearance to permit service and maintenance.

H. Should deviations beyond allowable clearances arise, request and follow ENGINEER's directive.

I. Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.

3.2 VALVES

A. Use pipe line sized valves except for control valves.

3.3 AIR VENTS

A. Install at high points of systems.

B. Install gate valve on automatic air vent inlet. Run discharge to nearest drain or service sink.

3.4 PRESSURE SAFETY RELIEF VALVES

A. Run discharge pipe to terminate above nearest drain.

END OF SECTION

SECTION 15185

HEATING PIPING AND FITTINGS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Materials and installation of steel piping valves, fittings for steam and condensate.

1.2 REFERENCES

A. American National Standards Institute (ANSI).

1. ANSI/ASME B16.1-98, Cast Iron Pipe Flanges and Flanged Fittings.
2. ANSI/ASME B16.25-97, Buttwelding Ends.
3. ANSI/ASME B16.3-98, Malleable Iron Threaded Fittings.
4. ANSI/ASME B16.5-03, Pipe Flanges and Flanged Fittings.
5. ANSI/ASME B16.9-01, Factory-Made Wrought Steel Buttwelding Fittings.
6. ANSI B18.2.1-03, Square and Hex Bolts and Screws (Inch Series).
7. ANSI/ASME B18.2.2-87 (R1999), Square and Hex Nuts (Inch Series).

B. American Water Works Association (AWWA).

1. AWWA C111-2000, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

C. American Society for Testing and Materials International (ASTM).

1. ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
2. ASTM A53/A53M-02, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
3. ASTM A126-95 (2001), Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

D. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.

1. MSS-SP-70-98, Cast Iron Gate Valves, Flanged and Threaded Ends.
2. MSS-SP-71-97, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS-SP-80-97, Bronze Gate, Globe, Angle and Check Valves.
4. MSS-SP-85-94, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

A. Submittals in accordance with Section 01300 - Submittals.

PART 2 – PRODUCTS

2.1 PIPE

A. Steel pipe: to ASTM A53/A53M, Grade B, as follows:

1. Heating Water;

a. To NPS 6: Standard thickness.

2. Natural Gas:

a. To NPS 6: Standard thickness.

2.2 PIPE JOINTS

A. NPS 2 and under: screwed fittings with PTFE tape.

B. Flanges: plain or raised face. Flange gaskets to AWWA C111.

C. Pipe thread: taper.

D. Bolts and nuts: stainless steell, to ANSI/ASME B18.2.1 and ANSI/ASME B18.2.2.

E. Buttwelding ends: to ANSI/ASME B16.25.

2.3 FITTINGS

A. Pipe flanges: cast-iron to ANSI/ASME B16.1, Class 125.

B. Screwed fittings: malleable iron to ANSI/ASME B16.3, Class 150.

C. Steel pipe gaskets, flanges and flanged fittings: to ANSI/ASME B16.5.

D. Buttwelding fittings: steel to ANSI/ASME B16.9.

E. Unions: malleable iron, to ASTM A47/A47M and ANSI/ASME B16.3.

PART 3 – EXECUTION

3.1 PIPING

A. Install all pipes in locations as shown on the Drawings. Make deviations from these locations only after written approval from the ENGINEER. Obtain approval from the ENGINEER for location of piping not specifically shown on Drawings.

B. Install all piping in neat, parallel lines with valves located in accessible position where possible.

C. Connect branch lines into top of mains.

D. Install piping in direction of flow with slopes as follows, unless otherwise indicated:

1. Heating Water Pipes: 1:70.

E. Slope the gas piping towards low points or riser, low point drips shall have TEE and nipple cap.

F. All gas piping installation shall conform to the latest edition of the Gas Code.

G. All connection to equipment shall be by flanges or union.

H. Make provision for thermal expansion as indicated.

I. Drip pocket: line size.

J. Leave manufacturer's tags and labels showing the origin and grade of the goods until inspection is made. Thoroughly clean all piping systems upon completion of the installation.

K. All piping systems to have anchorage, sway braces, guides and supports satisfactory to the ENGINEER. Design all supporting equipment with the exception of springs with a minimum safety factor of 5, based on the ultimate tensile strength of the material. Base design of hangers or supports on the weight of the pipe, the weight of the medium transported, or the medium used for testing, whichever is heavier, and the weight of the insulation if used.

L. Suspend pipe to prevent an excessive stress, excessive variation in supporting force, and possible resonance with imposed vibrations while the system is in operation. Install supports for all pipelines so as not to constrain the piping to such an extent as to cause excessive transfer of load from support to piping, or from support to support. Rigid or spring type supports to be capable of taking the entire piping load imposed, including expansion or contraction.

M. Hanger rods and fastening hardware to be stainless steel unless noted otherwise.

N. At hangers where lateral and axial movement is allowed, provide hanger rods with welded or forged eye nuts or suitable sockets to permit movement without bending hanger rod.

O. Fit pipe hangers and rods with an adjusting nut or turn buckle and lock nut to allow for adjustment after erection while still under load. Screw adjustment to have a complete depth of thread.

P. Locate hangers and supports so that the piping is supported independently of valves and equipment to allow for removal of one without disturbing the other and to prevent imposing loads from one to the other.

Q. All ferrous metal hangers and supports to receive one field coat of primer paint prior to installation.

R. Make fabricated metal pipe supports from new, rust free material free from burrs, slag and cutting marks. Round all edges and corners.

3.2 HANGERS AND SUPPORTS

A. Horizontal piping shall be supported as close as practical to the connected equipment and intermediate hangers are to be spaced as follows:

Pipe Size (inches)	Rod Dia. (inches)	Maximum Spacing (Ft)	
		Copper	Steel
Up to ¾	3/8	5	6
1-1¼	3/8	5	8
1½-2	3/8	10	10
2½ and 3	1/2	10	12
4	5/8	10	15
6	3/4	10	17

3.3 TESTING AND CLEANING

A. Provide all labour, materials and equipment to pressure test all piping; minimum of two hours test duration with no leakage in the presence of the ENGINEER; conduct test prior to application of pipe covering. Flush all pipe sediment, scale and other foreign matter prior to tests; remove all air from line during hydrostatic tests.

B. Remove all specialty fittings, equipment and similar items and internal parts of piping system which are not designed to withstand the test pressure and replace after testing.

C. Conduct pressure tests with cold water, except compressed air systems which shall be tested with air and chlorine gas piping which shall be tested with nitrogen.

D. Examine all parts of test section while under pressure. If test pressure is maintained with no pressure drop for specified test duration, test result is satisfactory.

E. Test pressure: 1-1/2 times maximum system operating pressure or 125 psi, whichever is greater.

F. If test result is not satisfactory, repair all deficient parts of section and retest until satisfactory result is obtained.

G. All pressure and leakage tests shall be carried out by the CONTRACTOR and the cost of all labour and materials required shall be borne by the CONTRACTOR.

H. Do not put system into operation until clearance has been given by the ENGINEER and Operating Authority.

END OF SECTION

SECTION 15250

MECHANICAL INSULATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work required under this section of the specifications shall consist of furnishing all material and performing all labor required for the thermal insulation of all hot water and cold water piping, potable and non-potable water lines, equipment and ductwork all as described in these specifications and/or as shown on the Drawings and/or as identified in the Insulation Schedule herein.

B. All items to be insulated shall be completely primed and painted per specification Section 09900 prior to insulating.

C. The work includes but not limited to:

1. Cold water and hot water lines.

2. Potable and Non-Potable water lines.

3. Intake and exhaust damper housings per drawing details.

4. Boiler exhaust stack

5. Do not insulate the following:

a. Exhaust air ducts.

b. Valve actuators or controllers.

6. All insulated items except for aluminum coverings shall receive the PVC jacket, with color to match the painting scheme.

1.2 DEFINITIONS

A. The term "concealed work" as used herein refers to piping and ductwork above suspended ceilings and within walls, partitions, shafts, concrete encasement or service spaces and not normally exposed to view.

B. The term "exposed work" refers to piping, ductwork or equipment normally exposed to view within rooms and open areas.

C. The term "Exterior work" refers to piping, ductwork or equipment normally exposed to view located outside exposed to weather.

1.3 SUBMITTALS

A. Submit shop drawings to ENGINEER for review and approval as set out in Division 1.

PART 2 - PRODUCTS

2.1 HOT AND COLD WATER, POTABLE AND NON-POTABLE WATER

A. Armaflex Insulation System:

1. Shall be insulated with Armacell Armaflex insulation, 1" thick and PVC jacket.

2. Flexible closed cell elastomeric pipe insulation, ASTM C534, conductivity of 0.27 at 75 degrees F, water vapor permeability of 0.10. Composite flame spread/smoke density of 25/50. With PVC jacket over all insulated surfaces. PVC jacket shall be 0.03" thick, 6,000psi tensile strength (ASTM D-638), passing ASTM-E84 25/50. All jacketing applied shall be factory formed and oven cured. Jacketing shall be continuous utilizing solvent weld jointing system. Each pipe shall be color coded. Colors shall be selected by the OWNER/ENGINEER at the submittal process

3. Apply Armaflex 520 BLV Adhesive to seal all seams and joints.

4. Installation shall be in accordance with manufacturer's published installation instructions and of the highest quality and finish appearance.

2.2 DUCTWORK INSULATION

A. Intake/Exhaust Damper Housings and Exhaust Fan Wall Boxes:

1. Provide 1" thick Styrofoam SM rigid insulation board of shapes and sizes to suit damper and wall box housing sizes. Aluminum sheet metal enclosures fabricated by Contractor shall enclose the insulation.

2. Refer to mechanical and/or general trades drawings for details including locations and sizes.

2.3 BOILER EXHAUST STACK

A. Boiler stack shall be insulated with pipe insulation, 3" thick including all fittings.

B. Insulation shall be covered with Aluminum Jacketing as specified below.

C. Installations shall be in accordance to the manufacturer recommendations and procedure.

2.4 MECHANICAL INSULATION SCHEDULE

A. All piping, valves, ductwork and tanks identified in the attached schedule to be insulated with the type of material as identified in the schedule. Refer back to the various items previously described in this section for required insulation thickness.

B. Any mechanical insulation omitted from the Schedule but shown on the Drawings shall be supplied and installed by the CONTRACTOR.

C. The CONTRACTOR shall not claim for any extra costs for mechanical insulation that have not been listed, but which are shown on the Drawings.

MECHANICAL INSULATION SCHEDULE

Description	Diameter Ranges (inch)	Insulation Type	Covering
Cold water piping, Potable & Non Potable Water piping, Process Piping, Valves	½" to 36"	Armaflex	PVC Jacket
Supply and Return Ductwork		Armaflex	Aluminium Jacket
Boiler Exhaust Stack	12" to 18"	Paragraph 2.9	Aluminium Jacket

2.5 JACKETS

A. Polyvinyl Chloride (PVC):

1. One-piece molded type with pre-formed shapes as required.
2. Minimum service temperatures: -4°F.
3. Maximum service temperature: 149°F.
4. Moisture vapor transmission: 0.02 perm.
5. Fastenings
   a. Use solvent weld adhesive compatible with insulation system to seal laps and joints.

B. Aluminum:

1. To ASTM B209.
2. Thickness: 1/50 inch sheet.
3. Joining: Longitudinal and circumferential slip joints with 2 inch laps.
4. Fittings: 1/50 inch thick die-shaped fitting covers with factory-attached protective liner.
5. Metal jacket banding and mechanical seals: stainless steel, ¾ inch wide, 1/50 inch thick at 12 inch spacing.

C. Finishes:

1. Exposed steam pipes in boiler room: Aluminum jacket.
2. Exposed condensate water in boiler room: Aluminum jacket.
3. Concealed, indoors: canvas on valves, fittings. No further finish.

4. Use vapor retarder jacket compatible with insulation.

5. Finish attachments: SS bands, at 6 inch oc. Seals: closed.

PART 3 - EXECUTION

3.1 WORKMANSHIP

A. Insulation shall be installed in a smooth, clean workmanlike manner. Joints shall be tight and finished smooth. Cracked or chipped sections shall not be used in the work.

B. All surfaces to be insulated shall be dry and free of loose scale, rust, dirt, oil or water when insulation is applied.

C. Insulation shall fit tightly against the surface to which applied to prevent air circulation between the insulation and the pipe, equipment or ductwork to which it is applied.

D. Insulation applied to piping, equipment and ductwork shall be completely vapor sealed, free of pin holes or other openings.

E. Do not apply seal or cement until previous applications of cement and adhesives have thoroughly dried.

F. Any existing insulation and surface finish disturbed or damaged during the course of the work shall be restored in a manner acceptable to the ENGINEER.

G. All insulated finish surfaces shall be neat and uniform with a high level of workmanship and shall be reviewed and accepted by the ENGINEER.

H. Defects and/or poor workmanship found by the ENGINEER shall be repaired or replaced to the satisfaction of the ENGINEER at no additional cost.

END OF SECTION

SECTION 15510

POOL HEATING BOILER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Providing and installing a complete and fully functioning boiler system and all related equipment.

B. Boiler manufacturer shall be the sole source of the boiler and all related equipment, accessories and guarantee a single source of responsibility.

1.2 REFERENCES

A. American Boiler Manufacturer's Association (ABMA)

B. American National Standards Institute (ANSI)

C. American Society of Mechanical Engineers (ASME)

D. Underwriter's Laboratories

E. National, State and City Regulations

1.3 SUBMITTALS

A. Submit shop drawings in accordance with Section 01330 - Submittal Procedures.

B. Shop drawings shall indicate the following:

1. General arrangement showing terminal points, instrumentation test connections.

2. Clearances for operation, maintenance, servicing, tube cleaning, tube replacement.

3. Foundations with loadings, anchor bolt arrangements.

4. Piping hook ups.

5. Equipment electrical drawings.

6. Burners and controls.

7. All miscellaneous equipment.

8. Flame safety control system.

9. Breeching and stack configuration.

10. Emission and noise data.

C. Engineering data to include:

1. Boiler efficiency at 25%, 50%, 75%, 100% of design capacity.

2. Radiant heat loss at 100% design capacity.

D. Closeout submittals:

1. Submit operation and maintenance manuals.

1.4 CLARIFICATIONS

A. Manufacturer's Certification: The boiler manufacturer shall certify the following:

1. The products and systems furnished are in strict compliance with the specifications.

2. The boiler, burner, and all associated mechanical and electrical equipment have been properly coordinated and integrated to provide a complete and operable boiler package.

3. The boiler, burner and all associated mechanical and electrical equipment materials of construction have been properly selected for corrosion-free service life.

4. ASME Certification.

5. ASME CSD-1 Certification.

6. UL Certification.

7. The specified factory tests have been satisfactorily performed.

8. The specified field tests have been satisfactorily performed.

B. CONTRACTOR's Certification: The CONTRACTOR shall certify the following:

1. The products and systems installed are in strict compliance with the specifications and manufacturer’s recommendations.

2. The specified field tests have been satisfactorily performed.

C. Boiler Inspectors' Certification: All boiler inspections during hydrostatic testing shall be performed by an authorized boiler inspector who is certified by the National Board of Boiler and Pressure Vessel Inspectors and shall be submitted in writing prior to final acceptance by the ENGINEER.

D. Operation and Maintenance Manuals: Manufacturer's printed operation and maintenance manuals shall be submitted prior to final acceptance by the ENGINEER. Operation and maintenance manuals shall contain shop drawings, product data, operating instructions, cleaning procedures, replacement parts list, maintenance and repair data, complete parts list, etc.

1.5 DELIVERY, STORAGE AND HANDLING

A. The CONTRACTOR shall be responsible for the timely delivery of the equipment to the jobsite. The CONTRACTOR shall be responsible for the unloading and rigging of the equipment. The CONTRACTOR shall be responsible for protecting the equipment from the weather, humidity and temperature conditions, dirt, dust, other contaminants, as well as jobsite conditions during construction.

B. Equipment shall be unloaded, handled, and stored in accordance with the manufacturer's handling and storage instructions.

C. Equipment shall not be stored outside, tarped or untarped.

1.6 MAINTENANCE

A. Provide maintenance materials to include:

1. Special tools for burners, manholes, handholes and Operation and Maintenance.

2. Spare parts for 2 years of operation.

3. Spare gaskets.

4. Spare gauge glass inserts.

5. Probes and sealants for electronic indication.

5. One (1) additional neutralizer.

PART 2 - PRODUCTS

2.1 GENERAL

A. Packaged boiler:

1. Complete with burner, complete gas trains, valves, controls, boiler trim, refractory, all factory assembled and tested prior to shipping. Boiler shall be furnished with necessary accessories and controls.

2. Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance.

3. Ready for attachment to piping, electrical power, controls, flue gases exhaust.

4. Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.

5. Boiler/burner package to bear UL label.

6. The boiler design and operation shall conform to all the Occupation Health and Safety regulations.

7. Boiler shall be furnished with the necessary pressure reducing valves for gas and regulators to comply with all regulations.

8. Boiler shall be Lochinvar Copper Fin2, gas fired pool heating boiler Model CPN1802-M9.

B. Performance:

1. In accordance with American Boiler Manufacturers Association (ABMA).

2. The pool heating boiler shall be rated for 1,602 MBH Output, and 1,800 MBH Input.

3. Boiler efficiency: 89 %

C. Electrical:

1. Controls: 120 V, 1 phase, 60Hz.

2. Electrical components: UL approved.

3. Controls: factory wired. Enclosed in NEMA12 with gasket cabinet.

2.2 POOL HEATING BOILER

A. Boiler

1. The water containing section shall be of a "Fin Tube" design, with straight copper tubes having extruded integral fins spaced seven (7) fins per inch. The tubes shall terminate into a one piece, lined, cast iron header. There shall be no bolts, gaskets or "O" rings in the head configuration. There shall be access to the front header of the heat exchanger for the purposes of inspection, cleaning or repair. The heat exchanger shall be mounted in a stress free jacket assembly in order to provide a "free floating design" able to withstand the effects of thermal shock. The boiler shall bear the ASME "HLW" stamp for 160 psi working pressure and shall be National Board listed. The complete heat exchanger assembly shall carry a five (5) year warranty.

   The combustion chamber shall be sealed and completely enclosed with Loch Heat™ ceramic fiberboard insulation. A burner/flame observation port shall be provided on each end of the unit. The burners shall be constructed of a high temperature stainless steel and fire on a horizontal plane. The boiler shall have a multi-speed combustion air blower to precisely control the fuel/air mixture for maximum efficiency.

   The boiler shall be certified and listed by CSA International under the latest edition of the appropriate ANSI test standard. The boiler shall comply with the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard. The boiler shall operate at a thermal efficiency of up to 89%.

   The boiler shall be furnished with a factory supplied pumped by pass assembly to ensure proper operation without condensation. The bypass assembly shall include a sealed all bronze pump suitable for outdoor installation. The bypass assembly shall be constructed of schedule 80 CPVC piping ith brass inserts and an automatic three-way valve to protect the unit against inlet water temperatures that would cause the heat exchanger to condense. Instructions for proper setup and operation of the bypass will be supplied with the boiler.

B. Controls

1. The boiler shall be equipped with an Electronic Integrated Control Module with a microprocessor-based platform incorporating software customized for operation of the Lochinvar Copper-Fin II. All internal safety, operating and ignition controls shall be included in the electronic integrated control module. The electronic integrated control module shall provide on/off control of the gas supply to the burner, operation of the combustion air blower, ignition of the gas-air mixture, flame proving, control of water temperature set points, and monitoring of all safety functions. Modbus protocol (optional).

   The boiler shall feature the “Smart System” control with a 2-line, 16 character LCD display, password security, pump delay with freeze protection, pump exercise and PC port connection. The boiler shall allow 0-10 VDC input connection for BMS control and have built-in “Cascade” to sequence and rotate while maintaining stage firing of up to eight boilers without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.

   Local communication, programming and a display of operating and alarm status conditions shall be accessible through the Smart System control panel. The Smart System control panel shall contain an on/off main power switch, a digital display of a temperature functions, the operational status of the boiler, or an active alarm fault. Data points visible in the digital display include inlet water temperature, outlet water temperature, water temperature differential, percent firing rate, setpoint temperatures, setpoint differential, minimum temperature, maximum temperature and maximum reset temperature. Operational status shall be displayed for Off, Standby, Pre-purge, Ignition, Pool and/or Spa Water Heating, and Post-purge. Fault status shall be provided for high limit, gas pressure (optional), low water, blocked drain, louver proving, and air pressure switch status.

   The standard operating control system shall include redundant proven pilot Hot Surface Ignition with full flame monitoring capability. Multiple main gas valves with redundant valve seats and built in low gas pressure regulators shall be supplied as standard. Gas valves will be referenced to the combustion chamber to ensure proper air/gas mixture for efficient combustion.

   Additional standard controls shall include a water pressure switch, blocked flue pressure switch, low air pressure switch for each fan, low voltage transformer for the control circuit, 7 amp circuit breaker for 24 VAC control circuit, ASME temperature and pressure relief valve and flow switch. The manufacturer shall verify proper operation of the burners, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping. A quality test report shall be shipped with each unit.

   A 24 VAC control circuit and components shall be used. All components shall be easily accessed and serviceable. All components shall have multi pin plug in type connectors to ease service, troubleshooting and lower removal and replacement cost.

   Provide and install pool return sensors on upstream and downstream of the pool heater pipe.

C. Venting

The boiler shall be provided with manufacturer supplied Direct Vent kits. The venting system shall be approved for DirectAire Vertical vent with Sidewall Air Inlet. Venting shall be classified Category I, negative draft, non-condensing, to use type "B" double wall venting materials. Direct Vent installation requires the use of AL29-4C stainless steel vent material. Follow all manufacturers' installation requirements.

D. Warranty

1. The package boiler shall be warranted for a period of one year from date of OWNER accepted start-up.

2.3 AUXILIARIES

A. Provide for each boiler and to meet ANSI/ASME requirements.

2.9 WARRANTY

A. The boiler shall be covered by a One year parts and labor warranty, for the first year of operation.

B. Boiler manufacturer will repair or replace, at its discretion, boiler pressure vessel which is found to be defective, in workmanship, or material within seven years from date of shipment from the factory, provided said pressure vessel has been operated in accordance with conditions of service outlined by the boiler manufacturer's Installation operation manual and directions.

C. Copper heat exchangers shall be warranted for 5 years against tube leakage from date of shipment.

2.10 MANUFACTURER'S ACCEPTANCE

A. Listing of specific manufacturers above does not imply acceptance of their products that do not meet the specific ratings, features and functions. Manufacturers listed shall meet these specifications entirely. Products in compliance with the specification and manufactured by others but not named will only be considered if pre-approved by the ENGINEER.

B. The use of any other manufacturer other than the equipment used in the drawings and specifications, shall not qualify the CONTRACTOR for any additional work, materials or time.

C. The CONTRACTOR shall be responsible for any modifications or changes to the existing design in case the CONTRACTOR uses different equipment manufacturers.

2.11 ACCEPTABLE MANUFACTURERS

A. Lochinvar Copper Fin2, gas fired pool heating boiler Model CPN1802-M9.

2.12 BOILER START-UP

A. Manufacturer representative shall inspect and confirm the installation as per their recommendations prior to commissioning.

B. CONTRACTOR shall inform the ENGINEER, in writing, as the manufacturer's representative complete the inspection and review of boiler installations.

C. All requirements of Division 1 shall apply.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations having jurisdiction, except where specified otherwise, and manufacturers recommendations.

B. Make required piping connections to inlets and outlets recommended by boiler manufacturer.

C. Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.

D. Pipe hot water relief valves full size to nearest drain.

E. Natural gas fired installations

3.2 MOUNTINGS AND ACCESSORIES

A. Safety valves and relief valves:

1. Run separate discharge from each valve.

2. Terminate discharge pipe as indicated.

3. Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

3.3 COMMISSIONING

A. Manufacturer to:

1. Certify installation.

2. Start up and commission installation.

3. Carry out on site performance verification tests.

4. Demonstrate operation and maintenance.

5. Provide Training (min. 4 hours).

B. Provide ENGINEER at least 24 h notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

C. All requirements of Division 1 shall apply.

END OF SECTION

SECTION 15861

FANS

PART 1 - GENERAL

1.1 SCOPE OF THE WORK

A. The work required under this Section of the Specifications shall consist of furnishing all labor, materials, tools, equipment and services to perform all operations in connection with Fans to the full extent of the Drawings and Specifications.

B. The principal items of work are as follows:

1. Work consists of all fans and specialties shown on the drawings, specified or required to complete the building as shown. The work includes providing the equipment and services for the supply and installation of the exhaust fans specified hereinafter.

2. All fans shall be provided with chemical and corrosion resistant coating suitable for the environment – Pool Chemicals. All fasteners and mounting accessories shall be stainless steel.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Section 15990: Testing, Balancing and Controls

PART 2 - PRODUCTS

2.1 FANS - GENERAL

A. Fans shall be of the models, sizes and capacities shown on the Schedule herein and/or on the drawings and installed in the location shown on the contract drawings.

B. Construct fans in strict accordance with the standards of AMCA and rated in full conformance with the "Standard Test Code for Centrifugal and Axial Fans", (latest edition) approved jointly by the ASHRAE and the AMCA.

C. Classification for Spark Resistant construction levels A, B, and C shall conform to AMCA 99.

D. Comply with National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories.

E. Shop drawings to include complete information on fan construction and performance, including certified performance curves and sound criteria.

F. The ENGINEER reserves the right to reject any fan whose noise level data appears objectionable for the particular application and to reject after installation any fan whose noise levels exceed that indicated by the data submitted with shop drawings. Failure to submit such data does not release the manufacturer of this liability.

G. Unless otherwise specified or shown on the Drawings, equip fans with heavy duty grease lubricated ball or roller bearings with ample thrust provision to prevent end play during the normal life of the bearing. Bearings are to be designed for minimum 200,000 hr. life. All fans to have extended grease and lubricating lines to exterior of fan casings or housings.

H. All exhaust fans shall have an enameled weather resistant finish compatible with the aluminum construction and as recommended by the manufacturer.

2.2 ROOF EXHAUST FAN:

A. Spun aluminum exhaust fans shall be belt drive type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure and a corrosion resistant bird screen. Roof curb to be supplied and installed with the fan.

B. Motors shall be heavy duty ball bearing type to match the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the air stream. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors and drives shall be readily accessible for maintenance.

C. Motor pulleys shall be adjustable for final system balancing. A disconnect switch shall be factory installed and wired from the fan motor to a junction box installed within the motor compartment. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.

D. All fans shall be provided with chemical and corrosion resistant coating suitable for the environment – Pool Chemicals. All fasteners and mounting accessories shall be stainless steel.

E. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

F. All components to be of same manufacturer unless specified or approved otherwise.

G. Manufacturer:

1. Design basis on Greenheck.

2. Acceptable alternate manufacturers are Hartzell, or Cook.

2.3 EXHAUST FAN SCHEDULE:

A. Refer to contract drawings for Exhaust Fan Schedule including fan selection and design criteria.

PART 3 - EXECUTION

A. Install fans of the capacities and sizes shown in the locations shown on the schedules on the contract drawings, and install in the location shown on the contract drawings.

B. Fans shall be installed with vibration isolators as recommended by the manufacturer as approved by the ENGINEER.

C. Install flexible duct connections where indicated on the contract drawings between the fan and the main duct connected to the fan.

D. Install fan per detail as shown on the contract drawings.

E. Connect duct from inside the building to the fan

F. Provide spare belt for each belt driven fan.

END OF SECTION

SECTION 15990

MECHANICAL TESTING AND BALANCING

PART 1 – GENERAL

1.1. DESCRIPTION

A. This section specifies the testing and balancing requirements concerning air and hydronic systems.

1.2. RELATED DOCUMENTS

A. General and Supplementary Conditions and requirements of Division 1 apply to Work of this Section.

B. Related work specified in other Division 15 Sections:

1. 15010 – Mechanical Basic Materials and Methods

2. 15510 – Pool Heating Boiler

3. 15861 – Fans

1.3. INTENT

A. The intent of this section is to call for finished work, tested and ready for operation.

B. Furnish all materials, supplies, equipment, tools, transportation and facilities, and perform all labor and services necessary for the complete testing and balancing of the mechanical air and hydronic systems as shown on the Drawings, as herein specified, and as required to make complete and operating systems.

C. The work shall also include the completion of such details of mechanical work not mentioned or specifically shown, but which are necessary for the successful operation of all mechanical systems.

D. Adjust and balance the following mechanical systems:

1. Supply air systems

2. Exhaust air systems

E. Conduct the following mechanical systems testing:

1. Sound testing

2. Vibration testing

3. Verification of temperature control system operation

4. Duct leakage testing

F. Air Balancing shall include as a minimum all devices for which a CFM is indicated in the plans, schedules or specifications.

G. Testing, Adjusting and Balancing Reports, as detailed in Part 3.

1.4. QUALITY ASSURANCE

A. The CONTRACTOR shall obtain the services of an independent Test and Balance Contractor. Air and water balancing and testing shall be done by the same Test and Balance Contractor.

B. Testing and balancing shall be performed in accordance with standards of either AABC ("National Standards for Field Measurement and Instrumentation - Total System Balance", Current Volume and Supplements,) or NEBB ("Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems").

C. Testing and Balancing Contractor shall be a current member in good standing of AABC, NEBB and SMACNA.

1.5. SEQUENCING AND SCHEDULING

A. Where performance testing is specified, equipment and systems must be tested under conditions that are near design conditions. Various components and systems shall be tested in summer or winter design conditions to accurately reflect specified conditions.

1.6. WARRANTY

A. For a period of 90 days after the acceptance of the balancing report, the balancing subcontractor shall recheck or reset any part of any system to meet the OWNER's needs, where these variations are within the capabilities of the equipment.

PART 2 – PRODUCTS

Not used in this section.

PART 3 – EXECUTION

3.1 PREPARATION

A. Testing and Balancing (TAB) Contractor shall meet with Mechanical Contractor during early phase of construction to point out location of taps and dampers to allow TAB Contractor to conduct tests.

B. Phased Construction: Coordinate TAB procedures with any phased construction requirements for the project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of the project may require balancing for each phase prior to final balancing.

3.2 TESTING AND BALANCING - GENERAL REQUIREMENTS

A. Conduct final TAB after system has been completed and is in full working order. Prior to completing balancing, inspect and test systems and components to verify proper installation and operation, including but not limited to:

1. Verify motor and equipment rotation, lubrication and alignment.

2. Align belts and pulleys. Adjust tension.

3. Check operation of all automatic dampers.

4. Check position of dampers.

B. In cooperation with other CONTRACTORS, correct deficiencies.

C. Field testing and balancing shall be performed under the direct supervision of journeyman technician.

D. TAB Contractor shall report all deficiencies discovered in work by other trades that result in flow rate inadequacies or elevated noise.

E. Immediately notify the ENGINEER when any deficiencies are detected, whether associated with design, installation or equipment.

F. TAB Contractor shall provide all required tools and equipment necessary to perform TAB services. Take measurements with certified and calibrated devices. Do not rely on field installed sensors and gauges.

G. Measure motor and equipment speed (RPM) with strobe tachometer. Record full load and part load slippage, and calculate motor brakehorsepower (BHP) using BHP = nameplate HP x (part load slip / full load slip).

3.3 AIR BALANCING - GENERAL REQUIREMENTS

A. Place systems in operation with filters installed and control systems complete and operating. Balance systems to design ratings. Adjust each air terminal unit, inlet and outlet within plus or minus 10 percent of design requirements, but total air for each system shall be not less than shown.

B. Check flow rates for all factory set air terminal units and reset if not correct.

C. Adjust fan speeds by adjusting or replacing sheaves and belts. If required, Mechanical Contractor shall furnish new sheaves and belts, for installation by TAB Contractor. V-belt drives, including fixed pitch requirements.

D. Set supply fan static pressure as low as practicable while maintaining required pressure at the most aerodynamically remote terminal units.

E. Record pressure drop readings across all major system components and significant drops within duct systems.

F. Label all diffusers, registers and grilles with clear plastic adhesive labels indicating number and outlet number corresponding to the balance report.

3.4 AIR BALANCING - CONSTANT VOLUME SYSTEMS

A. Balance system to achieve design system flow with filter artificially loaded at the midpoint between clean and dirty condition.

B. Adjust fan speed to minimize wasted horsepower and noise at throttled balancing dampers.

3.5 AIR BALANCING - AIR HANDLING EQUIPMENT AND SYSTEMS

A. Test air handling units, exhaust and return fans, and associated automatic dampers in all modes of operation. Determine the most restrictive operating mode and balance systems in this mode.

B. In addition to values listed in ASHRAE Standard 111-1988, the following shall also be measured and reported.

1. Minimum and maximum outdoor air quantities. (Include setting minimum outside air.)

2. Power factor or watts for motors larger than 10 HP.

3. Component pressure drops.

C. Record actual motor amps, volts, and rpm, and fan flow, static pressure and rpm.

D. Check all equipment motors, belts, drives, bearings, filters.

E. Check supply and return fan tracking to assure compliance with design requirements.

F. For new air handing units and above ceiling fan coil units: Test cooling coil condensate drain and trap performance. Artificially load filters to simulate dirty filter conditions. Verify drain pan does not overflow, and air does not blow by trap.

3.6 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements for all rotating equipment, including compressors, pumps, fans and motors.

B. Inspect vibration isolation system and alignment and report deficiencies.

C. Allowable Vibration Tolerances: Self-excited, vibration maximum velocity shall not exceed the following limits, measured in inches per second RMS (not in mils peak to peak), filter in. Measure vibration at bearing caps of machine in vertical, horizontal and axial directions or at equipment mounting feet if bearings are concealed.

1. Except where noted otherwise: 0.20

2. Pumps: 0.13

3. Fans: 0.09

D. For variable speed equipment, inspect at full range of speeds. Test at full speed and intermediate speed that indicate possible harmonic vibrations.

E. Include in the report a summary sheet indicating pass/fail for each unit. For each unit of equipment, record detailed initial measurements, corrections made, retest measurements, and suggested course of action for equipment that still fails limits after CONTRACTOR correction.

3.7 COMPLETION SERVICES

A. Final Check: Make final checks and do any testing as directed.

B. Acceptance: Final acceptance of the project will not be made until a satisfactory report is received. OWNER reserves the right to spot check the report by field verification prior to final acceptance.

3.8 CERTIFIED TEST REPORT

A. For each system tested, provide a certification testifying that the system has satisfactorily tested measurements required under previous sections of this specification:

B. General

1. Date tested.

2. Measurements and checks used to ensure accuracy of data obtained and that tolerances were met.

3. Media used for testing, calibration and certification dates.

4. Performance data sheets shall be furnished for all equipment including curves and operating information.

5. List of necessary repairs made before system passed the test.

6. Methods or formulas and references used for correcting measured readings.

7. Report shall include table of contents, index, tests, results, summary and comments.

8. Final report shall include a one line diagram of each measured air and water system with equipment nomenclature as defined in construction documents. Correlate all devices to the balance report.

9. Submit one copy of balancing report to the OWNER.

C. Air System Data: Include for each air-handling system the data listed below:

1. Equipment:

a. Installation data:

1) Identification number.

2) Manufacturer and model.

3) Size.

4) Service.

5) Arrangement, discharge and class.

6) Motor hp, rated voltage, phase, cycles and rated full load amps.

7) Full load amperes.

8) Location and local identification data.

b. Design data: Data listed in schedules on Drawings and Specifications or submittals.

c. Fan recorded (test) data:

1) CFM

2) Static pressure: Suction, discharge, total.

3) Fan rpm.

4) Motor rpm.

5) Motor sheave diameter: adjustable or solid.

6) Fan sheave diameter.

7) Outlet velocity.

8) Motor operating amperes.

9) Motor operating BHP.

10) Actual voltage.

2. Duct system:

a. Duct air quantities-main, submains, branches, outside air, total supply air, return and exhaust:

1) Duct size(s).

2) Number of pitot tube (pressure) measurements.

3) Sum of velocity measurement, excluding pressure measurement.

4) Average velocity.

5) Recorded (test) CFM and FPM.

6) Design CFM and FPM.

7) Outside air minimum and maximum CFM, design and test valves.

b. Individual air terminals:

1) Terminal identification (supply, return or exhaust, location and number designation).

2) Type, size, manufacturer and catalog identification.

3) Design and recorded quantities-CFM, including minimum and maximum air flows even when factory calibrated.

4) Deflector vane or diffusion cone settings.

5) Applicable factor for application, velocity, area, etc.

6) Design and recorded velocities-FPM (state “core”, “inlet”, etc., as applicable).

3. Filter and coil data as specified; scheduled on Drawings or as required.

D. Room temperatures.

E. Water System Data:

1. Flow devices including control valves:

a. Service.

b. Locations.

c. Size.

d. Required GPM.

e. Measured pressure difference.

f. Resultant actual GPM from venturi curves.

2. Air heating and cooling equipment:

a. Recorded data:

1) Type of equipment and identification (location or number designation).

2) Entering and leaving air conditions (DB and WB).

3) Entering and leaving water temperatures.

4) GPM, including flow thru bypass leg, where applicable.

5) Temperature rise or drop.

6) Water and air pressure drop.

F. Vibration Testing

1. Measured vibration.

2. Corrective measures taken.

3.9 ADJUSTMENT TOLERANCE

A. Establish an Adjustment Tolerance Schedule with permissible tolerances as follows:

1.	Supply, return and exhaust fans	+5% to 10%
2.	Diffusers and supply grilles	0% to +10%
3.	Return and exhaust grilles	0% to -10%
4.	Heating and cooling GPM	0% to -10%

3.10 ACCEPTABLE T&B CONTRACTORS

A. Airflow Testing, Inc.

B. Absolut Balancing Co., Inc.

C. Enviro Aire Total Balance Co.

D. OWNER approved equal.

END OF SECTION

SECTION 16010

ELECTRICAL SYSTEM GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Related Sections

B. Work Included

C. Codes and Standards

D. Drawings

E. Submittals

F. Permits, Fees and Inspections

G. Record Drawings

H. Operation and Maintenance Manuals

I. Site Examination

J. Utilities

K. Temporary Power

L. Storage at Site

M. Equipment and Materials

N. Grounding and Bonding

O. Workmanship and Completion of Installation

P. Cutting and Patching

Q. Coordination

R. HVAC Equipment Wiring and Control

S. Miscellaneous

1.2 RELATED SECTIONS

A. The requirements set out in the contract documents, contract forms, general conditions, supplementary general conditions and general requirements apply to all work specified herein.

1.3 WORK INCLUDED

A. Refer to the entire set of contract documents to become familiar with the project. CONTRACTOR is responsible for all equipment mounting, conduit routing and incidental work which may be necessary because of construction requirements, whether or not they are shown on the electrical drawings.

B. The CONTRACTOR shall furnish all materials, labor, transportation, tools, permits, fees and incidentals necessary for the installation of a complete electrical system.

C. It is the intent of the contract documents to provide an installation complete in every respect. In the event that additional details or special construction are required for work indicated or specified, it shall be the responsibility of the CONTRACTOR to provide all materials and equipment which are usually furnished with such systems in order to complete the installation, whether mentioned or not.

1.4 CODES AND STANDARDS

A. Codes and Standards: this Division of Specifications contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this Division and those of the listed documents, the requirements of this section shall prevail.

1. All work shall be in compliance with all applicable portions of the edition recognized by the Authority Having Jurisdiction (AHJ) of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and all city and county codes and ordinances, which may or may not be specifically referenced in these contract documents. None of the terms or provisions of these contract documents shall be construed as waiving any of the rules, regulations or requirements of these authorities.

2. NEMA, National Electrical Manufacturers Association

3. UL, Underwriters' Laboratories

4. ANSI, American National Standards Institute (ANSI).

5. NEC, ANSI/NFPA 70 National Electrical Code

6. IEEE, Institute of Electrical and Electronics ENGINEERS

7. ICEA S-68-516/NEMA WC-8 Ethylene-Propylene Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

8. AEIC CS-6 Specifications for Ethylene Propylene Rubber Insulated Shielded Power Cables Rated 5 through 69KV.

9. UL 1072 Medium-Voltage Power Cables.

10. IEEE 48 Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Termination.

11. IEEE C2 National Electrical Safety Code

B. In any instance where these contract documents call for construction materials of a better quality or larger size than required by the codes, the provisions of the contract documents shall take precedence. The codes shall govern where violations are indicated in the construction documents. In any instance where there is a conflict between the drawings and specifications, the larger size, higher quantity or better quality shall be provided, unless the OWNER's Representative directs otherwise.

1.5 DRAWINGS

A. The accompanying drawings are intended to show the general arrangement and extent of the work. The exact location and arrangement of all parts shall be determined as the work progresses to conform in the best possible manner with the surroundings and as directed by the OWNER and/or ENGINEER.

B. If any departures from the drawings are deemed necessary by the CONTRACTOR, details of such departures and the reasons therefore shall be submitted to the OWNER's Representative for review. No departures shall be made without prior written acceptance of the OWNER and/or ENGINEER.

C. Figured dimensions shall be followed without reference to scale. Where dimensions are not shown, measurements shall be scaled.

D. The Electrical Drawings and Specifications are complementary to each other and each form part of this contract. In the event of discrepancies between the drawings and specifications, the Project ENGINEER shall be contacted for a written clarification prior to tender closing. Misinterpretation of any requirements of either the drawings or specifications will not relieve the Contractor of responsibility to complete the work.

1.6 SUBMITTALS

Shop drawings for all electrical equipment shall be provided as specified in Division 1.

1.7 PERMITS, FEES AND INSPECTIONS

A. Obtain and pay for all permits and fees required for the execution and inspection of the electrical work and pay all charges incidental to such permits.

B. Bid price shall include all fees related to the approval and inspection of electrical work.

C. Notify the Project ENGINEER of all changes required by the Electrical Inspection Department prior to making changes.

D. Arrange and pay for any special inspection of equipment specified, if and when required.

E. Provide Certificates of Acceptance from all authorities having jurisdiction including the Electrical Inspection Department on completion of work and include them in the operating manuals.

F. The Electrical CONTRACTOR shall notify the Consultant when the final inspections can be performed. Defects of deficiencies found during this inspection shall be corrected to the satisfaction of the Consultant before final payment is made.

1.8 RECORD DRAWINGS

A. The CONTRACTOR shall maintain a set of electrical record drawings at the job site neatly marked with all changes from the original contract drawings, in accordance with Section 01780, Closeout submittals.

1.9 OPERATION AND MAINTENANCE MANUALS

A. The CONTRACTOR shall furnish of operation and maintenance manuals to the OWNER and and/or ENGINEER per the requirements of Section 01781, Operation and Maintenance Data.

1.10 SITE EXAMINATION

A. The CONTRACTOR shall be responsible for the coordination and proper relation of his work to the building structure and to the work of all trades. The CONTRACTOR shall visit the premises and thoroughly familiarize himself with all details of the work and working conditions, and verify all dimensions in the field. The CONTRACTOR shall advise the OWNER's Representative of any discrepancy at least seven days prior to bidding. The submission of bids shall be deemed evidence of the CONTRACTOR's site visit, the coordination of all existing conditions and the inclusion of all considerations for existing conditions.

1.11 UTILITIES

A. The contract documents reflect the general location, voltage, capacity, size and manner of routing for all utilities known to be required on this project. It shall be the responsibility of the CONTRACTOR to visit the site and to meet with the local utility companies in order to coordinate and confirm the exact requirements for all electrical utilities, including, but not limited to, all facilities required to provide complete and operative electrical power and telephone services. The bid submitted by the CONTRACTOR shall include costs for all such coordinative work as well as any and all utility company charges and/or fees.

1.12 TEMPORARY POWER

A. The CONTRACTOR shall coordinate with the OWNER, and other trades involved, the requirements for temporary power on this project. No additional charges shall be made to the OWNER for wiring, connections, poles, fixtures or devices required to facilitate construction.

B. The CONTRACTOR shall provide the necessary wiring, connections, service switches, poles, wiring protective devices, lighting fixtures, lamps, outlet devices, disconnect switches, etc., as required for temporary lighting. In addition, a similar system shall be provided for the distribution of single- and three-phase power of voltage levels and adequate ampacity as required to facilitate the construction of the project. These services shall be installed in accordance with requirements of the NEC and OSHA.

1.13 STORAGE AT SITE

A. The CONTRACTOR shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust and physical damage.

B. Store major electrical equipment (switchboards, panelboards, lighting fixtures, dry type transformers, VFDs, etc.) sealed in original factory wrapping in a clean, dry and conditioned environment protected from the weather. Storage outdoors is not acceptable.

C. Ship equipment in accordance with manufacturer's instructions or in upright position.

D. Ship channel bases and anchor stencils ahead of equipment.

E. Block moving parts where necessary to prevent damage during shipping and handling of equipment. Clearly and conspicuously display instructions to remove blocking before putting equipment into service.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. All materials shall be new and of high quality. All materials of a type for which the Underwriters' Laboratories, Inc. (UL) has established a standard shall be listed by UL and shall bear the UL label.

B. Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

C. Verify, before energizing, that equipment supplied under this contract or by the OWNER is compatible with the related electrical power supply system.

D. No variations from the drawings or specifications will be permitted without a written authorization from the Consultant.

E. Products and materials called for on the drawings or in the specifications by trade names, manufacturer's name and catalogue reference are those that are to be used as the basis for the Tender.

F. The ENGINEER will only consider alternate products and materials to those specified if they are shown in the Bid as a material variation and if they are submitted with an appropriate price adjustment. The ENGINEER will reserve the right to accept or reject any alternative without explanation.

G. The alternate submission shall provide sufficient information to enable the ENGINEER to determine whether the alternate is acceptable or unacceptable. Provide complete information on required revisions to other work and products to accommodate each alternate product.

H. The CONTRACTOR assumes full responsibility when providing alternative products or materials that all space, weight, connections, power and wiring requirements etc. are considered and compensated for. Any costs incurred for additional components, changes to other services, structural or space requirements, layouts and plans, etc. that may arise from the use of the alternate shall be borne by the CONTRACTOR.

I. Unless otherwise indicated, supply equipment enclosures, boxes, electrical materials and products suitable for ambient environment of the following areas. Provide NEMA 4X (stainless steel) material.

J. Equipment identification shall be provided on all electrical equipment. CONTRACTOR to provide sample labels for approval prior to printing and affixing on the equipment. Supplier nameplates and labels shall be clearly visible and legible after equipment installation and field painting.

2.2 GROUNDING AND BONDING

A. Provide all equipment bonding as required regardless whether it has been shown on the drawings or called for in this specification.

B. Arrange grounds so that under normal operating conditions no injurious amount of current will flow in any bonding conductor.

C. Include a separate bonding wire to all devices that are rewired and to all new devices. The conduit raceway system is not to be used as the sole bonding path.

PART 3 - EXECUTION

3.1 WORKMANSHIP AND COMPLETION OF INSTALLATION

A. All electrical work described within this specification and on the project drawings shall be carried out by qualified, licensed electricians or apprentices, skilled in their trade, as per the conditions of the Local Act respecting manpower vocational training and qualification. Registered apprentices shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks. The activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties. All works shall be executed in a thorough and substantial manner.

B. The CONTRACTOR shall be held responsible for transportation of his materials to and on the job, and for their storage and protection until the final acceptance of the job.

C. The CONTRACTOR shall be held responsible for timely placing of all conduit and outlet boxes, cabinets and other wiring devices in the walls, ceilings, slabs, beams, etc., as construction progresses.

D. CONTRACTOR shall furnish all necessary scaffolding, tackle, tools and appurtenances of all kinds, and all labor required for the safe and expeditious execution of his contract.

E. All equipment shall be installed in a manner to permit access to parts requiring service. All electrical equipment shall be installed in such a manner as to allow removal for service without disassembly of other equipment, and shall have working clearances as required by NEC. Any large piece of apparatus which is to be installed in any space in the building, and

which is too large to fit through finished openings, shall be placed before enclosing structure is completed. Following placement, such apparatus shall be completely protected from damage.

F. The CONTRACTOR shall, at all times, keep the premises free from accumulations of waste material and packaging debris. This debris shall be removed daily from the construction site.

G. This CONTRACTOR shall include for disconnecting and removing all existing electrical equipment, conduit and wiring back to the point of supply that is not being re-used or is redundant. Patch all holes in existing interior and exterior walls, bases, structures, ceilings, etc. resulting from conduit/raceway removal.

H. All removed electrical equipment shall remain the property of the OWNER unless otherwise stated and delivered to the OWNER’s designated storage location on the site. Conduit and wire removed shall be considered as scrap and properly disposed from the site by this CONTRACTOR.

I. Include relocating, making temporary connections, reinstalling and reconnecting any equipment, as required, for systems being modified as part of this project.

J. Prior to saw cutting or core drilling holes in existing walls or floor slabs, test to ascertain that the concrete section does not contain buried conduit raceways.

3.2 CUTTING AND PATCHING

A. Where it becomes necessary to drill or cut through any floors, walls or ceilings to permit the installation of any work under this contract, or to repair any defects that may appear prior to the expiration of the warranty, such cutting shall be done under the supervision of the OWNER's Representative by the CONTRACTOR. After the necessary work has been completed, the damage shall be repaired by the CONTRACTOR, who shall pay all costs of such cutting and repairing.

B. No joists, beams, girders or columns shall be cut by the CONTRACTOR without first obtaining written permission from the OWNER's Representative.

C. All drilling for expansion bolts, hangers and other supports shall be done by the CONTRACTOR, subject to the approval of the OWNER's Representative. Labor and materials required to replace or rebuild parts cut or injured shall be furnished at the CONTRACTOR's expense, subject to the satisfaction of the OWNER's Representative.

D. All openings made in fire-rated walls, floors and ceilings shall be patched by the electrical CONTRACTOR in a manner maintaining the original fire rating.

3.3 COORDINATION

A. The CONTRACTOR shall coordinate the work of the different trades so that interferences between piping, equipment, structural and architectural work shall be avoided. Before commencing work, obtain a ruling from the ENGINEER on any conflicting issues between divisions. No compensation will be made for any costs arising from conflict not identified before work has commenced.

B. Cooperate with all other trades on the job, so that all equipment can be satisfactorily installed and so that no delay is caused to any other trade.

C. The CONTRACTOR is responsible for ensuring that all conduit sleeves are timely installed and are sealed, flashed or caulked to the satisfaction of the OWNER's Representative.

D. Make all temporary connections as required to maintain operation of the plant during the construction and equipment replacement or modifications. Schedule work for shutdown or non-productions periods as required.

3.4 HVAC EQUIPMENT WIRING AND CONTROL

A. In general, the CONTRACTOR shall provide the low-voltage (less than 120 volts) control wiring from the heating, ventilation and air conditioning equipment (HVAC) to the mechanical furnished device (T-STAT, temperature control system, etc.). The electrical drawings will indicate only branch circuit power supplies to serve the HVAC equipment.

B. If substitution of controls or mechanical equipment for that specified requires any changes in the electrical work, any extra cost of the equipment or electrical work will be the responsibility of the CONTRACTOR.

3.5 MISCELLANEOUS

A. Each piece of floor-mounted equipment, such as switchboards, transformers, etc., shall be set on a concrete base. Bases shall not be less than 4 inches high and shall be pinned to the floor.

B. The CONTRACTOR shall furnish and install vibration isolation means for all equipment and materials furnished under this contract which may transmit perceptible noise or vibration, structure borne or air borne, to occupied areas.

C. All transformers and other equipment indicated shall be mounted on 1-inch-thick cork rib or rubber pads or steel spring isolator units properly sized, spaced and loaded, as specified herein, which in turn shall rest on a 4-inch minimum concrete base.

D. Electrical conduit shall be isolated from all dry type transformers and rotating or reciprocating machinery with flexible metal conduit. Use lengths approximately 10 diameters in length.

E. Schedule the electrical work so that disruption to the rest of the circuitry will be kept to a minimum. Coordinate with the OWNER to schedule shutdowns required for system connection or equipment replacement.

F. CONTRACTOR is responsible for any damage resulting from operations to existing facilities such as underground cables, hard surface areas, piping and other utilities. CONTRACTOR is to restore, replace or repair any such damage to the satisfaction of the ENGINEER. Obtain locates prior to commencing work wherever possible.

END OF SECTION

SECTION 16112

CONDUIT SYSTEMS

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Division 1 – General Requirements

B. Section 16010 – Electrical System General Requirements

1.2 REFERENCES

A. All applicable UL, NEC and ANSI standards.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Comply with standards listed in 1.2, References.

B. All materials installed shall be of 316 stainless steel.

C. Stainless steel rigid:

1. Conduit: UL listed and manufactured in accordance to UL 6A and ANSI C80.1 standards. 316 stainless steel, seamless, Schedule 40. Size as per the drawings or in accordance to Inspection Authority requirements.

2. Conduit connectors, fittings, adaptors and couplings are to be of the same material of the conduit raceway.

3. As manufactured by Calbrite or approved equal.

D. Beam clamps: Stainless steel designed to clamp onto both sides of the flange, manufactured by Sasco Tube & Roll Forming Inc. or Canstrut Inc.

E. Swivel couplings: Threaded, one piece, manufactured by Elliot Electrical Manufacturing Co. Running threads are not acceptable.

F. Pull cords: 6mm polypropylene or nylon material. Pro-pull rope manufactured by Ideal.

G. Sleeves: All sleeves to be made from stainless steel Schedule 40 pipe.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Connect conduits to electrical boxes and electrical equipment enclosures in wet areas with watertight conduit connectors. Provide watertight, steel capped bushings on ends.

B. Install conduits 6 inches minimum clear of steam and hot water pipes and 40 inches minimum clear of heaters.

C. Provide conduits, minimum trade size 7/8 inches for concealed or exposed conduits and 1 inch for conduits embedded in concrete.

D. Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Install exposed conduits symmetrical with building construction and with accepted bends or pull boxes where conduits change direction. Route conduits to avoid beams, columns and other obstructions. Conduits shall be run in a neat manner and close to building structures.

E. Provide expansion fittings in straight conduit runs exceeding 2-3/8 inches and at building expansion joints.

F. Attach exposed conduits in place with stainless steel hangers or one-hole straps spaced at 51 inches centres maximum. Group conduits together whenever possible. Use stainless steel hangers and supports. Perforated and galvanized straps are not acceptable.

G. Provide pipe spacers for exposed conduits on concrete or masonry walls.

H. Provide drilled-in type expansion bolts and machine screws for supporting hangers and straps. Comply with Section 16010.

I. Locate conduits penetrating floors, permitting direct vertical connection with minimal bending.

J. Provide flexible liquid-tight conduit between rigid conduit system and equipment subject to vibration or adjustment, such as motors or motorized equipment.

K. Clean conduit run with an accepted cleaner equipped with a mandrel.

L. Install expansion fittings on dry side of plastic water stops where required.

M. Where possible, drain conduits toward outlets. If not possible, provide drainage holes or C conduits for exposed conduits and non-hardening compound filled boxes for concealed conduits.

N. Do not commence surface conduit installation work until repair to any masonry ceiling, wall and floor finishes are completed. Finish surface mounted conduit installation work prior to surface painting.

O. Provide pull cords in conduits with 40 inches slack at each end.

P. Maintain the integrity of all fire separations by sealing around all conduits and cables where they pass through any fire barriers.

Q. Adequately seal around all conduits going through building walls or roofs with a fire stopping system equal to 3M fireproofing system.

END OF SECTION

SECTION 16120

WIRING SYSTEMS

PART 1 – GENERAL

1.1 RELATED SECTIONS

A. Division 1 – General Requirements

B. Section 16010 – Electrical System General Requirements

1.2 REFERENCES

A. All applicable UL, NEC and ANSI standards.

1.3 DESIGN REQUIREMENTS

A. Number and sizes of wires (and associated raceways) indicated are a guide only and are not necessarily the exact number and sizes required. Wire or cable sizes smaller than indicated are not acceptable.

B. Connect all wiring to terminal strips. One side of terminal strip shall be left empty for remote connections. Not more than two conductors shall be terminated on each terminal. Use shorting bars or shorting combs as applicable where looping is required between terminals.

PART 2 - PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Comply with standards listed in 1.2, References.

B. Low Voltage Unarmoured Wire and Cable (1000V and Below)

1. Acceptable manufacturers: Phillips Cables Limited, Alcatel Wire Inc., Pirelli Cables Inc. and United Wire.
2. Construction: Stranded, annealed copper conductors, 600V minimum rating for #14AWG, #12AWG and #10AWG and 1000V rating for conductors larger than #10 AWG, RW90 cross-linked polyethylene (XLPE) insulation, suitable for handling at minus 40ºC ambient, 90ºC maximum conductor temperature, limited flame spread FT4, jacketed.
3. Minimum conductor sizes: Unless otherwise indicated, #12AWG for power and current transformer circuits; #14AWG for control circuits. Increase conductor size as required compensating for voltage drop.
4. Multi-conductor cables: PVC flame retardant black jacket overall, suitable for handling at -40ºC, flame test rated FT4.
5. Lighting wiring: GTF wire, 600V, 125ºC, flexible copper conductor for connections between luminaire and outlet boxes.
6. Color coding: For insulated conductors, conform to the following:
   a. Power wiring – Red, Black, Blue, White (Neutral)
   b. AC Control Wiring – Red
   c. DC Wiring – Blue

d. Interlock Control Circuit – Yellow
e. Equipment Grounding - Green
f. Isolated Ground - Green/Yellow Stripe
g. Insulated ground conductors forming part of a multi-conductor cable assembly: Inspection Authority color coding.

C. Low Voltage Armoured Wire and Cable (1000V and Below)

1. Acceptable manufacturers: Phillips Cables Limited, Alcatel Wire Inc., Pirelli Cables Inc. and United Wire and Cable.

2. Construction: Stranded, annealed copper conductors, 1000V rating, RW90 cross-linked polyethylene (XLPE) insulation, suitable for handling at minus 40ºC ambient, 90ºC maximum conductor temperature, flame test rated FT4.

3. Power cabling: TECK construction.

4. Control cabling: TECK construction.

5. Receptacle branch wiring: BX construction.

6. Minimum conductor size: Unless otherwise indicated, #12AWG for power and current transformer circuits and #14AWG for control and fire alarm circuits.

7. Grounding conductor: Stranded, soft, bare copper conductor in multi-conductor cables, concentric copper wires over insulation in single conductor cable.

8. Multi-conductor cables: With inner jacket of suitable PVC (-40ºC).

9. Interlocking armour: Flexible, galvanized steel or aluminium for multi-conductor cables and aluminium for single conductors, spirally wound over inner jacket.

10. Outer jacket: PVC (-40ºC), flame-retardant, FT4 flame test rated, low acid gas evolution, black outer jacket extruded over the armour.

11. Color coding: For insulated conductors, conform to the following:

a. Power wiring - Red, Black, Blue, White (Neutral)

b. AC Control Wiring - Red

c. DC Wiring - Blue

d. Interlock Control Circuit - Yellow

e. Equipment Grounding - Green

f. Isolated Ground - Green/Yellow Stripe

D. Wiring Accessories

1. Wire markers: Plastic slip-on, black letters on white background, Thomas & Betts Ltd. Shur-Code or Wieland Electric Inc. Z-Type.

2. Cable markers: For cables or conductors greater than 13mm diameter, strap-on type, semi rigid PVC carrier strip, Wieland Electric Inc. type K.

3. Terminal blocks: 600V, 25A minimum rating, modular, 35mm DIN rail mounted, provision for circuit number labelling, individually removable, sized to accommodate conductor size and circuit current, Weidmüller Sak Series, Phoenix Terminal Blocks Ltd. UK Series, Wieland Electric Inc. WK Series or Entrelec.

4. Field wiring terminations: Where screw-type terminal blocks are provided, supply insulated fork tongue terminals, Thomas & Betts Ltd. Sta-Kon, 3M Inc. Scotchlok.

5. Splice connectors for equipment pig-tail, lighting and receptacle circuits: For wire sizes #12AWG and #10AWG inclusive, twist-on compression spring type, Ideal type Wing-Nut or Marr Electric Ltd. Marrette Type II.

6. Equipment pigtail power circuit connections: For wire sizes #8AWG minimum, split-bolt type, sized to suit number and size of conductors, Burndy Inc. Servit Type KS.

7. 5kV motor terminations: Heat shrinkable connection kits, including compression lug connectors, sealant, cover caps and tubes, Raychem Ltd. type MCK-5.

8. Low voltage (1000V and lower) motor terminations: Heat shrinkable connection kit, including sleeves, caps and sealant, Raychem Ltd. type MCK.

9. Cable ties: Nylon, one-piece, self-locking type, Thomas & Betts Ltd., Burndy Inc., or Wieland Electric Inc.

10. Electrical insulating tape: 3M Inc. Scotch 33.

11. Cable grips: To accommodate type and geometry of cable supported, single weave, variable mesh design, Thomas and Betts Ltd., Crouse Hinds, Woodhead Ltd.

12. Cable pulling lubricant: Compatible with cable covering and not to cause damage or corrosion to conduits or ducts, Ideal type Yellow 77.

E. Wire and Cable Connections

1. Power wire connections at motors shall be with Burndy, or approved equal, pressure type lugs using a ratchet type crimping tool and "Everdur" hardware.

2. Service and feeder wiring connections shall be made with solderless or pressure type lugs.

3. Conductor splices and taps shall be made with mechanical compression connectors.

4. Identification Markers: All control devices within panels shall be identified with lamicoid nameplates, black letters on white background. Nameplates shall be applied to the panel backplate adjacent to the device.

5. Pulling Compound

a. Non-toxic, non-corrosive, non-combustible, non-flammable, wax-based lubricant;

b. Suitable for rubber, neoprene, PVC, polyethylene. Hypalon, CPE, and lead-covered wire and cable.

c. Suitable for zinc-coated steel, aluminium, PVC, bituminized fibre, and fibreglass raceways.

d. Manufacturers and Products: Ideal Co.; Yellow 77; Polywater, Inc.; Cable Grip Co.

PART 3 - EXECUTION

3.1 COORDINATION

A. Prior to installation of wiring, compare Contract Drawings with latest issue of Vendor shop drawings.

B. Report discrepancies promptly to Engineer.

3.2 INSTALLATION

A. Provide wires of number and size (including corresponding raceways) required, with spare conductors as indicated. Provide adequate wiring for actual equipment installed.

B. Provide wire and cable according to the drawings and electrical system requirements.

C. Pull cable into ducts and conduits in accordance with cable manufacturer's recommendations. Use patented cable grips suitable for cable type, or pulling eyes fastened directly onto cable conductors.

D. Limiting pulling tension and minimum bending radii to those recommended by manufacturer.

E. Prevent damage to cable jackets by utilizing adequate lubricant when pulling cables through ducts and conduits.

F. Connect cables to electrical boxes and equipment enclosures located in sprinkled areas with watertight cable connectors.

G. Provide cable grips for vertical and catenary cable suspension installations to reduce cable tension at connectors and at cable bends.

H. Install through wiring in junction and pull boxes having no connection within the box. Leave 6 inches minimum of slack inside box.

I. Facilitate making of joints and connections by leaving sufficient slack in each conductor at panel boards, outlet boxes and other devices.

J. Do not connect more than three lighting circuits for three phase panels and two lighting circuits for single-phase panels to a common neutral.

K. Use #10AWG minimum for home runs to lighting panels exceeding 1 inch.

L. Identify each cable by attaching a cable marker at each end, in all intermediate manholes, junction boxes and pull boxes.

M. Provide cable grips on vertical and horizontal catenary cable suspensions.

3.3 WIRING TERMINATIONS

A. Insulate equipment pigtail power circuit connections with wire sizes #8AWG and larger, with heat shrink sleeving termination kits.

B. Terminate armoured cables with accepted connectors suitable for application, size and type of cable.

C. Except where pulling tensions exceed allowable cable limits or where tap connections are required, only install splices in power, control and instrumentation cable runs with written permission of ENGINEER. Where unavoidable, install splices in junction boxes complete with terminals.

D. Make power (1000V and below), control and signal wiring taps, splices and terminations in junction boxes with labelled terminal blocks, securely fastened to avoid loosening under vibration or normal strain. Terminate lighting circuits and 120V convenience receptacle circuits with twist on or split-bolt type connectors and insulating tape.

E. Terminate control, signal and instrumentation circuit conductors, including spares, on terminal blocks. Use ferrules for all wiring. Label terminal blocks with assigned circuit code associated with connected wires.

F. Identify each conductor, including spares, by wire markers at each termination. Indicate circuit designation or unique wire number. Identify spare conductors as 'SP1', 'SP2', etc.

3.4 TESTING

A. Cable and Wire - 1000V and below

1. Conduct insulation resistance measurements using a properly rated megohmmeter (500V instrument for circuit up to 350V systems, 1000V instrument for 351-600V systems).

2. Record test results in a logbook and submit to ENGINEER for reference. Replace or repair circuits that do not meet Inspection Authority requirements. With equipment disconnected, measure insulation resistance of the following circuits:

a. Power and motor feeders: Phase-to-phase, phase-to-ground.

b. Control circuits: To ground only.

c. Do not perform insulation tests on equipment containing solid-state components.

3.5 WIRING INDICATION

A. Identify wiring with wire markers.

B. Color code power, feeder and branch conductors at both ends with colored plastic tapes. Tapes are not required where conductors are identified by jacket color. Maintain phase and color sequence throughout.

C. Identify each conductor, including spares, with assigned circuit code to facilitate troubleshooting and maintenance.

END OF SECTION